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Rapport de synthèse des travaux de recherche

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Habilitation à diriger des recherches

présentée par

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Essais sur les différentiels socio-économiques
des comportements de fécondité en Europe

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Für Lisa

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INTRODUCTION

Introduction

Mes travaux de recherche s'inscrivent dans le champ de l'économie démographique. J'analyse les moteurs et barrières socio-économiques[1] de la fécondité dans les pays développés. Je m'appuie pour cela sur l'économétrie de données internationales de panel, permettant de modéliser les déterminants macro- et micro-économiques de la fécondité, ainsi que leurs interactions potentielles.

Un premier volet de recherche porte sur les déterminants macro-économiques de l'évolution des niveaux de fécondité dans les pays développés. Un deuxième volet porte sur les différentiels socio-économiques des comportements individuels de fécondité dans les pays européens.

Les taux de fécondité stagnent actuellement en dessous du seuil de remplacement (2.1 enfants par femme) dans un grand nombre de pays développés, notamment dans les pays germanophones, les pays de l'Europe de l'Est et les pays Méditerranéens. Ceci est susceptible de contrarier non seulement le développement macro-économique, mais aussi le bien-être individuel. Savoir si, et dans quelles circonstances, de nouvelles évolutions économiques, sociales et institutionnelles peuvent influencer le niveau de fécondité dans les pays développés revêt donc un intérêt politique, social et économique majeur.

Dans la mesure où la fécondité affecte la croissance démographique et la pyramide des âges, son évolution a des conséquences importantes sur le développement économique, la croissance de la productivité et certains aspects des systèmes de protection sociale. Un niveau de fécondité en dessous du seuil de remplacement est aujourd'hui considéré, dans les pays développés, comme néfaste aux performances macro-économiques, principalement parce qu'il accélère le processus du vieillissement de la population (Lee et Mason 2010, 2011). Le faible niveau de fécondité est un déterminant majeur du vieillissement dans les pays développés, à côté de l'augmentation de l'espérance de vie. Même si l'immigration augmente dans les prochaines années, elle ne sera pas suffisante pour compenser le frein démographique lié aux faibles niveaux de fécondité (Héran 2010, 2012). En outre, dans la plupart des pays européens, le surcroît de fécondité des immigrées ne pèse guère dans la moyenne nationale de la fécondité (c.f. par exemple Héran et Pison 2007 et Toulemon 2004, pour la France)[2].

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[1] Je me focalise principalement sur des déterminants qui sont empiriquement quantifiables et observables D'autres aspects, comme les normes culturelles et les facteurs intermédiaires de la fécondité (nuptialité, fertilité, accès à différentes méthodes de contraception…) ne sont pas traités de façon explicite dans mes travaux, mais sont pris en compte de façon implicite par certaines techniques d'analyse (notamment par les modèles à effets fixes).

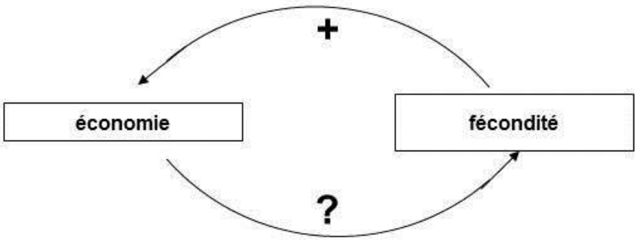
[2] Si en France le taux de fécondité des femmes immigrées est supérieur à celui des autres, il influe peu sur les statistiques car les femmes immigrées en âge d'avoir des enfants représentent moins d'une femme sur dix. Ceci est également valable pour la population de descendants d'immigrés. Même si leur taux de fécondité est légèrement supérieur à celui des autres, il ne pèse pas sur les statistiques. Selon l'INSEE, seulement 6% des nouveau-nés entre 2006 et 2008 en France ont au moins un des grands-parents né au Maghreb et 11 % ont au moins un des grands-parents né dans une autre région du monde (Breuil-Genier, Borrel et Lhommeau, 2011).

Les économistes fondateurs des modèles de croissance endogène considèrent que l'évolution de la main-d'œuvre joue un rôle essentiel pour la croissance économique, car non seulement sa nature qualitative, mais aussi sa nature quantitative déterminent le niveau du capital humain générant du progrès technique (Romer 1986, Lucas 1988, Barro and Sala-i-Martin 1995). Certes, dans les pays en voie de développement ayant un niveau de fécondité élevé, une réduction de fécondité peut être bénéfique pour le développement économique parce qu'elle réduit le rapport de dépendance jeunes/population active (c.f. par exemple Bloom, Canning et Sevilla, 2003 ; 'le dividende démographique') et parce qu'elle favorise l'activité professionnelle des femmes (c.f. par exemple Galor et Weil, 1996 ; 'unified growth theory'). Toutefois, dans les pays développés qui ont déjà terminé leur transition démographique, un niveau de fécondité en-dessous du seuil de remplacement nuit à l'évolution quantitative de la main-d'œuvre (Bloom, Canning et Sevilla, 2003). Certes, à court terme, des taux de fécondité faibles ont le potentiel de stabiliser les finances publiques via la diminution du rapport de dépendance jeunes/population active. Pourtant, à moyen et long terme, le rapport de dépendance personnes âgées/population active augmentera et les dynamiques productives ainsi que la consommation risquent d'être significativement freinées si, chaque année, plus de personnes quittent le marché de travail qu'ils n'y en rentrent. Ceci est le cas dans certains pays européens qui ont un niveau de fécondité bien en-dessous du seuil de remplacement (« lowest-low fertility countries », c.f. Kohler, Billari et Ortega 2002, Billari et Kohler 2004), comme la plupart des pays de l'Europe de l'Est et les pays germanophones.

Au-delà de la préoccupation économique, le niveau de fécondité d'un pays peut être considéré comme un indicateur reflétant certains aspects du bien-être individuel et social. Dans la plupart des pays développés, les préférences de fécondité des couples convergent vers deux enfants (Sobotka et Beaujouan, 2014). Un niveau de fécondité en-dessous du seuil de remplacement laisse donc entendre qu'une grande partie des parents (potentiels) sont confrontés à des obstacles pour réaliser leurs intentions de fécondité. Certes, un taux de fécondité temporairement faible peut être principalement causé par un changement dans le calendrier des naissances (le « tempo »), sans pour autant influencer le « quantum » (le nombre d'enfants qu'une femme aura à la fin de sa vie reproductive). Pourtant, la re-augmentation (aussi nommé 'rebond') de fécondité a été relativement rapide et important dans certains pays européens, alors que dans d'autres, la fécondité stagne à des niveaux très bas depuis deux décennies. Cette hétérogénéité suggère que les différences en termes de fécondité entre pays développés ne résultent pas seulement des différences dans le calendrier des naissances, mais reflètent également les disparités entre les possibilités des parents (potentiels) de réaliser leurs intentions de fécondité. Ceci représente une perte de bien-être social. Cette perte du bien-être social peut aussi exister dans les pays ayant un niveau moyen de fécondité autour du seuil de remplacement, car il est possible que certains individus soient confrontés à des obstacles socio-économiques qui limitent la réalisation de leurs intentions de fécondité, tandis que d'autres arrivent à dépasser leurs intentions initiales.

Dans la littérature économique, l'impact du niveau de fécondité sur le développement économique dans les pays développés est relativement bien documenté. L'impact inverse du développement économique sur la fécondité dans les pays développés est moins étudié. Pourquoi les niveaux de fécondité stagnent-ils en-dessous du seuil de remplacement dans certains pays développés, mais pas dans d'autres ? Qui sont les couples qui sont confrontés aux barrières les empêchant de réaliser leurs intentions de fécondité dans les deux types de pays développés ?

Le défi scientifique que je me suis donné est d'allier les outils d'analyse économique et démographique afin de mieux comprendre les déterminants socio-économiques de fécondité dans les pays développés. Pour cela, je suis une approche macro- ainsi que micro-économique : J'identifie d'abord, de façon agrégée, les déterminants macro-économiques et institutionnels des niveaux de fécondité dans les pays développés. Ensuite, j'analyse les différentiels socio-économiques de fécondité entre individus au sein des pays européens. Plus précisément, je cherche à identifier l'impact de l'éducation, du statut professionnel et du revenu des individus sur leur comportement de fécondité (nombre d'enfants, âge à la naissance…). A cet égard, je prends en compte les interactions entre partenaires ainsi qu'entre caractéristiques individuelles et institutionnelles.



Mes recherches intégrées, au carrefour de l'économie et de la démographie, relèvent un certain challenge méthodologique, car j'utilise des données socio-économiques d'enquête qui ne sont pas, à la base, conçues pour étudier des comportements de fécondité. Cette synthèse propose donc un résumé non seulement de la contribution de fond mais aussi de la contribution méthodologique de mes travaux.

La synthèse est organisée de la façon suivante : La première partie présente mes travaux menés jusqu'à aujourd'hui. Cela comprend l'analyse macro-économique de l'impact du développement économique et institutionnel sur le niveau de fécondité dans les pays développés (travaux postdoctoraux), ainsi que l'analyse micro-économique des différentiels socio-économiques des comportements de fécondité et leur dépendance au contexte institutionnel (travaux effectués au Centre d'Economie de la Sorbonne). Dans la deuxième partie, j'expose mes perspectives de recherche pour les cinq prochaines années. Cela comprend la prévision de l'impact des différentiels socio-économiques de fécondité sur le futur niveau agrégé de fécondité dans les pays développés, ainsi que l'analyse des comportements de fécondité dans un contexte de cycle de vie et de changements familiaux. La troisième partie décrit mes activités de recherche et d'enseignement ainsi que mes responsabilités collectives. La conclusion rappelle mes résultats scientifiques principaux ainsi que mes futurs objectifs académiques qui me motivent à présenter cette habilitation à diriger des recherches.

1. Présentation de mes travaux

1.1. Le lien entre le développement économique et institutionnel et le niveau de fécondité dans les pays développés

Cette partie de mes recherches identifie dans quelle mesure les niveaux de fécondité sont déterminés par le contexte macroéconomique et institutionnel des pays. Pour cette partie, j'ai travaillé, en coopération avec l'économiste Olivier Thévenon (Ined et OCDE), sur des données agrégées des pays de l'OCDE.

Dans une première partie, nous avons identifié un impact convexe du développement économique sur la fécondité (i.e. l'impact du développement économique sur la fécondité est d'abord négatif puis devient positif).

Dans une deuxième partie, nous avons décomposé le PIB par tête. Ceci a permis d'identifier le taux d'emploi des femmes comme élément moteur de la ré-augmentation des taux de fécondité qui peut être observée à l'intérieur de certains pays développés. Les résultats de ces deux parties ont été publiés dans la revue *European Journal of Population*[3].

Dans une troisième partie, nous avons évalué l'effet des politiques familiales sur la fécondité dans les pays développés. En prenant en compte les interactions entre les différents instruments de la politique familiale, nous trouvons que l'impact d'un instrument donné dépend de la complémentarité existant entre tous les instruments influençant la fécondité. Un ensemble cohérent de politiques familiales soutenant les parents actifs ayant des enfants d'âge préscolaire permet d'améliorer l'efficacité des politiques familiales. Nos résultats concernant l'impact des politiques familiales sur la fécondité ont été publiés dans la revue *European Journal of Population*[4]. L'analyse des différents objectifs de la politique familiale et leur efficacité a été publiée dans la revue *Population Research and Policy Review*[5]. Nos résultats concernant l'efficacité de la politique familiale en Europe sont également publiés dans un chapitre d'un ouvrage[6].

1.1.1. Le développement économique – une condition nécessaire, mais pas suffisante, au rebond de la fécondité

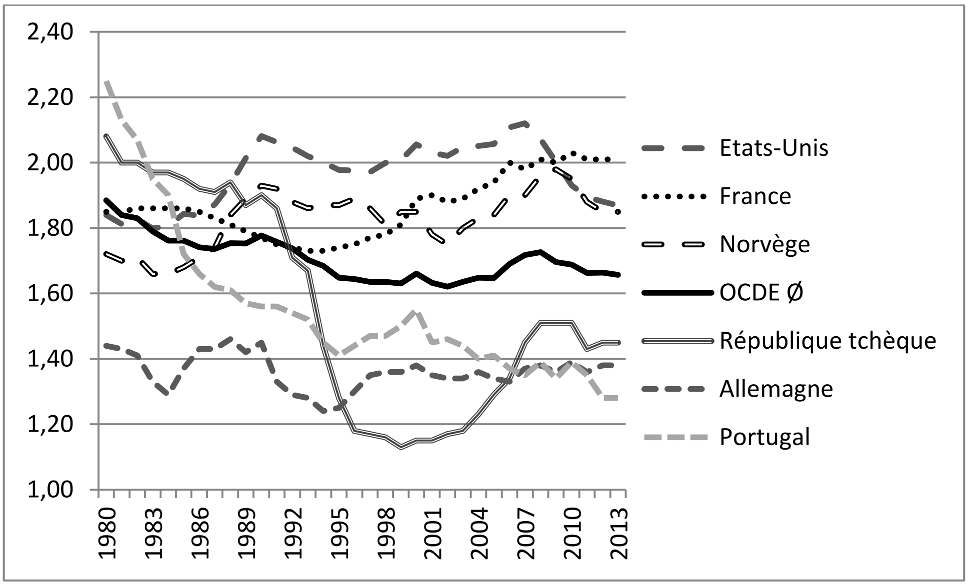
Notre première étude (Luci-Greulich et Thévenon, 2014) analyse le lien ambigu entre développement économique et niveaux de fécondité dans les pays développés, afin de savoir

[3] Luci-Greulich, O. Thévenon (2014): "Does economic development 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960-2007)", *European Journal of Population,* Vol. 30, pp.187-221.
[4] A.Luci-Greulich, O. Thévenon (2013): "The impact of family policy packages on fertility trends in developed countries." *European Journal of Population,* Vol. 29 N° 4, pp.387-416.
[5] O. Thévenon, A. Luci (Greulich) (2012): "Reconciling work, family and child outcomes: What implications for family support policies?" *Population Research and Policy Review,* (2012) 31: 855.
[6] A. Greulich (2016) : *"The impact of family policies on fertility trends",* Chapter 13 in "As problematicas de natalidade em Portugal", edited by V. Cunha, D. Vilar, K. Wall, J. Lavinha and P. Trigo Pereira, Imprensa de Ciencias Sociais, Lisboa.

si, et dans quel contexte, le progrès économique est susceptible d'augmenter le niveau de fécondité dans les pays développés.

Motivation

Dans la plupart des pays développés, une chute rapide de l'indice synthétique de fécondité (taux total de fécondité – « *total fertility rates* ») en dessous du taux de remplacement (2,1 enfants par femme) a été observée au cours des dernières décennies, et en particulier durant les années 1960 et 1970, tandis que les niveaux moyens de revenu (mesuré par le PIB par tête) ont continué d'augmenter. Le graphique 1 illustre que dans la plupart des pays, ce déclin ininterrompu s'est poursuivi jusqu'au milieu des années 1990. Toutefois, ces dernières années, la fécondité est repartie à la hausse dans plusieurs pays très développés, simultanément à un développement économique continu. Ce « rebond » a été particulièrement marqué en France, aux États-Unis, au Danemark, en Suède, en Finlande et en Norvège. Dans le même temps, la fécondité stagne à des niveaux très bas dans un bon nombre d'autres pays ayant des niveaux de revenu similairement élevés. Dans les pays germanophones et dans la plupart des pays de l'Est et du Sud méditerranéens, la fécondité stagne depuis la fin des années 1990 à des niveaux inférieurs à 1,5 enfant par femme. Depuis la récente crise économique, la fécondité a de nouveau chuté dans de nombreux pays développés, à l'instar des États-Unis, de la Norvège et de la Suède, ainsi que du Portugal et de l'Espagne. Dans la plupart des autres pays développés, la fécondité stagne depuis 2008.



Graphique 1 : Indice synthétique de fécondité dans quelques pays développés

Source : Indicateurs de développement de la Banque mondiale, 2016

Ce tableau montre qu'il n'est pas possible de dégager un lien strict entre la fécondité et le niveau du développement économique de long terme pour les pays développés. Il semble plutôt que l'impact du développement économique sur la fécondité soit ambigu. Dans certains pays, le processus de développement économique est accompagné par une inversion de la tendance de la fécondité, également appelée « rebond de la fécondité ». Pourtant, en raison de la crise économique récente, rien ne prouve que les niveaux de fécondité dans ces pays convergent naturellement vers le niveau de remplacement une fois atteint un certain seuil minimal. En parallèle, certains autres pays semblent bloqués dans un scénario de faible fécondité, malgré une performance économique relativement stable.

Il semble donc que l'évolution de la fécondité dans les pays développés dépende de nombreux facteurs, au-delà et en plus du développement économique. Les décisions en matière de fécondité émergent dans le cadre d'une interaction complexe entre institutions, circonstances individuelles et contexte macroéconomique.

Quelques récentes études ont analysé l'évolution des relations entre croissance économique et fécondité. Myrskylä, Kohler et Billari (2009) ont observé, pour un échantillon de plus 100 pays, une corrélation strictement négative entre l'IDH (indice de développement humain qui associe l'espérance de vie, le niveau d'études et le PIB par habitant) et les taux de fécondité totale (appelé ici l'indice synthétique de fécondité - ISF) pour l'année 1975. En revanche, pour l'année 2005, le tableau est moins uniforme : on constate que les pays ayant de faibles niveaux de développement ont des niveaux de fécondité très élevés, que les pays ayant des niveaux de développement moyens ont des niveaux de fécondité très bas, et que dans les pays ayant des niveaux de développement les plus élevés, la fécondité se situe à un niveau quelque peu supérieur. Ces observations portant sur plusieurs pays suggèrent un virage du négatif au positif dans la relation entre développement et fécondité. Les estimations confirment une corrélation négative entre IDH et ISF uniquement pour les pays ayant un niveau d'IDH inférieur à un certain minimum. Pour les pays ayant un niveau d'IDH supérieur à ce seuil, Myrskylä *et al.* (2009) constatent que les deux variables sont positivement corrélées.

Toutefois, les auteurs ne donnent aucune estimation du seuil de développement qui marque l'inversion de la tendance de la fécondité. Ils montrent aussi uniquement des corrélations transversales, mais rien ne dit qu'il y ait une inversion de la tendance à l'intérieur des pays. Qui plus est, l'utilisation d'une mesure composite du développement humain occulte les contributions particulières de chacune des composantes de l'indicateur. Le PIB par habitant représente à lui seul un indicateur composite qui reflète de nombreuses dimensions, telles que l'apport de travail fourni par les femmes et les hommes.

Ainsi, on ne sait pas précisément si, et dans quelles circonstances, un maintien de la croissance économique devrait s'accompagner de hausses de la fécondité dans les pays développés.

Nous abordons donc les questions suivantes: Quel est le seuil de développement qui marque l'inversion de la tendance de la fécondité ? Et quel est le moteur derrière le développement qui conduit au rebond ?

Notre approche empirique

Afin de traiter ces questions, nous évaluons l'impact du PIB par habitant sur la fécondité en utilisant des données agrégées pour 30 pays de l'OCDE sur une période couvrant plus de quarante années (1960-2007).

L'indice synthétique de fécondité ainsi que l'indice synthétique de fécondité corrigé de l'effet tempo (ou « de calendrier ») sont utilisés comme mesures de la fécondité.

L'indice synthétique de fécondité est généralement interprété comme étant le nombre moyen d'enfants par femme. Plus exactement, cette mesure périodique représente le nombre moyen d'enfants qu'aurait une femme au cours de sa vie si elle se conformait exactement aux taux de fécondité actuels par âge observés pour une année donnée tout au long de sa vie. Si les taux de fécondité par âge sont constants au fil du temps, c'est-à-dire qu'en l'absence d'effets de calendrier, l'indice synthétique de fécondité serait égal à la descendance finale d'une cohorte des femmes ayant terminé leurs années de procréation.

Il se peut que l'indice synthétique de fécondité baisse d'abord et puis remonte simplement à cause d'un effet de calendrier : Un grand nombre de femmes reportent les naissances pendant une certaine période, et se 'rattrapent' ensuite. Ceci peut expliquer que l'indice synthétique de fécondité soit en dessous du seuil de remplacement pendant une certaine période, sans que les femmes aient pour autant moins d'enfants une fois qu'elles atteignent la fin de leur période reproductive (Goldstein, Sobotka et Jasilioniene 2009, Bongaarts et Sobotka, 2012). Nous nous intéressons néanmoins à la question de savoir si le rebond de fécondité qui a eu lieu dans certains pays développés est aussi lié à un effet 'quantum', c'est-à-dire si les femmes ont effectivement plus d'enfants qu'avant. Dissocier l'effet quantum de l'effet tempo représente un défi majeur pour l'analyse démographique.

La descendance finale, qui correspond au nombre moyen d'enfants qu'ont eus les femmes d'une même cohorte une fois atteinte la fin de leur vie reproductive (en pratique, l'âge de 50 ans), constitue une mesure stricte de la fécondité fondée sur le quantum. Cette mesure correspond à la somme des taux de fécondité par âge d'une certaine cohorte. L'écueil de cette mesure est qu'elle est un indicateur qui se calcule uniquement pour les cohortes ayant terminé leur vie féconde. Elle ne permet donc pas d'avoir d'information sur la fécondité des cohortes plus récentes.

La meilleure alternative est donc de recourir au taux de fécondité corrigé de l'effet tempo, lequel mesure les niveaux de fécondité au cours d'une période donnée en l'absence d'ajournement (Bongaarts et Feeney, 1998). Le taux de fécondité corrigé de l'effet tempo utilise des données mesurant le nombre, la nature et la répartition temporelle des naissances au cours de l'année et des années qui l'encadrent. En pondérant l'indice synthétique de fécondité par les changements dans l'âge moyen des femmes à l'accouchement, on obtient une mesure ajustée qui se concentre sur la composante « quantum » des évolutions en matière de fécondité. Dans l'hypothèse d'un ajournement uniforme pour toutes les cohortes, autrement dit en l'absence d'effets de cohorte, cette mesure corrige des effets tempo (Kohler et Philipov, 2001).

Voici la formule de Bongaarts et Feeney (1998) :

$$adjTFR(t) = \sum_i adjTFR_i(t)$$

avec

$$adjTFR_i(t) = \sum_i \frac{TFR_i(t)}{1 - r_i(t)}$$

et

$$TFR_i(t) = \sum_x ASFR_i(t, x)$$

et

$$r_i(t) = \frac{MAC_i(t+1) - MAC_i(t-1)}{2}$$

adjTFR : tempo-adjusted total fertility rate (taux de fécondité corrigé de l'effet tempo)
TFR : total fertility rate (indice synthétique de fécondité)
ASFR : age specific fertility rate (taux de fécondité par âge)
MAC : mean age at childbearing (l'âge moyen à la naissance)
t : année de calendrier
i : rang de naissance
x : âge
facteur d'ajustement :

$$\frac{1}{1 - r_i(t)}$$

$r_i(t)$: taux de variation de l'âge moyen à la naissance pour une naissance de rang *i*
$r_i(t)$ est estimée comme étant la demi-différence entre l'âge moyen à la naissance de l'année suivante et l'année précédente.

En tant que mesure du développement économique, notre étude se concentre sur le PIB par habitant, puisque pour les pays à haut niveau de développement et pour la période considérée, les variations du PIB par habitant sont bien plus importantes que les évolutions en termes d'espérance de vie ou de scolarisation. Pour une analyse plus détaillée, nous décomposons le PIB en plusieurs facteurs.

Par rapport à la littérature qui existait jusqu'alors, notre étude propose plusieurs avancées méthodologiques majeures sur le lien entre développement économique et fécondité.

Premièrement, nous utilisons un modèle d'estimation « en une étape » pour tester l'hypothèse d'une corrélation non-linéaire entre la fécondité et le niveau de développement économique : au lieu de faire deux régressions basées sur deux sous-échantillons (comportant des pays classés selon leur niveau de PIB par habitant : faible/élevé), cette spécification permet de faire une seule régression basée sur l'ensemble des données. Pour détecter un éventuel impact non-linéaire du développement économique sur l'indice synthétique de fécondité, nous intégrons le PIB par habitant ainsi que son carré comme variables exogènes dans l'équation de régression. Cela permet d'identifier précisément le tournant dans la relation entre développement économique et fécondité. Les études précédentes scindaient arbitrairement l'ensemble de données en deux sous-échantillons, sans tester de manière empirique le point d'inflexion dans la relation entre développement économique et fécondité.

Deuxièmement, nous appliquons une régression à effets fixes qui élimine les différences entre pays qui sont constantes dans le temps, permettant ainsi de mettre l'accent sur les variations au sein des pays pour une période de près de 50 ans. Les études précédentes se concentraient sur les variations entre les pays, en comparant seulement deux périodes.

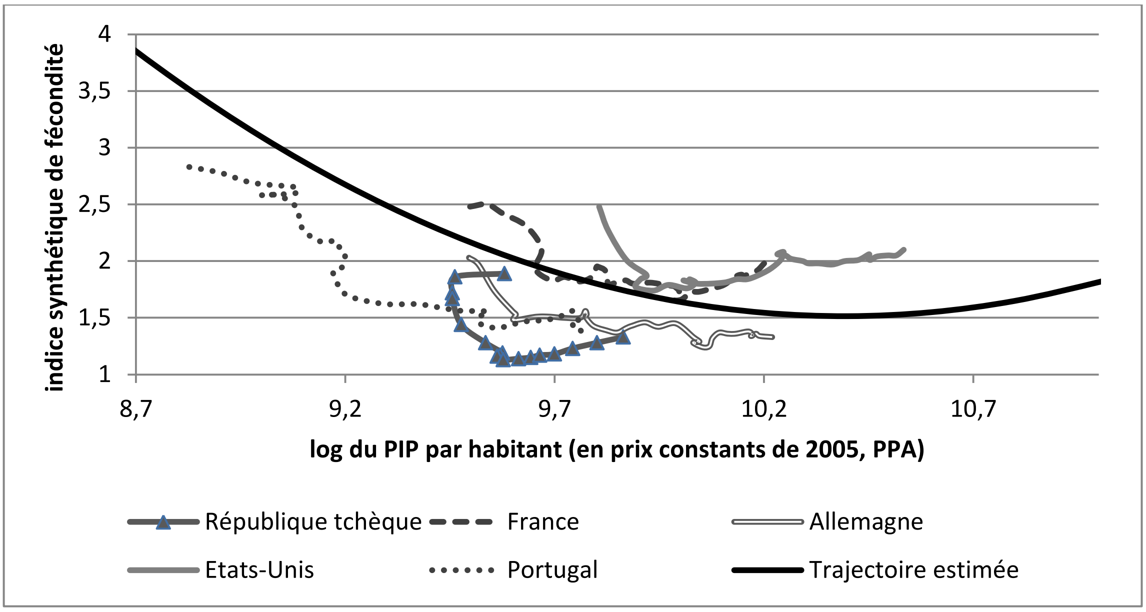
Troisièmement, une attention particulière est accordée au suivi de l'effet causal du développement économique sur la fécondité. Des variables exogènes décalées dans le temps permettent de réduire le biais d'endogénéité. Pour ce faire, nous utilisons l'estimateur de la méthode des moments généralisée par système (MMG par système). La méthode MMG remonte à Arellano et Bond (1991), lesquels proposent un estimateur MMG en différence qui transforme les régresseurs en différences premières, ce qui a pour effet d'éliminer l'effet fixe spécifique au pays. En outre, l'utilisation de niveaux décalés des régresseurs en tant qu'instruments pour les régresseurs exprimés en différence première prend en compte l'endogénéité. Toutefois, les niveaux décalés des régresseurs ont toutes les chances de se révéler de piètres instruments pour l'équation en différences premières. C'est pourquoi nous utilisons une version augmentée, laquelle se traduit par un gain d'efficience par rapport à l'estimateur MMG en différence première de base : un estimateur MMG par système en une étape, qui remonte à Arellano et Bover (1995) et à Blundell et Bond (1998). L'estimateur MMG par système associe un ensemble d'équations en différences premières à des équations en niveaux décalés pour former un « système », en recourant simultanément à différents instruments pour chaque équation estimée. Cela implique l'utilisation de niveaux décalés des variables exogènes en tant qu'instruments pour l'équation de différence ainsi que l'utilisation de différences premières décalées des variables exogènes en tant qu'instruments pour les équations en niveaux. De plus, l'estimateur MMG par système est un estimateur de panel dynamique qui permet de tenir compte de la dynamique d'ajustement en ajoutant une variable endogène décalée aux variables exogènes.

Notre étude fournit d'importantes informations techniques de base pour la méthode d'estimation MMG par système et aborde en détail ses avantages et ses inconvénients (instruments faibles, degrés de liberté réduits). En outre, nous développons une procédure de compilation des données particulière permettant d'accroître les degrés de liberté et d'intensifier la prise en compte de l'endogénéité.

Principaux résultats

En substance, nos estimations suggèrent que la corrélation entre le PIB par habitant et la fécondité passe de négative à positive à partir d'un niveau de PIP par habitant de 33 000 USD. Le niveau minimal estimé de l'indice synthétique de fécondité se situe à 1,5 enfant par femme.

Le graphique 2 illustre la trajectoire estimée et la compare aux tendances réelles observées dans quelques pays sélectionnés.



Graphique 2 : Tendance estimée en matière de fécondité et tendances observées en matière de fécondité dans quelques pays tout au long du processus de développement économique (1960-2007)
Source : Luci-Greulich et Thévenon (2014)

À l'image de la trajectoire estimée, la plupart les tendances des pays de l'OCDE présentent un profil en « J inversé », c'est-à-dire une corrélation négative entre le PIB par tête et les taux de fécondité pour des niveaux de PIB pt relativement faible, puis une ré-augmentation légère à partir d'un certain niveau de développement économique. La différence avec la trajectoire estimée s'observe par rapport au niveau de fécondité auquel les tendances des pays se situent : Dans la plupart des pays nordiques et anglophones (Etats-Unis, Grande-Bretagne) ainsi qu'en France, la tendance se situe à un niveau de fécondité supérieur au niveau estimé. Le graphique 2 montre qu'en France et aux États-Unis, la reprise de la fécondité est plus importante que celle prévue par la trajectoire estimée. Dans les pays à faible fécondité tels que l'Allemagne, le Portugal et la République tchèque, la tendance se situe à un niveau de fécondité plus faible et la reprise est moins importante que prévue.

L'Allemagne et la France enregistrent des tendances quasiment parallèles, mais le niveau de fécondité est globalement plus élevé et le rebond beaucoup plus important en France. Compte tenu des niveaux de développement économique relativement similaires des deux pays, les résultats montrent que le développement économique ne suffit pas à expliquer la raison pour laquelle un rebond de la fécondité survient dans certains pays et pas dans d'autres. Le développement économique émerge donc comme une condition nécessaire, mais pas suffisante, au rebond de la fécondité dans les pays développés.

Afin de déterminer quels facteurs – outre les progrès économiques – sont à l'origine du rebond de la fécondité, nous décomposons dans une deuxième partie le PIB par habitant selon ses composantes, à savoir la productivité du travail, les heures de travail et l'emploi. Les composantes sont également différenciées en fonction des contributions des femmes et des hommes, ce qui permet de prendre en compte les aspects de genre lors de l'analyse de la relation entre développement et fécondité.

Nous trouvons que la variable la plus corrélée à la reprise de la fécondité est l'emploi des femmes : l'évolution de l'incidence du développement économique sur la fécondité, qui de négative devient positive, émerge dans les pays dans lesquels la hausse du PIB s'accompagne d'une hausse de la participation des femmes au marché du travail.

Tandis qu'au début des années 1980, les taux de fécondité les plus élevés étaient clairement observés dans les pays ayant les taux les plus faibles d'emploi des femmes, c'est aujourd'hui le contraire qui est constaté, avec des taux de fécondité plus élevés dans des pays où les taux d'emploi sont également plus élevés. À ce jour, des taux élevés d'emploi des femmes ainsi que des taux élevés de fécondité s'observent notamment dans les pays nordiques, alors qu'en Europe du Sud et de l'Est, la fécondité, et les taux d'emploi des femmes, sont relativement faibles. En Allemagne, une faible fécondité apparaît de concert avec un faible taux d'emploi à temps plein des mères de jeunes enfants, tandis que ces deux mesures sont beaucoup plus élevées en France.

1.1.2. Le rôle clé de l'emploi des femmes – synthèse de la littérature théorique

Comment le passage d'un lien négatif à un lien positif entre fécondité et emploi des femmes s'explique-t-il ? Pour répondre à cette question, je me sers d'abord des arguments de la théorie économique classique, et notamment de la « *New Home Economics Theory* » de Gary Becker. Selon cette approche, les choix en matière de fécondité sont des actions rationnelles dans la mesure où les individus maximisent leur utilité à partir de préférences basiques qui sont relativement stables. Les individus dépensent leur revenu en vue de maximiser l'utilité. Une hausse du revenu devrait accroître la demande en biens et en services pouvant être acquis à un certain prix sur le marché. En dehors de l'argent, le temps disponible est lui aussi alloué. Le revenu est en partie déterminé par le temps passé à des activités sur le marché. Les contraintes budgétaires et les contraintes de temps influençant les décisions familiales ne sont donc pas indépendantes les unes des autres. Par conséquent, une hausse du revenu découlant d'activités sur le marché du travail augmente les coûts d'opportunité du temps parental, ce qui conduit à une réduction du temps consacré à l'éducation des enfants. En ce qui concerne les décisions en matière de fécondité, une augmentation du revenu/ du salaire engendre deux effets opposés : un effet « revenu » qui est positif (un revenu plus élevé permet d'avoir plus d'enfants) ainsi qu'un effet « de substitution » qui est négatif (l'augmentation du salaire augmente le coût indirect, dit « d'opportunité » des enfants: consacrer du temps à des activités en dehors du marché, comme élever des enfants, représente une perte implicite de salaire) (Mincer, 1958 ; Becker, 1960).

Une augmentation du revenu baisse donc le niveau de fécondité quand l'effet de substitution domine l'effet revenu. Dans quel contexte est-ce le cas ? Avec l'augmentation de l'éducation des femmes, celles-ci repoussent le moment d'avoir des enfants (Blossfeld, 1995). De plus, la hausse du revenu potentiel des femmes entraîne une augmentation des « coûts d'opportunité liés au fait d'avoir des enfants », dans la mesure où le temps passé à la maison représente une perte de revenu implicite. Les femmes sont donc encouragées à investir plus de temps dans un travail rémunéré que pour élever des enfants. Dans un contexte où la possibilité de faire garder des enfants est limitée ou coûteuse, de nombreuses femmes favorisent le travail au détriment de la maternité (Hotz et al., 1997). Cela peut conduire à une baisse de la descendance finale. Cette baisse sera accentuée si les parents sont enclins à investir davantage dans l'éducation de chaque enfant (dilemme quantité/qualité, Becker et Lewis, 1973).

La théorie de la Nouvelle économie de la famille reconnaît des inégalités en termes d'éducation et de rémunération entre époux et entre groupes de la société. Ces inégalités ont des répercussions sur la formation des familles en raison de différences en matière de revenu et de coûts d'opportunité entre femmes et hommes. En l'absence d'accès à des services de garde d'enfants, le conjoint qui gagne le moins (le plus souvent, la femme) est désigné pour s'occuper des enfants. À un niveau donné de revenu du conjoint, les femmes ayant un niveau d'éducation plus élevé enregistrent des niveaux de fécondité plus bas, dans la mesure où elles sont confrontées à des coûts d'opportunité plus importants liés au fait de rester à la maison. Conformément à cette théorie, le lien entre emploi des femmes et fécondité est donc strictement négatif.

Une première lacune importante de l'approche de la fécondité proposée par Becker est qu'elle pâtit d'une approche excessivement statique de l'incompatibilité entre vie professionnelle et vie familiale ainsi que de la spécialisation entre époux. Liefbroer et Corijn (1999) ont développé une approche plus dynamique montrant que dès lors que les politiques publiques contribuent à limiter les coûts liés à la garde et à l'éducation des enfants pour les parents, les compléments de revenu obtenus grâce à l'augmentation de l'emploi des femmes sont susceptibles de permettre aux ménages de surmonter leurs contraintes budgétaires, ce qui peut accroître la fécondité. Lundberg et Pollak (1996) ont développé un modèle dans lequel les conjoints négocient, ce qui permet d'abandonner l'approche dit « unitaire » et de supposer que les conjoints ont des fonctions d'utilité différentes et potentiellement conflictuelles (modèle de négociation non coopératif). Le pouvoir de négociation dépend, entre autres choses, de la situation relative en termes de revenu de chacun des conjoints. Plus une femme dispose d'un pouvoir de négociation élevé, plus l'époux sera incité à contribuer aux tâches ménagères et éducatives.

Une seconde lacune majeure de l'approche de Becker est qu'elle ne permet aucune variation en termes de préférences et de valeurs. Easterlin *et al.* (1980) introduisent ainsi des expériences de socialisation intrafamiliales observées pendant l'enfance dans le modèle micro-économique. Outre les potentiels de gain, ce sont les modes de vie souhaités qui doivent être pris en compte, lesquels peuvent différer entre les sexes et les groupes d'hommes et de femmes. En dehors du modèle micro-économique, plusieurs théories culturelles de la fécondité ont été développées, avec comme représentante principale la thèse de la « *Deuxième Transition Démographique* » (Lesthaeghe 1978, 2010). Cette théorie établit que l'évolution de la fécondité fait partie d'un éventail plus large de changements démographiques et sociaux. A côté de la rationalité économique, il faut prendre en compte la hausse de la valeur de l'accomplissement personnel par l'éducation et la carrière pour expliquer le changement de comportement de fécondité. L'évolution des normes était promue par les mouvements féministes dans les années 1970 et 1980 dans les pays développés, qui revendiquaient pour les femmes plus d'autonomie, de réalisation individuelle et d'égalité avec les hommes.

La comparaison entre la théorie de la Nouvelle économie de la famille et la thèse de la Deuxième Transition Démographique montre une certaine complémentarité dans la mesure où toutes deux prédisent des diminutions de la fécondité en période d'augmentation de l'éducation et de la participation au marché du travail des femmes. Le paradoxe, c'est qu'aujourd'hui, nous observons que, parmi les sociétés développées, les niveaux de fécondité sont les plus élevés dans les pays qui ont les normes familiales les plus « modernes » (van de Kaa 1987, Zuanna et Micheli 2004) comme en Suède par exemple, où le système d'imposition individuelle pourrait-être considéré comme reflétant une certaine approche « individualiste »).

Les deux approches se concentrent sur les fonctions d'utilité individuelle/des couples sans reconnaître que les décisions en matière de fécondité sont également façonnées par des conditions sociétales, telles que les conditions macro-économiques, les politiques sociales, l'égalité des genres et l'environnement culturel, ainsi que par leurs interactions. Pourtant, les décisions de fécondité reflètent un ensemble de considérations économiques, culturelles et structurelles. Billari (2004) identifie une dichotomie entre facteurs institutionnels (contexte économique, structures politiques : l'état providence, le marché de travail, les aides financières, etc.) et facteurs culturels (attentes normatives, idéaux, valeurs, etc.) dans la littérature sur les comportements de fécondité. Dichotomie qu'il conviendrait de dépasser. Il faut donc confronter les aspirations professionnelles, individuelles et familiales des individus et des couples avec leurs possibilités de les réaliser.

Esping-Andersen (2007) établit que la corrélation négative qui existe entre emploi des femmes et fécondité est devenue positive dans les pays où les politiques familiales facilitent la conciliation de la vie professionnelle et de la vie familiale (par exemple les pays scandinaves, la France). Les institutions telles que les services de garde d'enfants ont ainsi la capacité d'encourager une participation égalitaire des femmes et des hommes dans les sphères professionnelles et privées (Fraser, 1994). Au lieu de l'individualisme, ce serait donc plutôt l'égalité entre femmes et hommes qui facilite pour les couples la réalisation de leurs intentions de fécondité. Ceci n'est pourtant pas contradictoire avec le modèle individuel de maximisation de l'utilité : les services de garde d'enfant concourent à diminuer le coût indirect de l'enfant.

Outre leurs effets sur le revenu et sur les coûts d'opportunité, de telles politiques possèdent également potentiellement un pouvoir normatif (Bourdieu, 1996). Une faible fécondité apparaît ainsi comme un déséquilibre entre niveaux d'institutions axées sur la famille et sur l'égalité des genres (les familles), et niveaux d'institutions axées sur les individus (par exemple, le système éducatif, le marché du travail). En l'absence d'une évolution des normes et des institutions, les femmes qui accordent de la valeur à leur participation à des activités individuelles sont confrontées à une incompatibilité des rôles (McDonald, 2000a, 2000b). L'accès à des services formels et subventionnés de garde d'enfants, par exemple, pourrait donc être interprété comme le signe d'un assentiment social pour les femmes de concilier vie professionnelle et vie familiale. Parallèlement, McDonald mentionne qu'à l'inverse, les normes sociétales dominantes sont également susceptibles d'influencer le contexte institutionnel d'un pays. Par conséquent, une extension des services publics de garde d'enfants ne devrait affecter l'équilibre travail-famille que de manière positive pour peu que les schémas culturels dominants identifient cet équilibre comme un objectif positif.

Pour résumer les principaux arguments des théories présentées, le développement économique peut inverser le lien entre emploi des femmes et fécondité, qui de négatif devient positif, de deux façons : En premier lieu, l'emploi des femmes apporte un revenu supplémentaire qui renforce la situation économique des ménages. Cela rend plus abordable le fait d'avoir davantage d'enfants. En second lieu, les pays peuvent se permettre d'investir de plus en plus dans des politiques qui aident les parents à supporter le coût indirect des enfants en leur permettant de concilier plus facilement travail et vie de famille. Ainsi, le cadre institutionnel a le potentiel d'encourager ou de freiner un partage plus égalitaire des activités professionnelles et domestiques entre partenaires. Bien sûr, le développement économique peut aussi être accompagné d'un changement des normes et des paradigmes ce qui permet aux parents de mieux partager les responsabilités économiques et éducatives. En tout cas, selon les prédictions théoriques, il semble que les couples égalitaires soient ceux qui arrivent à réaliser leurs intentions de fécondité le plus fréquemment aujourd'hui.

1.1.3. Combiner vie professionnelle et vie familiale – quelles institutions sont-elles- importantes ?

Dans une deuxième étude empirique (Luci-Greulich et Thévenon, 2013), nous évaluons l'impact des politiques familiales sur le niveau de fécondité. Nous discutons également l'impact des politiques familiales sur d'autres dimensions sociales (redistribution, développement des enfants, égalité entre femmes et hommes, etc.) dans les pays développés (Thévenon et Luci 2012, Greulich 2016).

Trois conceptions différents sont identifiées pour expliquer les différences nationales en termes de programmes de politiques familiales : certains pays misent l'accent sur la réduction de la pauvreté (focus sur les transferts monétaires forfaitaires, notamment dans certains pays de l'Europe de l'Est), tandis que d'autres essaient surtout de réduire l'antagonisme supposé entre fécondité et emploi des femmes (focus sur les services de garde d'enfants, notamment en France et dans les pays Nordiques), et encore d'autres essaient principalement de réduire le conflit potentiel entre activité féminine et développement des enfants (focus ici plutôt sur l'emploi à temps partiel des femmes, notamment dans les pays germanophones).

Compte tenu des arguments théoriques présentés, la compatibilité entre maternité et emploi des femmes apparaît comme un paramètre clé permettant de concilier tous les trois objectifs. Les politiques qui fournissent une aide institutionnelle visant à combiner vie professionnelle et vie familiale contribuent potentiellement à la reprise de la fécondité. Elles permettent de :

- réduire les coûts monétaires directs liés aux enfants (logement, éducation),
- réduire les coûts indirects (opportunités de revenu manquées),
- signifier aux parents qu'il est socialement acceptable de sortir d'un partage rigide des rôles (parentaux et économiques)

Afin de déterminer quelles institutions publiques sont les plus efficaces pour cela, nous évaluons d'abord l'impact des changements de politiques familiales sur les tendances de la fécondité dans les pays développés. Nous examinons un ensemble complet d'instruments de politique familiale et identifions l'influence respective de chaque élément de soutien, qu'il soit financier ou en nature, sur la fécondité. Nous nous efforçons de dissocier l'incidence des politiques familiales vis à vis des autres caractéristiques institutionnelles (contexte du marché du travail, normes). Pour ce faire, nous intégrons dans les analyses, des facteurs tels que le degré de protection sur le marché du travail ou la part de naissances hors mariage en tant que mesure indirecte des normes de la famille « moderne ». Toutefois, nous reconnaissons que dissocier les différents effets n'est pas toujours possible, dans la mesure où la théorie a montré que les normes et les institutions étaient fortement interdépendantes (Bourdieu, 1996).

Des données agrégées de panel provenant de 18 pays de l'OCDE et portant sur la période allant de 1982 à 2007 sont utilisées (Luci-Greulich et Thévenon, 2013). Les données viennent principalement de la base de données OCDE sur la famille (OECD Family Database : L'OCDE a élaboré une base de données sur les caractéristiques actuelles des familles et les politiques relatives à ces dernières, avec des indicateurs pour chaque pays de l'OCDE. La base de données regroupe des informations provenant de différentes bases de données nationales et internationales).

Plusieurs instruments de la politique familiale sont pris en compte : différents types d'allocations, durée du congé parental rémunéré ainsi que la couverture des besoins en garde d'enfants et les dépenses liées à la garde des enfants. Deux types différents de prestations financières sont distingués afin de dissocier le soutien octroyé au moment de la naissance du soutien fourni plus tard en vue de couvrir les coûts liés au fait d'élever des enfants (dépenses par naissance, en % du PIB par habitant, incluant les prestations de maternité, de paternité et de congé parental, la durée du congé parental rémunéré ainsi que les primes de naissance ; et dépenses de prestations en espèces par enfant de moins de 20 ans, également en % du PIB par habitant, transferts fiscaux non inclus). Les services de garde d'enfants sont fractionnés en termes de dépenses et de couverture (dépenses consacrées aux services de garde d'enfants par enfant âgé de moins de trois ans, en % du PIB par habitant ; et nombre d'enfants de moins de trois ans bénéficiant d'un service de garde d'enfants, en pourcentage du nombre total d'enfants de ce groupe d'âge). Enfin, le nombre de semaines de congé rémunéré (donc la durée du congé) fait office de cinquième variable de politique familiale, en additionnant les semaines de congé maternité et le nombre de semaines de congé parental que les femmes ont le droit de prendre après un congé maternité en tant que tel.

Notre contribution pour cette partie est triple.

Premièrement, nous avons élargi notre perspective par rapport aux précédentes conclusions, en examinant trois types principaux d'instruments de politique (transferts en espèces, congé parental et services de garde d'enfants), là où les études antérieures se concentraient essentiellement sur un ou deux de ces aspects. Deux types de prestations en espèces sont distingués afin de dissocier le soutien octroyé au moment de la naissance du soutien fourni plus tard en vue de couvrir les coûts liés au fait d'élever des enfants. Les services de garde d'enfants sont fractionnés en termes de dépenses et de couverture. Ainsi, nous pouvons analyser l'influence de différents types de soutien familial censés répondre aux besoins des familles en termes de temps, d'argent et de services lors de la naissance et de la totalité de la période d'éducation des enfants. En outre, nous nous efforçons d'éliminer les éventuels effets sur la fécondité du calendrier des naissances et du contexte institutionnel des pays (émancipation des femmes, chômage, protection sur le marché du travail, normes culturelles en matière d'éducation des enfants et contexte général d'État-providence).

Deuxièmement, nous actualisons des recherches antérieures en mettant l'accent sur une période couvrant la récente hausse des taux de fécondité (avant la crise de 2008). Déterminer dans quelle mesure les politiques ont contribué à cette inversion des tendances de la fécondité a donc représenté un point essentiel.

Troisièmement, nous appliquons des méthodes d'estimation sur données de panel. Un modèle à effets fixes permet de contrôler pour des caractéristiques nationales et des variables constantes dans le temps, ce qui est impossible dans les études qui sont basées soit sur données temporelles, soit sur données transversales. D'autres méthodes d'estimation avancées sur données de panel nous permettent d'appliquer différents contrôles de robustesse afin de prendre en compte l'endogénéité potentielle, la non-stationnarité, le biais par omission de variables ainsi que la dynamique d'ajustement.

Notre étude apporte plusieurs résultats innovants par rapport aux études préexistantes, concernant l'incidence des politiques familiales sur la fécondité. Ces dernières étaient le plus souvent spécifiques à un pays ou bien couvraient une période plus courte et/ou encore ne mettaient l'accent que sur un sous-ensemble d'instruments de politique (Gauthier et Hatzius 1997, Adsera 2004, D'Addio et Mira d'Ercole 2005, Kalwij 2010).

Nous constatons que le montant moyen des prestations en espèces couvrant la période suivant l'année de naissance a une incidence positive considérable sur la fécondité. Cette incidence est confirmée lorsque les taux de fécondité corrigés de l'effet de calendrier sont pris en considération, ce qui laisse entendre que ces prestations en espèces ont non seulement une incidence sur le calendrier des naissances, mais ont aussi un effet sur l'intensité de la fécondité. Nous constatons également qu'un allongement de la durée des congés rémunérés a une incidence positive sur les taux de fécondité une fois que nous contrôlons pour les différences de volume de travail des femmes entre pays. Nous révélons enfin un effet positif significatif du taux de couverture de la garde d'enfants formelle (crèches, assistantes maternelles, garde à domicile) sur les niveaux de fécondité.

Nous constatons ensuite que si tous les instruments ont un effet positif sur la fécondité, tous les leviers politiques n'ont pas la même efficacité: les prestations en espèces couvrant l'enfance au-delà de un an après la naissance et le taux de couverture des services de garde d'enfants pour les enfants âgés de moins de trois ans ont une influence potentielle plus importante sur la fécondité que le droit au congé et les prestations allouées au moment de la naissance.

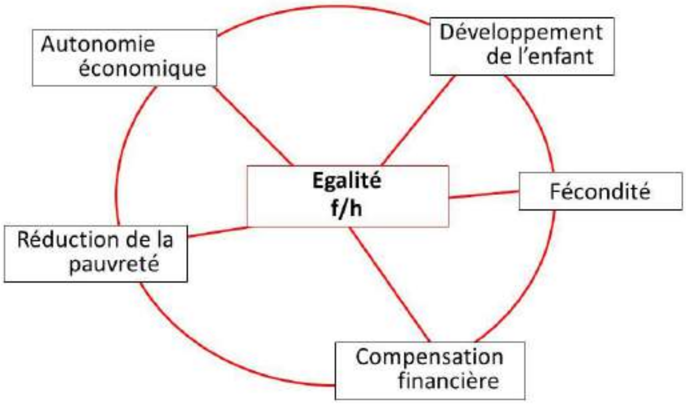
Finalement, d'autres objectifs au-delà de la fécondité sont intégrés dans notre spectre d'analyse (Thévenon et Luci 2012, Greulich 2016).

Nous constatons que les politiques encourageant un recours à la garde d'enfants formelle ont un effet positif significatif sur la participation des femmes au marché du travail, à temps plein et à temps partiel. Cet effet est d'ailleurs bien plus fort que les effets du montant des congés rémunérés, des autres prestations familiales en espèces ou du nombre de semaines de congé rémunérées. La garde d'enfants formelle émerge donc comme l'instrument de politique le plus efficient pour encourager à la fois la fécondité et l'emploi des femmes, par rapport aux autres politiques familiales.

En effet, les pays développés ayant les taux de fécondité et d'emploi des femmes, les plus élevés sont également ceux qui ont un taux de couverture élevé des services de garde d'enfants, à l'instar des pays nordiques ou de la France. En revanche, les pays caractérisés par des niveaux faibles de fécondité et d'emploi des femmes ont tendance à fournir un soutien relativement faible en faveur de la conciliation du travail et de la vie de famille. Dans les pays où l'accès à la garde d'enfants formelle est limité (faible taux de couverture des services publics de garde d'enfants, peu ou pas de subventions des services privés, écoles fermées l'après-midi etc.), les femmes sont contraintes de choisir entre emploi et enfants, ce qui réduit à la fois le taux de fécondité et le taux d'emploi des femmes. C'est le cas par exemple dans les pays du sud de l'Europe, où de nombreuses mères sont inactives. En Allemagne, beaucoup de mères doivent limiter leurs activités professionnelles à de petits emplois précaires à temps partiel (« mini jobs »), tandis que les femmes qui poursuivent une carrière à temps plein ont tendance à ne pas avoir d'enfants ou à n'en avoir qu'un seul. Notons que les faibles taux de couverture de la garde d'enfants ne sont en aucun cas causés par une faible demande de ce service, mais qu'il existe bel et bien un excès de demandes en ce qui concerne les services de garde, surtout pour les tout jeunes enfants, dans la plupart des pays européens (Thévenon, 2015).

La reprise de la fécondité se produit donc dans les pays développés qui investissent afin de permettre aux parents de concilier vie professionnelle et vie familiale. D'autres études récentes à l'échelle macroéconomique complètent cette conclusion en montrant que le rebond de la fécondité est plus important dans les pays développés qui ont le plus œuvré pour une évolution des relations entre les sexes en faveur d'une meilleure égalité. Cela a notamment été mesuré, à travers des attitudes favorables à l'égalité professionnelle entre les sexes, par le nombre croissant de naissances hors mariage ou par l'implication croissante des hommes dans la vie du foyer (Balbo, Billari et Mills, 2013 ; Goldscheider, Bernhardt et Brandén, 2013 ; Neyer, Lappegård et Vignoli, 2013 ; Arpino et Esping-Andersen, 2015 ; Baizan, Arpino et Delclos, 2015). L'égalité entre femmes et hommes (c'est-à-dire un partage égalitaire entre les responsabilités économiques et les responsabilités familiales) émerge donc comme un objectif clé qui permettrait aux politiques de répondre à plusieurs objectifs sociaux en même temps (fécondité, autonomie économique des femmes, prévention de la pauvreté des enfants, compensation des coûts liés aux enfants…).

Ce principe est illustré ici :



Source : Greulich (2016): "The impact of family policies on fertility trends", Chapter 13 in "As problematicas de natalidade em Portugal", edited by V. Cunha, D. Vilar, K. Wall, J. Lavinha and P. Trigo Pereira, Imprensa de Ciencias Sociais, Lisboa

1.2. Les différentiels socio-économiques des comportements de fécondité et leur dépendance au contexte institutionnel

Cette deuxième section expose mes travaux sur les différentiels socio-économiques des comportements de fécondité dans les pays européens.

En partant du constat qu'il y a un lien positif entre le niveau de participation économique des femmes et le niveau de fécondité dans les pays développés, je m'interroge maintenant dans quelle mesure ce lien reflète les comportements individuels. Est-ce vraiment les femmes éduquées et actives économiquement qui ont plus de facilité à réaliser leurs intentions de fécondité aujourd'hui ? Et le cadre institutionnel, influence-t-il les décisions de fécondité des parents de façon homogène ou y a-t-il un impact différentiel selon les caractéristiques socio-économiques des parents ?

Pour répondre à ces questions, j'ai mobilisé des données d'enquête longitudinales couvrant l'ensemble des pays européens. Etant donné la richesse de ces données et la complexité des questions de recherche posées, j'ai élaboré plusieurs projets de recherche qui sont tous complémentaires. J'ai collaboré non seulement avec des économistes, mais aussi avec des démographes et des sociologues, français et internationaux.

1.2.1. Motivation et méthode d'analyse

Mon ambition est d'analyser comment les différentes configurations des caractéristiques économiques et institutionnelles des pays européens coïncident avec des comportements démographiques différents. En identifiant des différences socio-économiques de la fécondité européenne et les impacts différentiels du contexte institutionnel et économique, mes recherches montrent l'importance de considérer explicitement l'hétérogénéité de la population dans l'interrelation entre le contexte agrégé et le comportement individuel. Mon attention particulière portée aux différents groupes socio-économiques me permet de fournir des recommandations politiques plus ciblées.

Peu d'études ont analysé le lien entre caractéristiques socio-professionnelles et parentalité au niveau individuel ou du couple en prenant en compte, en même temps, le contexte institutionnel. Les études qui mobilisent des données de panel individuelles et/ou du ménage se concentrent pour la plupart sur un ou quelques pays. Il est indéniable que ces études contiennent de précieuses informations relatives à l'évolution de l'éducation, de l'emploi et de la fécondité (par exemple, les études basées sur le PSID américain, sur le SOEP allemand, sur l'enquête britannique auprès des ménages, l'Etude transversale répétée sur la Famille et les Logements en France, etc.). Toutefois, en raison d'une couverture géographique limitée, ces études ne parviennent pas à tenir compte du cadre institutionnel d'un pays dans leurs analyses économétriques. Les institutions sont pourtant essentielles pour déterminer le lien individuel entre éducation, emploi et fécondité.

D'autres études couvrent un ensemble important de pays, mais font défaut en termes de modélisation d'un ensemble holistique de caractéristiques socio-économiques. Par exemple, l'enquête Genre et Générations (Gender and Generations Survey - GGS) couvre 19 pays développés et contient des informations rétrospectives sur l'éducation et l'emploi des individus interrogés. Toutefois, les informations relatives aux autres membres du ménage, tels que le conjoint, ne sont pas disponibles. Par conséquent, les études basées sur l'enquête GGS doivent se limiter à une modélisation de la fécondité en tant que décision individuelle plutôt qu'en tant que décision prise par les deux conjoints, ce qui revient à occulter la moitié de l'histoire dans la plupart des cas. De plus, ce genre d'enquête pâtit également d'un manque d'informations précises quant aux différents types d'activités économiques (temps plein, temps partiel, travail indépendant, etc.).

Afin d'éviter ces lacunes, j'utilise des données d'enquête issues des statistiques de l'union européenne sur le revenu et les conditions de vie (EU Statistics on Income and Living Conditions : EU-SILC) afin d'analyser les différentiels socio-économiques de fécondité en Europe. L'avantage des données EU-SILC est double : elles offrent une grande couverture géographique et fournissent des mesures socio-économiques harmonisées détaillées et individuelles pour tous les membres des ménages.

Les données EU-SILC sont issues d'une enquête européenne fournie par Eurostat. Cette enquête a été créée en 2003 afin de remplacer le Panel communautaire des ménages (PCM ; European Community Household Panel - ECHP) et inclut désormais trente-et-un pays européens. Depuis cette date, Eurostat publie une nouvelle vague chaque année. L'enquête recueille des données harmonisées et comparables, au niveau individuel et au niveau du ménage, relatives au revenu et aux conditions de vie. Les données EU-SILC sont compilées pour – et donc essentiellement utilisées pour – l'analyse socio-économique, dans la mesure où elles contiennent de très nombreuses informations concernant le revenu et le statut de l'emploi. Néanmoins, les données EU-SILC peuvent également être utilisées à des fins démographiques, puisque les données, en plus de fournir des informations démographiques de base telles que le sexe et l'âge, permettent d'étudier les caractéristiques des conjoints et des enfants et de mesurer les naissances.

Dans la mesure où l'enquête contient des informations et sur les individus et sur les ménages, il est possible de faire le lien entre les informations individuelles et les informations des autres membres des ménages. Il est donc possible d'identifier les femmes, leurs conjoints et leurs enfants vivant au sein d'un même foyer. Les données EU-SILC offrent ainsi la possibilité unique d'étudier les caractéristiques des femmes simultanément aux caractéristiques de leurs conjoints, tout en conservant une importante couverture géographique. Le suivi des naissances est possible car les données EU-SILC sont composées de deux ensembles de données – elles comprennent non seulement un module transversal, mais aussi un module longitudinal. L'ensemble de données longitudinales des EU-SILC est un panel rotatif sur quatre ans, ce qui signifie que pour la majorité des pays, les individus sont suivis pour une période maximale de quatre ans. La conception rotative du panel et le suivi relativement court réduisent le biais de mesures imputables à l'attrition de l'échantillon. Les données transversales annuelles sont produites à partir du panel longitudinal (« integrated design » : conception intégrée). Cela permet d'obtenir un vaste échantillon pour chaque pays.

L'ensemble de données transversales fournit un échantillon aléatoire représentatif au niveau national pour chaque pays. Cela permet aux chercheurs de compiler des mesures agrégées en termes d'emploi, de revenu, de fécondité, etc., et de les différencier en sous-catégories. L'échantillon longitudinal, bien que relativement court, peut servir à modéliser les déterminants du risque de naissance. En raison du suivi sur une certaine période, les caractéristiques individuelles des mères et des conjoints peuvent être étudiées avant la naissance, ce qui réduit les biais d'endogénéité résultant d'une causalité inverse. Le fait que les données EU-SILC fournissent des mesures socio-économiques détaillées en termes de statut sur le marché du travail, pour lequel des informations sont disponibles tous les mois, permet d'étudier les caractéristiques d'emploi des femmes et de leurs conjoints non seulement à un moment donné avant la naissance, mais aussi durant une certaine période avant la conception potentielle d'un enfant.

Dans la mesure où les données longitudinales couvrent la majorité des pays européens, la taille de l'échantillon est suffisante pour analyser les effets différentiés par sous-échantillon Cela est fondamental pour l'analyse des différentiels socio-économiques dans le comportement de fécondité. Les naissances, et en particulier les naissances de rang supérieur, sont des évènements relativement rares dans les panels courts. En moyenne, dans les données EU-SILC, environ 3 % des femmes présentant « un risque » de première naissance au début de la période considérée ont un premier enfant pendant la durée de suivi. Ce ratio est si faible car le dénominateur est très large (femmes à risque d'une première naissance : toutes les femmes âgées entre 15 et 45 ans qui sont sans enfants au début de la période observée). Le ratio de progression du premier au deuxième enfant n'est que de 10 %, et les ratios de progression pour les rangs supérieurs sont inférieurs à 5%. Grâce à la grande taille de l'échantillon international, il est toutefois possible de modéliser les naissances, différenciées par rang, comme une fonction des caractéristiques individuelles, des conjoints et des ménages telles que l'éducation, l'emploi et le revenu.

Par ailleurs, la grande couverture géographique permet de modéliser les déterminants institutionnels en liant les données d'enquête aux mesures agrégées, lesquelles varient entre pays et dans le temps. Cela est crucial pour expliquer les différences des niveaux de fécondité entre les pays, ainsi que pour identifier la mesure dans laquelle les différentiels socio-économiques de fécondité au sein des pays sont dépendants du contexte.

Ce sont tous ces aspects pratiques qui m'ont poussée à recourir aux données EU-SILC pour l'analyse des différentiels socio-économiques dans la fécondité au sein des pays européens. L'utilisation des données EU-SILC représente une nouveauté dans le domaine de l'analyse sociodémographique. Elle offre la possibilité d'introduire de nouvelles perspectives importantes, mais implique également des défis en termes de méthodologie. Dans la mesure où les données EU-SILC sont conçues pour l'analyse socio-économique, j'ai porté une attention particulière à l'identification et au contournement des inconvénients et des limites des données EU-SILC aux fins de l'analyse démographique.

Ma contribution à l'approfondissement des connaissances scientifiques revêt par conséquent deux dimensions, l'une de contenu et l'autre méthodologique.

En ce qui concerne la dimension de contenu, j'ai tiré parti de la nature multidimensionnelle des données EU-SILC (ensemble de mesures socio-économiques, grande couverture géographique, conception intégrée, etc.) pour développer plusieurs projets ayant des axes thématiques différents. Un premier axe thématique est consacré au lien entre éducation et fécondité, tandis qu'un deuxième axe met en avant le lien entre emploi et fécondité. Des comparaisons internationales permettant de modéliser les différences institutionnelles ont été réalisées ainsi que des études approfondies par pays (France, Allemagne, Turquie, Pologne).

En termes de méthodologie, j'ai analysé la qualité des différentes mesures de fécondité présentes dans les données EU-SILC. En plus d'une identification et d'une quantification exhaustive de ces biais pour chaque pays, des solutions ont été développées afin de les contrôler et de les éliminer. En outre, une méthode d'imputation multiple a été testée en vue de surmonter le problème posé par la durée très limitée de l'échantillon longitudinal en termes de modélisation des déterminants du risque de naissance.

1.2.2. Les différences de fécondité entre catégories d'éducation en Europe et leur dépendance à l'accès aux services de garde d'enfants

Ce premier volet de recherche consiste à analyser les différentiels de fécondité par niveau d'éducation dans les pays européens, en collaboration avec l'économiste français Hippolyte d'Albis (École d'économie de Paris, CNRS) et l'économiste argentine Paula Gobbi (Université catholique de Louvain, Belgique). Outre une analyse empirique, nous avons mis au point un modèle théorique de décision de fécondité basé sur l'éducation et l'accès à la garde d'enfants. L'article paraitra dans la revue *Journal of Demographic Economics*[7].

[7] H. D'Albis, P. Gobbi, A. Greulich (2017): "Having a Second Child and Access to Childcare: Evidence from European Countries" *Journal of Demographic Economics* (à paraître).

Les études récentes analysant le lien entre éducation et fécondité sont spécifiques à un pays, manquent d'informations relatives aux conjoints et/ou se concentrent uniquement sur des cohortes plus anciennes. Kravdal et Rindfuss (2008), par exemple, constatent qu'en Norvège, le lien négatif qui existe entre éducation des femmes et naissances de rang supérieur à un disparaît entre les cohortes nées au début des années 1940 et celles nées au début des années 1960, tandis que ce lien devient positif pour les cohortes plus jeunes. Baizan, Arpino et Delclos (2015) constatent que dans certains pays européens, la couverture des besoins en garde d'enfants est positivement liée à la descendance finale au niveau individuel pour l'ensemble des groupes de niveaux d'éducation, même si cette corrélation est plus marquée pour les femmes ayant un haut niveau d'éducation. Hazan et Zoabi (2015) constatent que des inégalités salariales plus marquées aux États-Unis conduisent les femmes très qualifiées à externaliser davantage la garde d'enfants, établissant une relation en forme de U entre éducation des femmes et fécondité. Basé sur les données EU-SILC, Klesment *et al.* (2014) confirment un lien positif entre éducation des femmes et naissance d'un second enfant dans le nord et l'ouest de l'Europe, mais pas dans les pays germanophones ni dans le sud et l'est de l'Europe. Le contexte institutionnel de ces pays n'est pourtant pas modélisé comme déterminant dans cette étude.

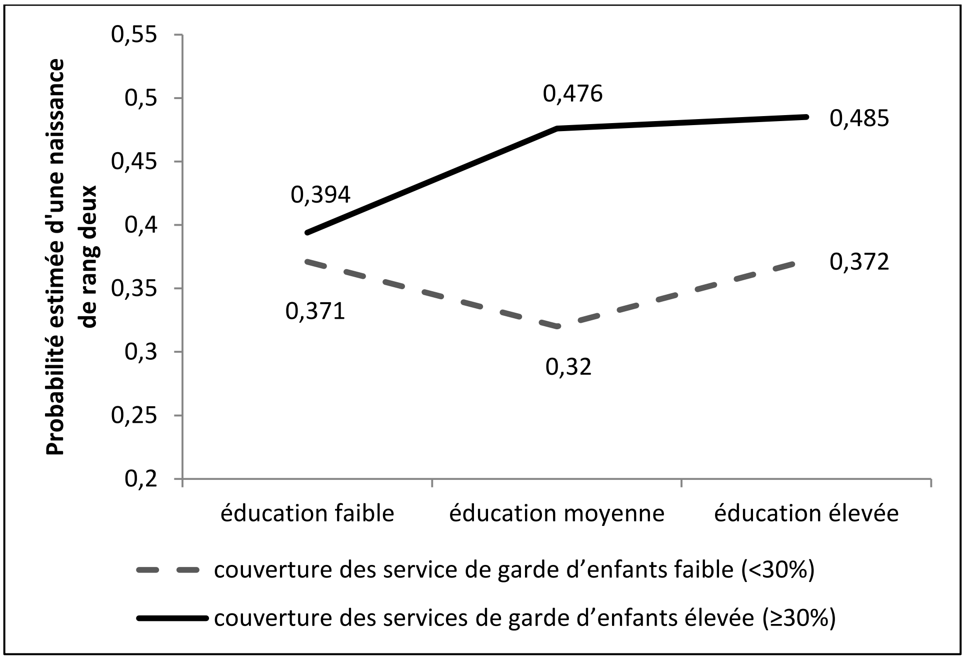
En mobilisant l'enquête européenne sur le revenu et les conditions de vie (EU-SILC), nous étudions les naissances pour les femmes de toutes les cohortes en âge d'enfanter pendant la période considérée et tenons compte des caractéristiques des conjoints. Nous appliquons des modèles multiniveaux qui prennent en considération le contexte institutionnel en combinant les données EU-SILC avec des données agrégées issues de la base de données de l'OCDE sur la famille.

Notre analyse apporte plusieurs éléments nouveaux à la littérature. Dans un premier temps, nous apportons la preuve empirique que le fait d'avoir un second enfant constitue la principale différence dans le comportement de fécondité entre les pays ayant un faible taux de fécondité et les pays ayant un taux de fécondité élevé en Europe. En d'autres termes, c'est l'absence d'enfants de rang de naissance deux qui contribue le plus à l'écart entre le taux de fécondité des pays à faible fécondité et celui des pays à forte fécondité. Breton et Prioux (2005) trouvent, avec la même méthode de calcul, une contribution un peu plus élevée des naissances de rang trois.
Ceci est dû au fait qu'ils n'incluent pas les pays de l'Europe de l'Est dans leur échantillon et qu'ils se concentrent sur des cohortes plus âgées. En même temps, ils trouvent comme nous, que moins d'enfants de rang un n'est pas la principale explication des faibles niveaux de fécondité. Nous constatons également que la probabilité d'agrandissement de rang 1 au rang 2 est plus élevée dans les pays qui possèdent une meilleure couverture en matière de garde d'enfants pour les enfants âgés de 0 à 2 ans.

Dans un second temps, nous fournissons un cadre théorique qui explique que l'impact de l'éducation et du niveau de salaire potentiel sur la probabilité d'avoir un deuxième enfant diffère selon le cadre institutionnel.

Dans un troisième temps, nous montrons que les implications qui découlent de la théorie se reflètent solidement dans les données : Afin de modéliser l'incidence de l'éducation et d'autres caractéristiques individuelles des conjoints et du cadre institutionnel sur la probabilité pour les femmes d'avoir un deuxième enfant, nous mobilisons l'ensemble des données longitudinales qui couvre 25 pays et les années d'enquête 2003 à 2011. Les déterminants individuels des mères et des conjoints sont observés pendant l'année précédant l'année civile de la naissance potentielle. Cela permet de réduire l'endogénéité.

Le graphique 3 illustre nos résultats. Nous constatons que les différences de comportements de fécondité entre niveaux d'éducation des femmes ne sont pas universelles en Europe, mais dépendent du contexte institutionnel. Dans les pays où la couverture en matière de garde d'enfants (âges 0-2) est faible (inférieure à 30%), la courbe représentant la probabilité estimée d'avoir un second enfant en fonction de l'éducation des femmes affiche un profil en forme de U : les femmes peu éduquées et ayant un niveau d'éducation élevée (éducation tertiaire) ont une probabilité plus élevée d'avoir un deuxième enfant pendant la période observée que les femmes moyennement éduquées (éducation secondaire). Dans les pays ayant une couverture élevée en matière de garde d'enfants (supérieure à 30%), l'éducation des femmes accroît la probabilité d'avoir un second enfant.



Graphique 3 : Probabilité estimée d'une naissance de rang deux en fonction de l'éducation de la femme et du niveau de couverture des services de garde d'enfants (0-2 ans) du pays

EU-SILC LT (2003-2011), femmes âgées de 15 à 45 ans

Source : d'Albis, Gobbi et Greulich (2017)

Education faible : pré-primaire, primaire et secondaire inférieur
Education moyenne : secondaire supérieur, post-secondaire
Education élevée : éducation supérieure

Nos résultats sont robustes en contrôlant pour d'autres facteurs contextuels comme le niveau général du revenu et les différences de rémunération entre femmes et hommes. En outre, nous trouvons que dans les pays ayant des niveaux élevés de couverture en matière de garde d'enfants, la probabilité d'une seconde naissance est généralement plus élevée pour tous les niveaux d'éducation que dans les pays ayant une couverture plus faible en matière de garde d'enfants.

L'accès à la garde d'enfants favorise donc la naissance d'un second enfant pour tous les niveaux d'éducation des femmes. Toutefois, nos résultats empiriques suggèrent également, que dans les pays ayant une forte couverture en matière de garde d'enfants, la naissance d'un second enfant est particulièrement facilitée pour les femmes ayant un niveau d'éducation moyen à élevé, tandis que dans les pays ayant une faible couverture en matière de garde d'enfants, ce sont surtout les femmes ayant un niveau d'éducation moyen qui sont confrontées à des obstacles à une seconde naissance. Compte tenu du fait que la transition vers un second enfant constitue un déterminant important pour le niveau de fécondité agrégé d'un pays, il apparaît que les niveaux de fécondité sont plus élevés dans les pays ayant une couverture plus forte en matière de garde d'enfants, en particulier en raison du fait que davantage de femmes ayant un niveau d'éducation moyen à élevé décident d'avoir un second enfant.

Notre modèle théorique nous permet de développer quelques hypothèses pour une meilleure compréhension des schémas mis à jour par notre analyse empirique : l'accès à la garde d'enfants joue un rôle important, en particulier pour les femmes ayant un niveau d'éducation moyen à élevé, du fait que ces femmes supportent un coût d'opportunité plus important en termes de revenu du travail perdu lorsqu'elles doivent garder elles-mêmes leur enfant. Un accès simplifié à des services de garde d'enfants, réduit ce coût et augmente donc la fécondité. Le profil en forme de U signifie que ce sont surtout les femmes ayant un niveau d'éducation moyen qui s'opposent à une seconde naissance dans les pays où il est difficile d'accéder à la garde d'enfants. Avoir un second enfant inciterait les femmes à interrompre ou à réduire leurs activités professionnelles, ce qui rend probable leur décision de ne pas avoir de second enfant afin de maintenir le revenu de la famille. Dans ces pays, les femmes ayant un niveau d'éducation élevé ont une probabilité plus forte d'avoir un second enfant que les femmes ayant un niveau d'éducation moyen, car le ménage peut se permettre les pertes de revenu liées à l'interruption ou à la réduction des activités professionnelles de la femme ou bien acheter des services de garde d'enfants sur le marché privé (garde à domicile, etc.). Les femmes ayant un faible niveau d'éducation ont une probabilité plus forte d'avoir un second enfant que les femmes ayant un niveau d'éducation moyen dans les pays ayant une faible couverture en matière de garde d'enfants, dans la mesure où elles supportent un coût d'opportunité relativement bas en termes de revenu sacrifié (coûts indirects liés au fait d'avoir des enfants). Par opposition, dans les pays ayant une forte couverture en matière de garde d'enfants et dans lesquels les parents, et en particulier les mères, n'ont pas à choisir entre travail et garde d'enfants, la probabilité d'une seconde naissance augmente avec le niveau d'éducation de la femme, puisque l'éducation (qui sert comme « proxy » pour le revenu) permet de supporter plus facilement les coûts directs des enfants (effet revenu).

1.2.3. Faciliter l'emploi des femmes : un catalyseur de la fécondité ?

Afin d'analyser l'incidence du statut d'activité des femmes et de leurs conjoints sur la décision du couple d'agrandir la famille, j'ai collaboré avec les économistes français Olivier Thévenon (OCDE, Ined) et Mathilde Guergoat-Larivière (Conservatoire national des arts et métiers, Centre d'études de l'emploi). L'article paraitra dans la revue *Population*[8]. Quelques-uns de ces résultats ont également été mobilisés et développés pour discuter les choix de fécondité en période de crise économique en Europe. Cette discussion a été publiée dans la *Revue D'Economie Financière*[9]. Nos résultats ont également été mobilisés pour un rapport scientifique de la Banque Mondiale ainsi que pour un dialogue avec les Ministères polonais et russe des Affaires Familiales (voir section 3.3. pour plus de détail).

Afin d'analyser l'incidence du statut d'activité des femmes et de leurs conjoints sur la décision du couple d'agrandir la famille, nous mobilisons des données d'enquête longitudinales couvrant 25 pays européens (EU-SILC). Des modèles probit bivariés permettent de prendre en compte l'endogénéité, tandis que des modèles multiniveaux tiennent compte de l'incidence du contexte institutionnel sur les décisions en matière de fécondité.

Les études pionnières, recourant à des données d'enquête, montrent que la relation entre fécondité et emploi féminin évolue dans le temps et dépend des préférences, des situations sur le marché du travail et des institutions. Ces études se concentrent soit sur la descendance finale (par exemple, Willis, 1973), soit sur un ensemble limité de pays (par exemple, Blau et Robins 1989, Hotz et Miller 1988, Moffitt 1984, Butz et Ward 1979). Les études plus récentes sont également principalement axées sur un seul pays ou ne couvrent qu'un ensemble limité de pays. Pailhé et Solaz (2012) analysent, par exemple, l'impact du chômage sur les comportements de fécondité pour la France. Les études qui couvrent plus de pays n'étudient généralement pas les caractéristiques des conjoints (par exemple Wood et al., 2015).

Matysiak et Vignoli (2008) procèdent à un examen systématique (une méta-analyse) des études disponibles analysant les effets de l'emploi des femmes sur la fécondité. Ils constatent que ces effets varient fortement selon les contextes institutionnels et observent une réduction significative du conflit entre vie professionnelle et vie familiale dans le temps au sein des pays où le taux de fécondité augmente à nouveau. Les données disponibles suggèrent que l'entrée des femmes sur le marché du travail va de pair avec la naissance d'un *premier* enfant dans les pays où le cadre institutionnel est suffisamment complet pour faciliter la conciliation du travail et de la vie de famille (Rendall *et al.*, 2014 ; Wood *et al.*, 2015 ; Schmitt, 2012). Adsera (2011) montre, en s'appuyant sur des données provenant de 13 pays européens, que l'incidence du statut d'emploi sur les transitions vers les naissances de rang supérieur à un, varie de manière significative entre secteur public et secteur privé et selon la durée du contrat. Sur la base de modèles de risque pour la transition vers le premier et le second enfant, Matysiak et Vignoli (2013) constatent que l'emploi des femmes fait obstacle à la maternité en Italie, tandis qu'en Pologne, les femmes ont tendance à concilier les deux activités.

[8] A. Greulich, O. Thévenon, M. Guergoat-Larivière (2017): "Employment and second childbirths in Europe." *Population* (à paraître).

[9] A. Greulich (2016): « Rebond de la fécondité » dans les pays développés, automatisme ou apanage de quelques rares privilégiés ? » *Revue d'Economie Financière* n° 122, pages 57-68.

Bien que chacune de ces études fournisse des renseignements essentiels, elles pâtissent d'importantes limites, dans la mesure où elles ne couvrent pas, ou insuffisamment, les interactions entre les conjoints et où la couverture géographique restreinte entrave l'analyse comparative. La mobilisation des données EU-SILC nous permet de couvrir un grand groupe de pays européens tout en observant les deux partenaires du couple.

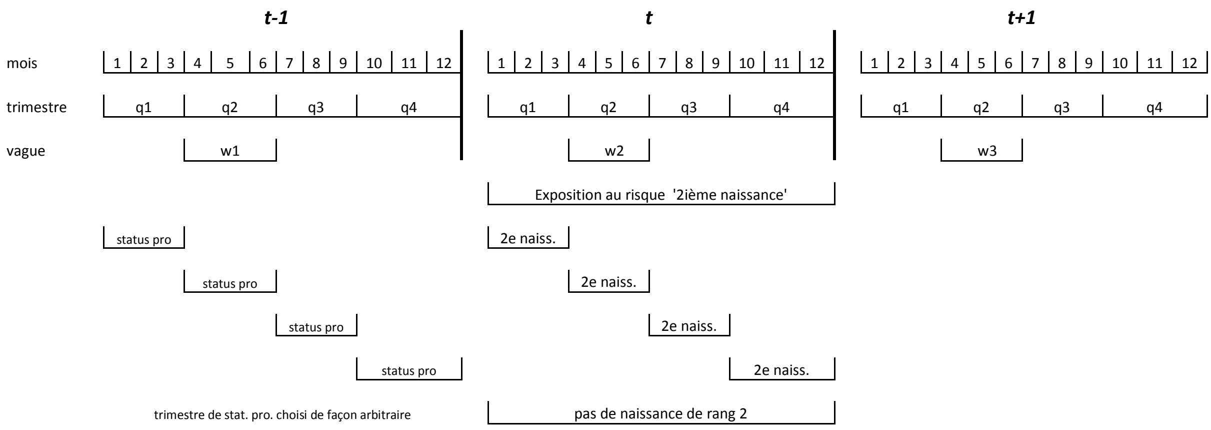
Nous analysons l'incidence de la participation des femmes au marché du travail sur les décisions des couples en matière de fécondité en se concentrant encore une fois sur la seconde naissance, dans la mesure où nous constatons que près de la moitié de l'écart dans la descendance finale entre pays à forte fécondité et pays à faible fécondité en Europe est dû au moindre nombre d'enfants de rang de naissance deux. Dans un contexte de préférences plutôt homogènes (à travers toutes les catégories socio-professionnelles) pour une famille à deux enfants dans les pays européens (Testa 2012, Sobotka et Beaujouan, 2014), ce constat laisse entendre que les parents dans les pays à faible fécondité sont confrontés à des obstacles à réaliser leurs intentions de fécondité. Ces obstacles concernent en particulier le second enfant dans la plupart des pays à fécondité faible.

Nous abordons ces obstacles en étudiant les facteurs favorables et défavorables à la décision d'avoir un second enfant pour les femmes âgées de 15 à 45 ans, en nous concentrant sur un éventuel conflit entre vie professionnelle et vie familiale. Ainsi, nous cherchons à déterminer, dans quelle mesure le fait d'occuper un emploi fait une différence dans la décision d'avoir ou non un second enfant – en tenant compte des caractéristiques des femmes, de leurs conjoints, des interactions au sein du couple et du cadre institutionnel du pays.

Par ailleurs, nous nous efforçons de tenir compte de la causalité inverse entre fécondité et participation au marché du travail. Nous proposons pour cela deux approches : nous permettons un délai temporel entre le statut d'activité observé et la naissance (potentielle), et nous appliquons une approche par variable instrumentale.

D'abord, les données longitudinales sont mobilisées spécifiquement pour étudier le statut d'emploi comme déterminant potentiel plutôt que comme conséquence de la fécondité. Dans la mesure où les données EU-SILC contiennent des informations mensuelles relatives au statut des enquêté-e-s sur le marché du travail ainsi que des informations relatives au trimestre de naissance des enfants, nous pouvons identifier le statut des femmes et de leurs conjoints sur le marché du travail *avant* la conception (potentielle) d'un second enfant. Le statut d'activité des femmes et des hommes est en réalité étudié durant une période de trois mois précédant la conception potentielle. En raison de la durée très limitée du panel et de sa conception rotative, nous ne pouvons pas étudier une période plus longue de statut d'activité pour une proportion importante d'individus. Nous restreignons donc la mesure du statut d'activité à trois mois pour tous les individus, ce qui permet de conserver un nombre d'individus observés aussi conséquent que possible (ultérieurement, nous allons élargir la période observée du statut d'activité à l'aide de la méthode d'imputation multiple - ce travail est décrit dans la section 1.2.6.).

Le graphique 4 illustre notre stratégie d'identification.



Graphique 4 : Illustration de la stratégie d'identification

Source : Greulich, Thévenon et Guergoat-Larivière (2017)

La possibilité d'observer le statut d'activité avant la conception potentielle de l'enfant réduit certainement l'endogénéité, mais il est néanmoins possible que certaines femmes qui ont plus de préférences pour la fécondité soient aussi celles qui ont les préférences les moins marquées pour la participation professionnelle (phénomène de sélection endogène, c.f. Edon et Kamionka 2011). Leur statut professionnel observé avant la conception serait donc le résultat d'un comportement reproductif anticipé.

Afin d'intensifier le contrôle pour l'endogénéité, nous appliquons également une approche par variable instrumentale. Nous mettons en œuvre cette approche en recourant à un modèle probit bivarié qui est estimé au moyen de la méthode du maximum de vraisemblance à information complète. Les taux de chômage régionaux sont censés être des instruments relativement satisfaisants, puisqu'ils sont en principe associés aux situations des femmes sur le marché du travail et ils ne sont pas, ou peu, influencés par leurs décisions en matière de fécondité. Le statut sur le marché de l'emploi des femmes est donc instrumentalisé par des taux de chômage régionaux. Tous les modèles sont exécutés en incluant des effets fixes par année et par pays, ce qui permet de contrôler pour des effets non-observables qui sont relativement constants à travers le temps (comme des normes culturelles au regard du rôle des femmes et des hommes ainsi qu'au regard de l'éducation des enfants, par exemple).

Nous constatons qu'en moyenne, dans les pays européens, les femmes occupant un emploi ont une probabilité significativement plus importante d'avoir un second enfant que les femmes inactives ou au chômage. L'ampleur de l'incidence varie toutefois selon les personnes et entre les groupes de pays. L'impact positif est renforcé pour les femmes ayant un partenaire qui a lui-même un emploi stable, ce qui montre qu'une double activité favorise l'agrandissement de la famille, davantage que les schémas d'emploi hétérogènes entre partenaires. Le fait d'être en emploi est un déterminant essentiel dans la décision d'avoir un second enfant pour les femmes ayant un niveau d'études élevé, mais ne facilite pas nécessairement cette décision pour les femmes ayant un niveau d'études inférieur.

Par rapport aux femmes qui occupent un emploi à temps plein, les femmes travaillant à temps partiel n'ont pas de probabilité significativement différente d'avoir un deuxième enfant. Une analyse par région montre qu'occuper un emploi a un impact significativement positif dans les pays d'Europe du Sud (Portugal, Espagne, Italie, Grèce, Chypre), et surtout en Europe du Nord (Finlande, Suède, Norvège, Danemark, Islande, Estonie, Lituanie et Lettonie). Par contre, être en emploi ne fait pas de différence en Europe de l'Est (Pologne, Hongrie, République tchèque, Bulgarie, Slovénie et Slovaquie) ainsi que dans les pays d'Europe occidentale (France, Luxembourg, Belgique, Autriche, Pays-Bas et Irlande). Toutefois, lorsque l'on distingue entre emploi à temps partiel et emploi à temps plein, nous constatons que l'emploi à temps partiel a un impact significativement positif sur la probabilité d'avoir un deuxième enfant dans les pays d'Europe occidentale. La prévalence des femmes dans l'emploi à temps partiel est relativement élevée dans ces pays par rapport à d'autres régions européennes, même si l'organisation du temps de travail diffère entre pays.

Afin d'aborder la question de la dépendance du lien entre emploi et fécondité du contexte institutionnel, des modèles multiniveaux sont exécutés, lesquels permettent d'intégrer à l'équation d'estimation des variables agrégées telles que le taux de couverture des services de garde d'enfants (enfants âgés de 0 à 2 ans), la durée du congé parental et les transferts monétaires aux familles. Nous observons que le développement de structures formelles de garde d'enfants augmente la probabilité pour les femmes d'avoir un second enfant, en particulier en ce qui concerne les femmes ayant un emploi, tandis que les autres types de soutien institutionnel n'ont pas un effet positif aussi marqué. Par ailleurs, nous constatons que les systèmes de garde d'enfants renforcent l'impact positif de l'emploi sur la probabilité d'avoir un second enfant.

Les politiques en matière de garde d'enfants qui facilitent l'emploi des parents apparaissent donc comme les plus susceptibles d'encourager les couples à agrandir leur famille. Dans les pays européens à faible fécondité, la faible probabilité pour les femmes d'avoir un second enfant est souvent liée aux obstacles institutionnels à l'agrandissement de la famille. L'insuffisance des structures formelles et subventionnées de garde d'enfants décourage en particulier les femmes ayant un niveau d'études inférieur et actives sur le marché du travail d'avoir un second enfant. Dans la plupart des pays à faible fécondité (notamment en Slovénie, en Slovaquie, en Lituanie et en Lettonie), la grande majorité des femmes travaillent à plein temps après la naissance d'un premier enfant. Ces femmes, et en particulier celles ayant un niveau d'études inférieur, qui vivent souvent dans un ménage à faible revenu, sont susceptibles de s'abstenir d'avoir un second enfant. Elles sont susceptibles de redouter de devoir cesser ou réduire leurs activités professionnelles, ce que le ménage ne peut se permettre. Dans d'autres pays à faible fécondité comme la Pologne, la Hongrie, la République tchèque, la Bulgarie, le Portugal, l'Autriche ou l'Allemagne, de nombreuses femmes sont inactives après la naissance de leur premier enfant ou n'exercent qu'un petit emploi à temps partiel. Là encore, ce sont surtout les ménages à faible revenu qui doivent s'abstenir d'agrandir leur famille, en raison de contraintes financières. Dans des pays à forte fécondité, tels que la France et les pays nordiques, l'accès à des structures formelles de garde d'enfants permet aux mères de travailler à temps plein. On constate dans ce cas que la continuité des activités professionnelles des deux parents est favorable à l'agrandissement de la famille pour toutes les catégories de niveau d'études dans ces pays.

Pour un bon nombre de parents, la possibilité de générer et de maintenir un revenu familial constitue une condition fondamentale pour fonder et agrandir une famille. Les pays qui investissent dans des politiques régissant l'équilibre entre travail et vie de famille, telles que celles favorisant les structures formelles de garde d'enfants, sont ceux qui enregistrent les taux de fécondité et d'emploi des femmes les plus élevés. Certainement, ce sont surtout les couples qualifiés qui réussissent le mieux leur insertion professionnelle et qui profitent donc le plus de ces dispositifs. Pour rendre possible, pour tous les couples, la réalisation de leurs intentions de fécondité, faciliter pour les deux partenaires l'accès à un emploi stable émerge comme élément clé. Afin de garantir la sécurité financière des familles, les politiques familiales d'une part, mais aussi les institutions du marché du travail d'autre part, jouent un rôle essentiel. Cela semble particulièrement important au regard de la récente crise économique. Au cours des dernières années, l'indice synthétique de fécondité a stagné ou diminué de nouveau dans beaucoup de pays développés, en particulier dans ceux qui sont les plus touchés par la crise. Le rebond de la fécondité est par conséquent tout sauf un automatisme. De nombreux parents ajournent la naissance d'un enfant (supplémentaire) en raison de l'incertitude économique actuelle. Si les pays ne parviennent pas à fournir des conditions d'emploi stable, les parents risquent non seulement d'ajourner les naissances, mais pourraient également y renoncer, en particulier en ce qui concerne les enfants de rang supérieur.

1.2.4. Les déterminants socio-économiques du calendrier des premières naissances en Europe

Dans le cadre d'un projet de recherche commun avec Hippolyte d'Albis et l'économiste belge Grégory Ponthière (Université Paris Est, Ecole d'Economie de Paris, Institut Universitaire de France), nous avons analysé l'éducation et l'emploi des femmes en tant que déterminants du calendrier des premières naissances. Une première partie de nos recherches a été publiée en français sous la forme d'un ouvrage (*Opuscule du Cepremap*)[10] et d'un chapitre de livre[11], contenant une série d'exemples nationaux et, notamment, une comparaison de l'Allemagne et de la France. Une version plus orientée vers la partie empirique, contenant plusieurs modèles d'estimation ainsi qu'une analyse par groupes de pays, rédigée en anglais, est publiée dans la revue *Demographic Research*[12]. Une autre version plus théorique est actuellement soumise à la revue *Journal of Economic Growth*[13]. Une version courte et adaptée à une audience non-

[10] H. d'Albis, A. Greulich, G. Ponthière (2015): *"Avoir un enfant plus tard. Enjeux sociodémographiques du report des naissances."* Opuscule du CEPREMAP N°39.
[11] H. d'Albis, A. Greulich, G. Ponthière (2017): *« Avoir un enfant plus tard: un risque démographique ? »* Chapitre 7 dans le quatrième volume d'Economiques aux éditions Albin-Michel.
[12] H. d'Albis, A. Greulich, G. Ponthière (2017): "Education, Labour, and the Demographic Consequences of Births Postponement in Europe." *Demographic* Research, Vol. 36, Art. 23, pages 691-728.
[13] H. d'Albis, A. Greulich, G. Ponthière (2017) : *"Development, Fertility and Childbearing Age: A Unified Growth Theory."* Travail en cours.

scientifique est publiée sur *www.niussp.org*, le magazine d'actualités scientifiques en ligne de « l'International Union for the Scientific Study of Population »

Finalement, j'ai élargi la comparaison France/Allemagne en intégrant d'autres pays afin de mieux comprendre les différences entre pays européens en ce qui concerne le partage des responsabilités économiques et familiales entre parents. Cette partie est actuellement soumise à la revue '*Review of Income and Wealth*[14]'. Ces résultats ont également été mobilisés pour un rapport scientifique de l'OCDE ainsi que pour un dialogue avec le Ministère allemand des Affaires Familiales (voir section 3.3. pour plus de détail).

Pour ce projet de recherche, nous avons d'abord mobilisé les données EU-SILC afin de mener une analyse par cohortes synthétiques, destinée à étudier l'incidence ambiguë du calendrier des naissances sur l'intensité de la fécondité. En partant du fait qu'il n'existe pas de corrélation significative entre le calendrier des premières naissances et les niveaux de fécondité en Europe, nous fournissons quelques indications selon lesquelles, dans certaines circonstances (investissements dans l'éducation et développement des carrières), un retard des premières naissances a plutôt pour effet de favoriser la fécondité qu'il ne risque de la réduire, tandis que dans d'autres circonstances (précarité de l'emploi en particulier), un allongement du calendrier des premières naissances risque d'entraver la réalisation des intentions en matière de fécondité.

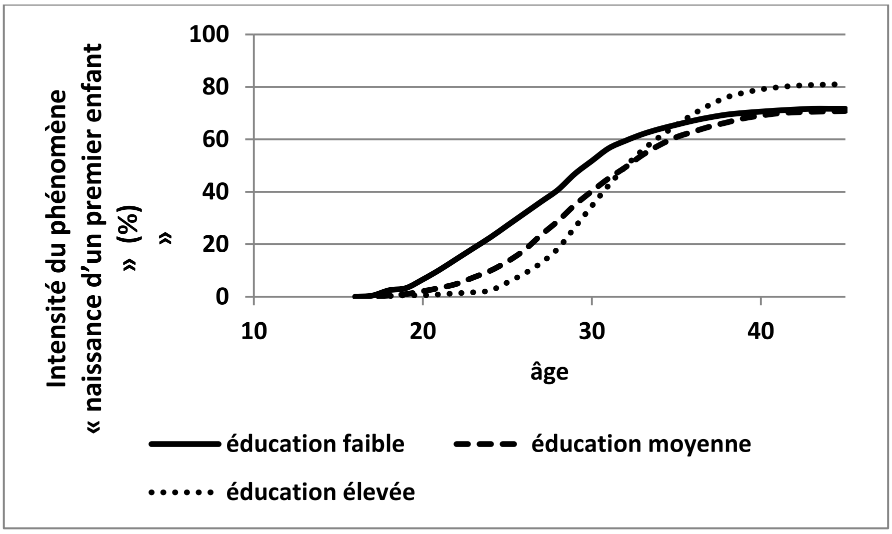
L'objectif est, d'abord, d'analyser l'impact de la durée des études sur la probabilité d'avoir un premier enfant pour une population susceptible d'en avoir un. Le calcul des probabilités d'avoir un premier enfant en fonction de l'âge et du niveau d'éducation présente de nombreuses difficultés. L'obstacle principal réside dans le simple fait que le niveau moyen d'éducation augmente avec l'âge. Par conséquent, lorsque l'on calcule la probabilité d'avoir un premier enfant à l'âge de 20 ans, le dénominateur de cette probabilité risque d'inclure des femmes ayant, à ce stade, un niveau d'éducation moyen, mais qui, dans l'espace d'un ou deux ans, obtiendront un niveau d'éducation élevé. Cette surévaluation du dénominateur conduit à une sous-estimation de la probabilité d'avoir un premier enfant à 20 ans pour les personnes moyennement éduquées. Pour éviter cette sous-estimation, nous calculons les probabilités d'avoir eu un premier enfant entre 15 et 27 ans de façon rétrospective pour les femmes ayant 28 ans, par niveau d'éducation observé à 28 ans. L'âge de 28 ans est ici utilisé comme l'âge auquel les études sont terminées pour la plupart des femmes. Cette procédure de calcul rétrospectif nous permet de soustraire du dénominateur toutes les femmes qui vont continuer leurs études et, ainsi, d'obtenir des probabilités non biaisées d'avoir un premier enfant aux âges jeunes pour les femmes moyennement éduquées.

Les probabilités d'avoir un premier enfant aux différents âges selon le niveau d'éducation peuvent ensuite être utilisées pour calculer l'intensité du phénomène « naissance d'un premier enfant » en fonction de l'âge, pour les différents niveaux d'éducation. Le calcul de l'intensité est basé sur un cumul de probabilités à travers les âges. L'intensité est l'inverse d'une probabilité de survie à la Kaplan Meier. Pour obtenir cette intensité et l'âge moyen, nous créons une génération fictive (« synthetic cohort approach »). L'hypothèse est que les femmes

[14] A. Greulich (2017): "*Sharing patterns among partners – a comparative analysis for European countries.*" Travail en cours.

d'âge *x* à la date *t* vont garder le même comportement de fécondité en *t+1* que les femmes d'âge *x+1* en *t*. Cette hypothèse pose certainement problème en cas de fort report des naissances et en cas de fortes différences de comportement d'une cohorte à l'autre. Néanmoins, par rapport à de simples calculs de répartition (répartition de l'âge à la naissance du premier enfant pour chaque groupe défini selon son niveau d'éducation en ne tenant compte que des femmes ayant eu un enfant), nos calculs, qui sont basés sur des probabilités et qui tiennent également compte des femmes « à risque » n'ayant pas eu d'enfant, éliminent les effets de structure.

Le graphique 5 illustre l'intensité du phénomène « naissance d'un premier enfant » par âge et catégorie d'éducation (moyenne pondérée pour l'UE 28). La partie droite de la Figure 4 nous permet d'affirmer que, même si les femmes éduquées ont, en moyenne, leur premier enfant plus tard que les femmes moyennement ou peu éduquées, elles n'en présentent pas moins une plus grande probabilité de devenir mère. Ce point précis est obtenu en soustrayant de 100 l'intensité du phénomène « naissance d'un premier enfant ». Par ce calcul simple, nous constatons que 19 % des femmes éduquées n'ont pas d'enfant à 45 ans. Cette proportion est bien plus faible que les proportions correspondantes pour les femmes peu ou moyennement éduquées, qui s'élèvent, respectivement, à 28% et à 29%. Ces chiffres vont à l'encontre d'une croyance répandue selon laquelle le report des naissances – lié, notamment, à l'investissement en éducation – tendrait à augmenter la probabilité de ne pas avoir d'enfant. Au moins pour les cohortes qui sont actuellement en âge de procréer, nous révélons qu'une éducation élevée augmente la probabilité de fonder une famille.



Graphique 5 : Intensité du phénomène « naissance d'un premier enfant » (ØUE 28)

EU-SILC CS (2011) et LT (2003-2011), femmes âgées de 15 à 45 ans

Source : d'Albis, Greulich et Ponthière (2017)

Education faible : pré-primaire, primaire et secondaire inférieur
Education moyenne : secondaire supérieur, post-secondaire
Education élevée : éducation supérieure

Ages 17 à 27 : Education observé à 28 ans ; probabilités de première naissance pour âges 17 à 27 calculées de façon rétrospective (SILC CS 2011)
Ages 28+ : Education observée à la vague précédant l'année de la conception potentielle d'un premier enfant (SILC LT 2003-2011)

La seconde variable que nous étudions concerne la situation des femmes sur le marché du travail. Cette variable est plus délicate à manier que celle relative au niveau d'éducation, car elle est susceptible d'évoluer tout au long de la vie. Nous considérons deux situations sur le marché du travail : d'une part, les femmes qui travaillent, qu'elles soient à temps plein ou à temps partiel et qu'elles soient employées ou indépendantes. D'autre part, le groupe des femmes qui ne travaillent pas comprend principalement les inactives et les chômeuses. Pour les femmes ayant eu un premier enfant pendant la période observée, la situation professionnelle que nous lui attribuons est celle observée pendant les trois mois précédant la conception de leur enfant. Pour les femmes susceptibles d'avoir un premier enfant mais n'ayant pas eu d'enfant au cours de la période étudiée, la situation professionnelle considérée comme pertinente est celle observée pendant une période de trois mois arbitrairement choisie pendant l'année précédant l'arrivée potentielle de l'enfant. Comme pour l'éducation, cette procédure permet de réduire, sans toutefois l'éliminer, le biais potentiel de causalité inverse résultant du fait que l'arrivée de l'enfant influence le statut professionnel de la mère.

A l'aide de notre construction d'une génération fictive, nous montrons que la durée des études et la précarisation professionnelle sont, toutes les deux, associées à des naissances plus tardives. Le report des naissances reflète donc deux tendances bien distinctes. Les femmes qui s'investissent dans l'éducation supérieure et dans le développement de leur carrière ont leur premier enfant plus tard que les femmes ayant un niveau d'études inférieur et que celles n'ayant pas réussi à s'intégrer sur le marché du travail, mais elles sont également moins susceptibles de ne pas avoir d'enfants.

La comparaison entre pays, et en particulier entre la France et l'Allemagne, révèle que l'environnement institutionnel joue un rôle majeur dans le calendrier des naissances, et le nombre de naissances. Le report des naissances observé à travers l'Europe est loin d'avoir un impact uniforme sur la descendance finale et l'indicateur synthétique de fécondité : alors qu'il ne conduit pas, en général, à une fécondité plus faible dans les pays européens à forte couverture en matière de garde d'enfants, il n'en est pas de même dans les pays à faible couverture. Par ailleurs, à l'intérieur d'un pays donné, le calendrier des naissances est significativement influencé par le niveau des études ainsi que par la stabilité de la situation professionnelle. Le report des naissances est donc le reflet d'un accès plus large des jeunes aux études supérieures, mais en même temps, de la plus grande difficulté des jeunes à s'insérer dans la vie professionnelle aujourd'hui.

Au vu des impacts différenciés d'un ensemble varié de politiques, en termes de nombre et de calendrier des naissances, nous discutons la question des contours optimaux des politiques publiques. Les politiques familiales peuvent, selon leur format, influencer non seulement le nombre et le calendrier des naissances, mais également la durée des études. À l'inverse, des politiques éducatives peuvent influencer le calendrier, voire le nombre de naissances. Nous concluons que le cadre institutionnel d'un pays ne devrait pas exercer des effets désincitatifs à la poursuite des études, comme c'est pourtant souvent le cas dans beaucoup des pays à fécondité faible en Europe avec des mesures pro-natalistes comme les primes à la naissance (qui peuvent encourager surtout des jeunes inactifs et faiblement qualifiés à avoir des enfants en proposant un substitut de revenu). Il devrait plutôt faciliter, pour tous les jeunes adultes, une meilleure conciliation de la vie professionnelle et de la vie familiale.

La comparaison entre l’Allemagne et la France est à cet égard éloquente. Nous montrons qu’entre ces deux pays, les différences de calendriers sont relativement faibles en comparaison de l’écart de descendance finale. Une première explication, souvent avancée, s’appuie sur le caractère largement insuffisant du soutien apporté aux familles allemandes en matière de garde d’enfants. Le congé parental en Allemagne encourage un emploi avant et après la naissance, mais du fait des infrastructures de garde limitées, les mères allemandes sont souvent contraintes de travailler à mi-temps. En France, en revanche, la conciliation entre carrière professionnelle et vie familiale semble plus facile pour les femmes, du fait d’un investissement public plus large dans les infrastructures de garde des jeunes enfants (la France dépense six fois plus que l’Allemagne pour les services de garde d’enfants âgés de 0-2 ans: 0.6% du PIB en France contre 0.1% du PIB en Allemagne en 2011 ; le taux de couverture de garde est de 49.7% en France contre 29.3% en Allemagne pour les enfants âgés de 0 à 2 ans en 2013 ; OECD Family Data Base). Les parents français ont, par rapport à l’Allemagne, un plus grand choix en termes d’infrastructures de mode de garde et il existe pour chaque type de garde un soutien financier (crèche, assistante maternelle, garde à domicile etc.) ce qui s’inscrit en France dans une logique de politique du « libre choix du mode de garde ».

Pourtant, l’ensemble des politiques familiales n’est pas optimal non plus en France : un congé parental long et faiblement rémunéré (24 mois à partir du deuxième enfant avec moins de 400€ par mois depuis le 01 janvier 2015) éloigne surtout les mères peu qualifiées du marché de travail, tandis que les femmes les plus éduquées ont tendance à ne pas y avoir recours et à regretter de ne pas avoir plus de temps pour s’occuper des enfants quand ils sont encore très jeunes. Les pays qui réussissent le mieux à faciliter la conciliation de la vie professionnelle et de la vie familiale semblent donc être certains pays Nordiques. A titre d’exemple, la Suède a mis en place un « policy mix » associant un congé parental court mais bien rémunéré avec un bon accès aux crèches. Le modèle du congé suédois prévoit une substitution du salaire net à 80%, ce qui encourage l’emploi des parents avant la naissance d’un enfant. La période maximale est de 13 mois. Les parents profitent de la totalité des 13 mois uniquement si le deuxième parent prend lui-même au moins 2 mois de congé. La durée relativement courte du congé facilite le retour à l’emploi après le congé. Ceci a deux implications : Premièrement, la rémunération en fonction du salaire permet au partenaire qui gagne plus (souvent l’homme) d’également profiter du temps avec l’enfant sans que le ménage perde trop de revenus. Deuxièmement, la carrière professionnelle de la femme devient moins interrompue, ce qui facilite la réduction de l’écart de salaire entre femmes et hommes.

Ceci a le potentiel de déclencher un cercle vertueux, car les inégalités professionnelles entre femmes et hommes et le partage des responsabilités familiales entre parents sont liés (Ponthieux et Meurs, 2004). Moins d’inégalités professionnelles anticipées peuvent mener à un partage plus égalitaire des responsabilités familiales, il peut en résulter une réduction des inégalités professionnelles. Effectivement, les inégalités professionnelles et familiales sont aujourd’hui moins élevées dans les pays nordiques que dans d’autres pays européens. En France, la hausse de la participation des femmes au marché du travail ne semble pas toujours s’accompagner d’une redéfinition des rôles de genre au sein de la famille, comme cela a été récemment montré par Sofer et Thibout (2015). Il est possible que réformer le congé parental en France, ce qui permettrait aux pères de s'investir davantage dans les tâches familiales, puisse contribuer à inciter les couples à répartir ces tâches de manière plus efficiente.

La comparaison des politiques familiales en Europe montre que les différents instruments doivent être cohérents afin de favoriser l'équilibre travail-famille des parents de manière efficace. Toutefois, l'ensemble optimal de politiques (« policy mix ») n'inclut pas uniquement des politiques familiales, mais intègre également des politiques sociales et fiscales ainsi que les institutions du marché du travail.

Faisons un point sur le marché du travail en focalisant sur l'organisation des heures de travail : Les données EU-SILC révèlent une grande hétérogénéité entre pays européens en ce qui concerne les heures travaillées des femmes et des hommes ayant des enfants. Pour la plupart des pays d'Europe de l'Est et du Sud, nous observons un comportement polarisé de la participation des mères au marché du travail : ces dernières sont soit inactives, soit travaillent à temps plein. Dans les pays nordiques et continentaux, en revanche, la grande majorité des mères participe au marché du travail. Parmi ces mères actives, la majorité d'entre elles travaillent à temps 'plein' dans les pays nordiques et en France, tandis que la majorité d'entre elles travaillent à temps partiel dans les pays continentaux. Dans les pays continentaux tels que l'Allemagne par exemple, il existe une polarisation importante entre travail à temps partiel et travail à temps plein : celles qui sont à temps partiel travaillent généralement moins de 20-25 heures/semaine (elles travaillent une demi-journée chaque jour) et celles qui sont à temps plein travaillent souvent plus de 45 heures. En France et dans les pays nordiques, la différence entre travail à temps partiel et travail à temps 'plein' est moins marquée : celles qui sont à temps partiel travaillent généralement plus de 25 heures/semaine et celles qui sont à temps plein ont tendance à travailler moins de 40 heures/semaine (en moyenne). Les mères travaillant à temps partiel en France, par exemple, ont tendance à travailler 4 jours sur 5 (la plupart d'entre elles ne travaillent pas le mercredi afin de s'occuper de leurs enfants) et le volume horaire hebdomadaire officiel pour le travail à temps plein est de 35 heures. Néanmoins, en France, le travail à temps plein est relativement polarisé entre ceux qui travaillent environ 35 heures/semaine (principalement ceux qui travaillent dans le secteur public) et ceux qui travaillent 45 heures ou plus (beaucoup d'entreprises françaises contournent la règlementation du temps de travail de 35h/semaine en proposant des journées de congé supplémentaires, dit journées RTT- réduction du temps de travail- à ceux qui travaillent plus de 35h/semaine). Dans les pays nordiques, en revanche, une telle polarisation n'existe pas. La vaste majorité des travailleurs à temps plein travaille environ 40 heures, toute hiérarchie, secteur et sexe confondus. En Suède, par exemple, une journée de travail traditionnelle commence à 8 h du matin et se termine à 16 h, la pause déjeuner étant comptabilisée comme du temps de travail. Dans ce pays, la polarisation entre les sexes, les hiérarchies et les secteurs est bien moindre que dans les autres pays européens. Les femmes et les hommes, indépendamment du nombre d'enfants qu'ils ont, ont tendance à travailler à temps plein et, par rapport aux autres pays, sont moins confrontés aux heures supplémentaires qui se prolongent en soirée, ce qui facilite grandement la conciliation de la vie professionnelle et de la vie de famille ainsi que le partage des tâches entre conjoints. Les schémas de partage entre conjoints en termes de travail rémunéré et de revenu sont donc les plus égalitaires dans les pays nordiques, et la répartition égalitaire des ressources économiques semble encourager les couples à concrétiser leurs intentions en matière de fécondité. Les politiques familiales (disponibilité des services de garde d'enfants et horaires d'ouverture, transferts en espèces, systèmes de congé parental, etc.) influent assurément sur les schémas de partage entre partenaires et sur leur comportement de fécondité, mais la structure du marché du travail (possibilité de réduire et d'augmenter à nouveau les heures de travail, culture des heures supplémentaires au sein de l'entreprise, ségrégation verticale et horizontale entre hommes-femmes, attentes et préjugés envers les femmes et les hommes, degré de précarité etc.), joue également un rôle fondamental, sans parler des politiques fiscales (imposition individuelle vs. imposition du couple vs. imposition de la famille) et des politiques sociales (accès à un logement abordable, à la sécurité sociale, etc.).

Certaines institutions risquent d'imposer des choix en termes de schémas de partage parental qui sont préjudiciables non seulement à l'égalité des genres dans la participation économique, le revenu et le développement des carrières, mais également aux possibilités qu'ont les couples de fonder et d'agrandir une famille. D'autres institutions, telles que les structures de garde d'enfants pour les enfants de tous âges, les écoles accueillant les enfants toute la journée, les congés parentaux rémunérés mais brefs, l'imposition individuelle et un volume raisonnable d'heures de travail par semaine pour les emplois à temps plein, sont quant à eux susceptibles d'encourager non seulement les schémas de partage égalitaires, mais aussi, et par là même, la fécondité.

1.2.5. Étude de cas appliquée à la Turquie

Avec le démographe français Aurélien Dasré (Université Paris Nanterre, Ined) et le démographe franco-turc Ceren Inan (Ministère français de l'Enseignement supérieur et de la Recherche), nous avons intégré la Turquie à l'analyse et nous avons comparé les résultats européens aux résultats turcs. Ceci est possible car les données EU-SILC couvrent aussi la Turquie (module à part à demander auprès des autorités statistiques en Turquie). En plus d'une modélisation économétrique de l'incidence de la situation d'emploi des femmes sur la fécondité, adaptée au contexte turc, nous avons appliqué une série de méthodes d'analyse démographique (calcul de composantes par rang de naissance, analyse de décomposition) qui nous ont permis d'identifier la nature particulière de la baisse continue de la fécondité en Turquie. Les résultats de ces recherches ont été publiés dans la revue *Population and Development Review*[15].

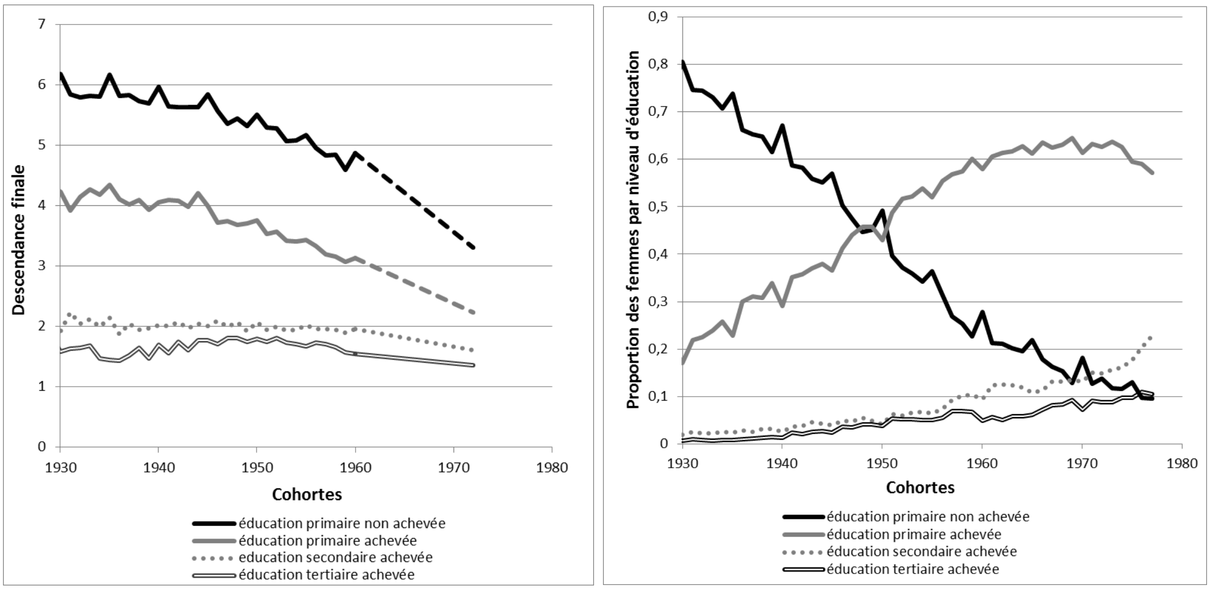
Une deuxième partie de nos recherches spécifiques à la Turquie cherche à savoir à quel point et dans quel contexte l'emploi des femmes influence les relations hommes-femmes au sein du couple. L'article est actuellement soumis à la revue *Demography*[16].

[15] A. Greulich, A. Dasré, C. Inan (2016): "Two or Three Children? Turkish Fertility at a Crossroads" *Population and Development Review*, 42(3): 537-559.
[16] A. Greulich, A. Dasré, C. Inan (2017): *"Combating domestic violence in Turkey. The role of women's economic empowerment."* Travail en cours

Nos résultats ont également été mobilisés pour deux rapports scientifiques de la Banque Mondiale ainsi que pour dialoguer avec le Ministère turc des Affaires Familiales (voir section 3.3. pour plus de détail).

En ce qui concerne notre analyse de la fécondité turque, nous montrons d'abord que la transition du second au troisième enfant est essentielle pour l'avenir des niveaux de fécondité en Turquie. La descendance finale a baissé de 5 à 2,3 enfants par femme entre la cohorte née en 1945 et la cohorte née en 1970 en Turquie. Un calcul des composantes par rang de naissance révèle que le déclin de la descendance finale au fil des générations s'explique d'abord par le fait que moins de femmes au sein des cohortes les plus jeunes ont un troisième enfant. La décision des parents d'avoir ou non un troisième enfant émerge donc comme un élément essentiel pour déterminer si la fécondité en Turquie sera ou non stabilisée et si elle recèle le potentiel d'augmenter à nouveau (pour la plupart d'autres pays européens, ceci est le cas pour l'enfant de rang deux, comme montré par d'Albis, Gobbi et Greulich, 2017).

Une analyse de décomposition montre ensuite que le déclin de la descendance finale au fil des générations en Turquie peut être observé pour tous les niveaux d'éducation, mais qu'il est davantage prononcé dans le cas des femmes ayant un faible niveau d'éducation. Comme illustré par le panel à gauche du graphique 6, les femmes qui ont reçu moins qu'une éducation primaire ou obtenu moins qu'un diplôme d'études primaires font face à une baisse drastique de la fécondité au fil des générations, tandis que les femmes ayant un niveau d'éducation plus élevé (secondaire et tertiaire) enregistrent un déclin de la fécondité beaucoup moins drastique. Dans le même temps, le nombre moyen d'enfants a toujours été très inférieur pour les femmes ayant au moins reçu une éducation secondaire. Ces dernières ont tendance à avoir un peu moins de deux enfants en moyenne. Parallèlement, comme montre le panel à droite du graphique 6, la répartition des femmes par niveau d'éducation a beaucoup évolué au fil des générations, avec une hausse importante de la proportion de femmes ayant au moins un diplôme d'études primaires.



Census (i-pums) 2000 et EU SILC CS 2011 Census (i-pums) 2000

Graphique 6 : Descendance finale et proportion des femmes par niveau d'éducation

Source : Greulich, Dasré et Inan (2016)

Cela signifie que la chute des taux de descendance finale en Turquie n'est pas uniquement due à un effet de niveau, mais également à un effet de structure : La fécondité ne baisse pas de façon drastique pour les femmes ayant reçu une éducation, mais les niveaux de fécondité sont généralement plus bas pour les femmes ayant un niveau d'éducation élevé que pour les femmes ayant un faible niveau d'éducation, et de plus en plus de femmes reçoivent une éducation en Turquie. Cet effet de structure explique, pour moitié environ, le déclin de la fécondité en Turquie. L'autre moitié s'explique par le fait qu'au sein de chaque groupe défini selon son niveau d'éducation, le nombre moyen d'enfants est en recul, et cette baisse est plus marquée pour les femmes ayant un faible niveau d'éducation. Il semble donc que les femmes diplômées, qui ont tendance à ne pas avoir d'enfant de rang de naissance trois ou supérieur, contribuent dans une large mesure au déclin de la fécondité en Turquie puisqu'elles sont de plus en plus nombreuses. La question de savoir si les femmes de ce groupe particulier peuvent être ou non encouragées à avoir un troisième enfant émerge donc comme essentielle pour l'évolution future de la fécondité en Turquie. Notons aussi qu'une fois contrôlé pour l'éducation, les différences de fécondité entre régions et ethnies sont négligeables en Turquie.

Ensuite, sur la base de données d'enquête issues du module turc de l'Enquête sur le revenu et les conditions de vie (SILC turque), nous analysons quels types de familles sont le plus susceptibles de décider ou non d'avoir un enfant. Nous centrons notre analyse sur le statut d'activité des femmes et de leurs conjoints, mais nous tenons également compte d'autres caractéristiques socio-économiques et démographiques. Notons que le taux d'emploi des femmes stagne depuis 20 ans autour de 30% en Turquie (76% pour les hommes, WB WDI 2012). Il est autour de 40% pour les femmes qui ont aujourd'hui entre 20 et 30 ans (Turkstat, 2012). Un quart des femmes en emploi travaille à temps partiel, et 40% des femmes en emploi travaillent dans l'agriculture (WB WDI, 2014).

Nous utilisons le module longitudinal de l'enquête SILC afin d'étudier le statut d'activité des femmes et de leurs conjoints avant la conception potentielle d'un enfant, et nous établissons une distinction entre les rangs de naissance.

Nous constatons que les femmes diplômées participant au marché du travail formel sont plus susceptibles de décider de ne pas agrandir leur famille que les femmes inactives ou au chômage. Leur contribution au revenu du ménage semble avoir trop d'importance pour être sacrifiée, en particulier lorsque le couple a déjà deux enfants. Les politiques permettant aux femmes de concilier vie professionnelle et vie familiale, qui se sont avérées efficaces dans d'autres pays européens, apparaissent donc utiles pour éviter un déclin de la fécondité en dessous des niveaux de remplacement en Turquie.

Dans un contexte d'opportunités croissantes en matière d'éducation et d'emploi pour les femmes turques, nos résultats suggèrent que le déclin de la fécondité reflète un conflit majeur entre vie professionnelle et vie familiale en Turquie qui touche en particulier les mères ayant un emploi formel. Lorsque les femmes ayant deux enfants ont un emploi, leur contribution au revenu du ménage est essentielle. En cas d'impossibilité de concilier emploi et vie de famille, les mères actives ayant un emploi formel sont donc les plus susceptibles de décider de ne pas avoir de troisième enfant. Donner aux femmes les moyens de travailler tout en élevant des enfants permettrait aux familles de générer les moyens financiers nécessaires à leur agrandissement. Ce résultat revêt une forte implication politique, dans la mesure où il montre que le cadre actuel des politiques en Turquie entrave plutôt qu'il n'encourage la fécondité. Dans ce pays, l'opinion publique en ce qui concerne le rôle des femmes demeure largement traditionaliste. Il est rappelé à ces dernières que leur rôle principal est d'être mères, raison pour laquelle le travail à temps partiel est privilégié au détriment du travail à temps plein. Le fait de priver les femmes ayant des enfants d'une pleine participation à la vie économique atteste que la promotion de l'égalité des genres ne fait toujours pas partie des objectifs politiques de la Turquie. Notre analyse (Greulich, Dasré et Inan, 2016) montre que cette approche risque de conduire à un faible niveau de fécondité, dans la mesure où les femmes sont contraintes de choisir entre agrandissement de la famille et gains économiques. Nous concluons donc que l'égalité des genres apparaît comme une condition nécessaire pour prévenir le déclin de la fécondité en Turquie jusqu'à des niveaux inférieurs au remplacement.

En ce qui concerne notre deuxième étude sur la Turquie (Greulich, Dasré et Inan, 2017) nous examinons le potentiel du pouvoir économique des femmes à améliorer le statut des femmes au sein de la famille. Nous testons, dans une première étape, dans quelles circonstances une activité professionnelle permet aux femmes de réduire le risque de subir des violences conjugales. Nous mobilisons à cette fin une enquête turque récente de haute qualité (standard international) sur les violences faites aux femmes (Turkish Domestic Violence Survey, vagues 2008 et 2014). L'avantage de cette enquête est qu'elle permet de distinguer différentes raisons d'inactivité professionnelle, y compris l'inactivité lié au fait que le partenaire ne permet pas à la femme d'aller travailler. Ceci nous facilite le fait de réduire le biais lié à l'endogéneité entre l'activité professionnelle des femmes et la violence conjugale subie. L'utilisation de cette enquête permet donc d'obtenir des résultats plus robustes que ceux d'autres études sur ce sujet (pour d'autres pays) qui souffrent souvent du biais d'endogénéité (c.f. Klasen, 2016).

Les premiers résultats suggèrent que la participation des femmes au marché du travail ne réduit pas en soi le risque que celles-ci soient confrontées à la violence conjugale. Ce sont les femmes ayant un revenu bien inférieur, mais aussi celles qui ont un revenu bien supérieur à celui du partenaire, qui sont les plus susceptibles d'être exposées à la violence conjugale. Un partage égalitaire des ressources économiques entre conjoints a lui, le plus fort potentiel de protéger les femmes de la violence conjugale. Un niveau d'éducation plus élevé donnant aux femmes accès à un emploi salarié formel leur permet, non seulement d'accéder à l'indépendance économique, mais aussi de choisir librement leur conjoint. Des conditions économiques instables qui nuisent aux opportunités de revenu des hommes constituent un important facteur de risque pour les couples d'être confrontés à des conflits pouvant favoriser la violence conjugale à l'encontre des femmes.

1.2.6. Le rôle de la stabilité de l'emploi des femmes dans l'agrandissement de la famille : la méthode d'imputation multiple

Avec le sociologue américain Michael Rendall (Université du Maryland, Maryland Population Center), nous avons abordé deux lacunes majeures de l'échantillon longitudinal des données EU-SILC. La première d'entre elles est qu'avec un suivi de quatre années seulement, le panel est très court. La seconde est qu'en raison de sa conception rotative, le panel est déséquilibré (autrement dit, certains individus sont suivis pendant une période encore plus courte que d'autres). Cela limite la possibilité de modéliser les déterminants de la naissance observés pendant un certain laps de temps avant une conception potentielle. Afin d'étendre la période observable, nous avons testé la méthode d'imputation multiple (IM) pour des variables prédictives censurées à gauche aux fins de l'analyse de la fécondité basée sur les données EU-SILC. Cette méthode nous a permis d'accroître la taille de l'échantillon d'individus pour lesquels les caractéristiques relatives au marché du travail peuvent être observées pendant une période étendue avant la conception potentielle d'un enfant. Au lieu d'observer le statut professionnel pour une période de trois mois seulement, comme nous l'avons fait dans notre étude décrite dans la section 1.2.3., la méthode d'imputation multiple nous permet ici d'obtenir une information concernant la « stabilité de l'emploi », en générant des observations du statut professionnel couvrant une période de deux ans.

Nous avons d'abord, pour un article centré sur la méthode d'imputation multiple, limité les données à la Pologne, en raison de la grande taille de son échantillon et de la bonne qualité de ses données. L'article a été publié dans la revue *Demographic Research*[17].

L'objectif de cette collaboration est de proposer une mesure cohérente de la stabilité d'emploi. À cette fin, nous souhaitons étudier le statut d'activité des femmes pour au moins deux vagues consécutives avant l'année de la naissance potentielle d'un premier enfant. Nous mobilisons donc les données EU-SILC, lesquelles contiennent des données issues d'un panel déséquilibré (« unbalanced panel data »). Dans la mesure où le nombre d'individus bénéficiant d'une période de suivi aussi longue est relativement faible dans les données EU-SILC, l'imputation multiple est utilisée pour les femmes de l'échantillon pour lesquelles nous disposons d'informations relatives à leur statut sur le marché du travail pour l'année précédant la première naissance potentielle (*t-1*), mais non pour *t-2*. Les informations relatives à *t-2* sont donc estimées sur la base d'observations réelles concernant les femmes pour lesquelles les informations relatives à *t-2* sont disponibles. Pour ce faire, nous appliquons une méthode d'imputation multiple.

La structure des données de panel déséquilibré dans une enquête ayant une conception rotative telles que les données EU-SILC reflète en réalité un problème auquel les chercheurs sont régulièrement confrontés lorsqu'ils utilisent des données de panel. Ainsi, les antécédents des individus qui intègrent le panel plus tard que d'autres ne sont pas entièrement connus lors de la première vague. Il est pratique courante, même s'il n'est pas conseillé de le faire, d'ignorer cette « censure à gauche ». Nous suggérons que l'imputation multiple (IM), une méthode généralement utilisée pour gérer la non-réponse, peut constituer une solution globale au problème de censure à gauche dans la modélisation des risques.

L'hypothèse que les données manquent « au hasard », nécessaire à une imputation multiple, pose parfois problème pour les données manquantes en raison de la non-réponse. Toutefois, cette hypothèse est bien moins susceptible d'être problématique dans le cas de la censure à

[17] M. Rendall, A. Greulich (2016): "Multiple imputation for demographic hazard models with left-censored predictor variables. Application to employment duration and fertility in the EU-SILC." *Demographic Research*, Vol. 35, Art. 38, p. 1135-1148.

gauche, dans la mesure où l'absence d'informations est « le produit de sa conception ». La « conception », dans le cas d'enquêtes de panel rotationnel, fait référence à la date de début du panel. Notre approche est innovante puisque l'IM n'a encore jamais été utilisée pour traiter le problème de la censure à gauche. Nous évaluons les avantages que présente cette utilisation de l'IM grâce à un exemple simple dans lequel les femmes d'une enquête de panel contribuent à une ou deux vagues de statut d'emploi, variable utilisée pour prédire la naissance du premier enfant d'un couple.

En vue de démontrer cela, nous nous basons sur l'échantillon polonais de l'Enquête européenne sur le revenu et les conditions de vie (EU-SILC). Nous avons choisi la première naissance afin d'obtenir l'échantillon le plus vaste possible. La conception rotative implique que les femmes qui sont observées pendant trois vagues seulement intègrent le panel plus tard que celles qui sont observées pendant quatre vagues. La vague manquante pour ces individus est donc manquante « au hasard ». Nous avons donc un sous-ensemble de femmes (et leurs conjoints) avec des observations personne-année (4 « person-years » : *t-2* jusqu'à *t+1*) complètes, et un autre sous-ensemble avec des observations incomplètes (3 « person-years » : *t-1* jusqu'à *t+1*). Nous utilisons d'abord l'ensemble d'observations complètes afin d'estimer une équation d'imputation pour le statut des femmes sur le marché du travail à *t-2*. Nous recourons à l'imputation multiple séquentielle, qui permet l'imputation de variables binaires, catégorielles ou continues. Nous appliquons des tirages aléatoires issus de la répartition des estimations de paramètres aux données incomplètes en vue de produire un grand nombre *m* de valeurs de statut d'emploi dans *t-2,* qui servent à produire des données complétées. Nous concaténons ensuite les données complètes avec chaque occurrence de données complétées et estimons l'équation d'analyse *m* fois. Ces *m* estimations sont combinées grâce à des algorithmes d'imputation multiple standard afin de produire un ensemble de paramètres contenant des écarts-types qui compensent l'incertitude introduite par l'imputation du statut d'emploi dans *t-2* aux observations personne-année incomplètes.

Par rapport aux régressions basées uniquement sur des données complètes, les régressions basées sur l'ensemble plus vaste de données complétées (contenant des observations supplémentaires estimées grâce à l'imputation multiple) montrent des variations significativement moins importantes des coefficients estimés.

En substance, nous constatons que l'emploi au cours de l'année précédant immédiatement l'exposition ne constitue pas une variable prédictive de la naissance significative du point de vue statistique, mais le fait d'avoir eu un emploi à temps plein pendant deux années ou plus est associé à une probabilité significativement plus élevée d'avoir un 1er enfant par rapport au fait de ne pas avoir eu d'emploi à temps plein au cours de l'année précédente. Le fait d'avoir un emploi à temps plein pendant deux années ou plus n'est significatif que dans l'analyse incluant les données résultant d'une imputation multiple. Les imputations multiples nous permettent donc d'obtenir un gain d'efficience non négligeable.

Le recours à des méthodes conventionnelles pour réaliser ce test aurait nécessité de n'utiliser que la moitié du nombre d'observations personne-année que nous avons pu utiliser dans notre analyse de données résultant d'une imputation multiple. Cela aurait conduit à des résultats non significatifs (mais de même signe).

Nos travaux en cours consistent à appliquer la méthode d'imputation multiple afin d'analyser la pertinence de la stabilité d'emploi des deux conjoints dans les décisions des couples de fonder ou d'agrandir une famille en couvrant l'ensemble des pays européens. L'élargissement de la couverture géographique nous permet d'étudier les déterminants institutionnels tels que les politiques familiales, mais aussi l'importance des caractéristiques des marchés du travail, En outre, nous tirons parti du fait que les données EU-SILC, qui couvrent également une période de près de 15 années (2003-2015), nous permettent de comparer la relation emploi-fécondité avant et après la crise économique de 2008. Nous vérifions l'hypothèse selon laquelle l'importance de la stabilité d'emploi des deux parents dans les décisions de fécondité a été renforcée après la crise économique.

1.2.7. Mesurer la fécondité à partir des données EU-SILC– une quantification des biais

En collaboration avec le démographe Aurélien Dasré, nous avons analysé la qualité des mesures de fécondité dans les données EU-SILC. Dans la mesure où ces dernières sont conçues comme une enquête socio-économique, un écueil important émerge lorsqu'il est question d'analyse démographique : Les mesures de la descendance finale sont susceptibles d'être biaisées principalement en raison du fait que les enfants ne sont observés que lorsqu'ils vivent dans les foyers des personnes sondées. En outre, l'attrition liée à la fécondité dans l'échantillon longitudinal conduit à une sous-observation des naissances. Les mesures de comportement de fécondité périodique sont, quant à elles, susceptibles d'être biaisées en raison de la sélection de l'échantillon (sous-représentation des individus sans enfants présentant un « risque » d'avoir un enfant) et de son attrition. Il est possible que l'attrition soit directement liée à la fécondité, dans la mesure où une naissance (qu'elle soit planifiée, imminente ou qu'elle ait eu lieu récemment) peut pousser un individu ou un ménage à déménager, ce qui entraîne un risque de perte des personnes sondées.

Ces biais posent problème, en particulier lorsque les individus pour lesquels les mesures de fécondité sont biaisées possèdent des caractéristiques socio-économiques particulières. Dans ce cas, les analyses descriptives, tout comme les analyses économétriques, pâtiraient d'une distorsion.

Nous proposons donc une quantification exhaustive du biais des différentes mesures de la fécondité pour une série des pays couverts par les données EU-SILC, en comparant les mesures de fécondité obtenues grâce aux données EU-SILC aux mesures non biaisées issues de la base de données HFD (Human Fertility Database). Nous appliquons une perspective transversale ainsi qu'une perspective longitudinale, établissons une distinction entre rangs de naissance et âges à la naissance et étudions les différentiels socio-économiques dans les biais de mesure. Nous proposons également des solutions sur la façon de contourner ces biais. Une première partie de notre étude (analyse des mesures périodiques de fécondité) est publiée dans la revue *Demographic Research*[18], et une deuxième partie (analyse du nombre d'enfants par

[18] A. Greulich, A. Dasré (2017): "The quality of periodic fertility measures in EU-SILC." *Demographic Research*, Vol. 36, Art. 17, pages 525-556.

femme) est actuellement soumise à la revue *Population*[19]. Nous avons également été invité par Eurostat afin de présenter nos résultats et de discuter des solutions (système de pondération qui compense pour l'attrition liée à la fécondité, modification du questionnaire).

Nous constatons que les données EU-SILC sous-estiment la descendance finale dans tous les pays sauf la Slovénie, et que cette sous-estimation est la plus importante pour le Luxembourg, la Norvège, la Belgique, le Danemark et la France. La moyenne arithmétique de la différence relative entre les taux de descendance finale dérivés des données EU-SILC et les taux de descendance finale non biaisés est de 11 %.

Les données EU-SILC sous-estiment l'indice synthétique de fécondité (ISF) dans la plupart des pays européens, à l'exception de la Suisse, de l'Islande, du Luxembourg, de l'Autriche et de la Suède. Le biais vers le bas est le plus fort pour la Bulgarie, la Grèce, la Lituanie et l'Allemagne. La moyenne arithmétique de la différence relative entre l'indice synthétique de fécondité dérivé des données EU-SILC et l'indice synthétique de fécondité non biaisé est de 14 %.

Les biais sont relativement hétérogènes entre pays et mesures de fécondité et ne semblent pas être systématiques. Les pays enregistrant d'importants biais dans la descendance finale ne sont pas nécessairement les mêmes que ceux qui enregistrent des biais élevés de l'ISF. En moyenne, le biais vers le bas est plus important pour l'ISF que pour la descendance finale. Les pays ayant des taux de fécondité élevés ne sont pas automatiquement les mêmes que ceux qui enregistrent les biais les plus importants dans les données EU-SILC. Le classement des pays en pays à fécondité élevée ou à faible fécondité reste le même pour la grande majorité des pays lorsque sont utilisées les mesures issues des données EU-SILC ou les mesures de fécondité non biaisées.

La descendance finale est sous-estimée, dans la mesure où le nombre d'enfants cohabitant avec leurs parents décroît significativement à partir du moment où la mère atteint l'âge de 40 ans, dans la plupart des pays. À partir de cet âge, les rangs de naissance ne sont donc plus attribués correctement dans les données EU-SILC : cela engendre une surestimation des enfants de rang de naissance un et une sous-estimation des enfants de rang de naissance deux. Cette sous-estimation est relativement hétérogène au sein des pays européens, dans la mesure où le nombre d'enfants vivant hors du foyer dépend de multiples facteurs (niveau de fécondité, âge à la naissance du premier enfant, intervalle inter-génésique, mode de cohabitation, etc.). La France et plusieurs autres pays continentaux tels que la Belgique, le Luxembourg, le Royaume-Uni et plusieurs pays nordiques sont les plus concernés, tandis que la sous-estimation est inférieure pour la plupart des pays d'Europe de l'Est et du Sud. Notre analyse, basée sur les données SRCV (Statistiques sur les ressources et conditions de vie), le volet français de SILC, lesquelles comportent une question sur le nombre d'enfants vivant en dehors du foyer, révèle des différentiels socio-économiques significatifs dans ce biais de mesure. Le biais est inférieur pour les femmes ayant un niveau d'éducation tertiaire ainsi que pour les femmes mariées ayant un emploi à temps partiel ou inactives, et supérieur pour les

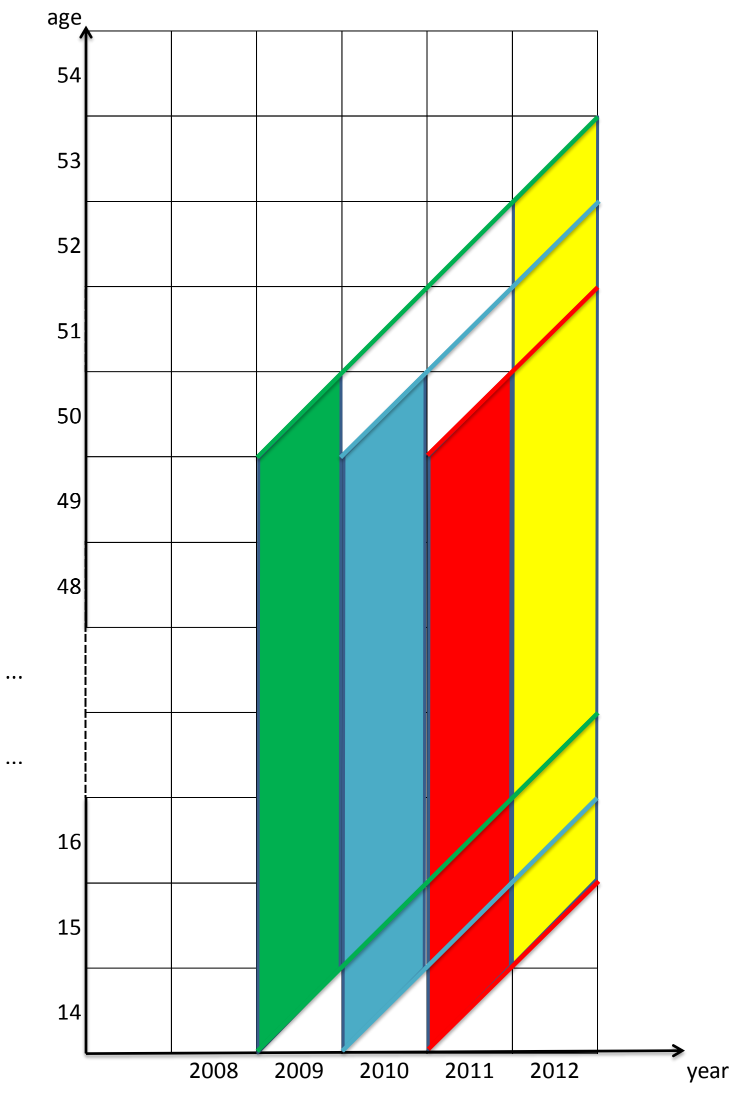
[19] A. Greulich, A. Dasré (2017):"*Observing the number of children with EU-SILC – a quantification of biases.*" Article actuellement soumis à *Population.*

femmes de nationalité non européenne. En général, le différentiel socioéconomique du biais de sous-estimation du nombre d'enfants augmente avec l'âge, en particulier à partir de 40 ans.

Pour ce qui est de l'analyse transversale de la fécondité, nous confirmons que l'attrition dans la base des données longitudinales est liée au comportement de fécondité. La naissance et la mobilité résidentielle sont des évènements corrélés. Par conséquent, les individus qui présentent un « risque » d'avoir des enfants ont une probabilité plus grande de changer de logement, ce qui augmente le risque de sortie du panel. Cela concerne en particulier les femmes sans enfants d'une vingtaine d'année. Les probabilités de suivi ne diffèrent toutefois pas de manière significative entre groupes socio-économiques dans les données EU-SILC. L'attrition n'est donc pas un problème général pour l'obtention d'estimations cohérentes lorsqu'on analyse les déterminants socio-économiques et les conséquences de la naissance. Pourtant, les naissances, et en particulier les premières naissances pour les femmes âgées de moins de 30 ans, sont sous-représentées dans les données EU-SILC. Les poids longitudinaux et transversaux réduisent, en partie, la sous-estimation de la fécondité puisque conçus pour contrebalancer les effets de l'attrition. Néanmoins, il semble qu'ils soient avant tout calibrés pour contrebalancer une attrition différentiée selon des caractéristiques socio-économiques. L'attrition liée à la fécondité touchant l'ensemble des groupes socio-économiques, les poids ne parviennent à redresser qu'imparfaitement les indicateurs de fécondité. Par ailleurs, les naissances sont également sous-représentées dans l'échantillon transversal, puisque les données transversales annuelles sont produites à partir du panel longitudinal (conception intégrée). Cela conduit à un biais vers le bas dans les mesures agrégées de fécondité périodique. Les différences relatives dans les ISF entre groupes socio-économiques ne seront pas nécessairement biaisées, mais les niveaux de fécondité seront généralement sous-estimés. En raison de l'attrition liée à la fécondité, l'ISF est plus élevé pour les individus qui viennent d'intégrer l'échantillon que pour ceux qui sont observés pendant des vagues consécutives. Une solution pour obtenir des mesures moins biaisées consiste donc à calculer l'ISF en intégrant uniquement les individus qui viennent d'intégrer l'enquête. Toutefois, limiter l'analyse à un groupe de rotation particulier réduit significativement la taille de l'échantillon. Cela est assez problématique pour certaines analyses présentant un intérêt démographique, telles que le calcul des ISF différenciés par caractéristiques socio-économiques par pays.

Afin de conserver une taille d'échantillon suffisamment grande, nous suggérons donc d'appliquer une approche rétrospective lors du calcul de l'ISF à partir des données EU-SILC. La naissance ne devrait pas être observée pour l'année civile précédant la vague transversale, mais avec un décalage plus important. L'application d'une approche rétrospective limite la sous-estimation de l'ISF dans une large mesure. Nous constatons qu'avec un décalage de trois ans, les ISF ne souffrent plus d'un biais significatif dans la plupart des pays européens. Le graphique 7 illustre la logique de cette approche rétrospective à l'aide d'un diagramme de lexis. Pour certains pays, néanmoins, le biais persiste en dépit de l'approche rétrospective, ce qui suggère des problèmes d'échantillonnage qui, en plus de l'attrition, faussent les mesures de fécondité périodique.

Nos résultats laissent entendre que pour la majorité des pays européens, les données EU-SILC peuvent être utilisées en vue de modéliser les décisions en matière de fécondité dès lors que les mesures de précaution mentionnées dans notre article sont respectées. Les EU-SILC constituent une base de données unique, dans la mesure où elles combinent plusieurs avantages : elles couvrent un vaste ensemble de pays et une période relativement longue, incluent non seulement des données transversales mais également des données longitudinales et, atout majeur, fournissent des informations socio-économiques comparables pour l'ensemble des membres adultes des ménages. Nous concluons donc que les données EU-SILC permettent d'enrichir non seulement l'analyse économique, mais également l'analyse démographique.



Graphique 7 : Diagramme de lexis: illustration de l'approche rétrospective pour calculer l'ISF avec les données EU-SILC

Source : Greulich et Dasré (2017)

How to read the lexis diagram: For example, we use the cross-sectional wave of 2012 to calculate total fertility rates of 2011, 2010, 2009 and 2008. For the TFR of 2011, we consider all children whose reported year of birth is 2011 by women aged 16 to 50 years old in 2012 (ages calculated by deducting the year of their birth from the survey year). For the TFR of 2010, we consider all children whose reported year of birth is 2010 by women aged 17 to 51 years old in 2012, and so on. We do not use the cross-sectional wave of 2012 to calculate total fertility rates of 2012, as interviews for the 2012 wave took place throughout 2012. Children born after the interview were therefore observed earliest in the interview of the following year.

2. Perspectives de recherche

Mon plan de recherche à moyen terme se compose de trois volets.

Un premier volet s'inscrit dans la continuité de l'analyse de l' « *hétérogénéité des comportements de fécondité* » au sein et entre pays européens. Après avoir identifié les déterminants individuels et institutionnels de cette hétérogénéité, je m'intéresse maintenant à ses conséquences démographiques. Plus précisément, j'envisage de mobiliser l'information qui explique pourquoi aujourd'hui les taux de fécondité stagnent bien au - dessous du seuil de remplacement dans certains pays européens, tandis que dans d'autres pays européens, les couples arrivent mieux à réaliser leurs intentions de fécondité, pour projeter le niveau de la descendance finale pour les cohortes qui sont actuellement en âge de procréer.

Un deuxième volet s'inscrit dans le champ de l' *« analyse de cycle de vie »*. L'objectif est d'évaluer l'impact des comportements démographiques sur l'équité socio-économique entre générations. La méthode des « Comptes de Transferts Nationaux » sera appliquée pour mesurer les transferts publics, les transferts privés et les allocations d'actifs entre les âges et entre les générations.

Le troisième volet s'inscrit dans le domaine de l'analyse du « *changement familial* ». Le concept du « family change » (Johnson-Hanks, Bachran, Morgan and Kohler, 2011) cherche à comprendre le changement des comportements sociodémographiques en analysant la variation du concept de la « famille » dans les sociétés modernes (cohabitation, alternatives au mariage, couples de même sexe, fécondité aux âges élevés, intensité des liens intergénérationnels, familles vivant séparément, etc.). Ce concept interdisciplinaire est complémentaire aux concepts plus classiques qui analysent les comportements de fécondité, comme les concepts économiques *(« New Home Economics »* Theory, c.f. Becker 1960), sociologiques (Théorie de la *« Deuxième Transition Démographique »* , c.f. Lesthaeghe 1978 et 2010) ou démographiques (concept de la « *lowest-low fertility* », c.f. Kohler, Billari et Ortega 2002, Billari et Kohler 2004). Le challenge majeur consiste aujourd'hui, d'abord, à développer des indicateurs quantitatifs du « family change » qui permettent de décrire des mécanismes de convergence et de divergence entre pays, périodes et individus. Le deuxième défi est d'identifier les déterminants et conséquences socio-économiques de ces mécanismes.

2.1. Prévoir la descendance finale future à partir des différentiels socio-économiques dans le calendrier des naissances

Ce premier volet consiste à mobiliser des données EU-SILC à des fins de projections démographiques. Je me propose de réunir des outils analytiques utilisés en démographie et en économie en intégrant des informations socio-économiques aux modèles de prévision démographique pour un vaste ensemble de pays développés. Le but est de préciser les schémas socio-économiques (éducation, emploi, revenu des femmes et leurs partenaires) qui favorisent l'agrandissement de la famille et qui ont, en cela, le potentiel d'accroître les futurs niveaux de descendance finale pour les cohortes qui sont actuellement en âge d'avoir des enfants. Pour l'instant, les projections des taux de fécondité ne prennent pas en compte des différentiels socio-économiques. L'utilisation des données EU-SILC permet de prévoir/ d'estimer les niveaux de descendance finale pour des cohortes qui sont actuellement en âge fécond, différenciés en fonction de caractéristiques socio-économiques et contextuelles. Cette différentiation représente un élément novateur majeur dans le champ de l'analyse démographique. La plupart des projections de fécondité existantes reposent uniquement sur des données démographiques sans mobiliser l'information socio-économique et/ou institutionnelle (par exemple Myrskylä, Goldstein et Cheng 2012) Myrskylä et Goldstein 2013, Schmertmann et al. 2014). Un challenge important consiste à développer des pondérations dans les données EU-SILC qui évitent que les mesures de fécondité périodique ne soient biaisées par l'attrition. Pour les projections de fécondité, des modèles prévisionnels bayésiens seront utilisés comme points de repère. Des modèles à simulations multiples viendront compléter la démarche.

Afin de mener à bien ce projet, j'ai noué des collaborations avec des experts reconnus dans le domaine de la modélisation démographique. Une première partie de cette analyse sera menée avec le démographe français Laurent Toulemon (directeur de recherche à l'Ined). L'hypothèse centrale de notre projet de recherche consiste à tester l'impact potentiellement positif d'un retard volontaire des naissances sur la descendance finale. Nous voulons tout particulièrement isoler les conditions sous lesquelles un retard des naissances peut engendrer une plus forte fécondité finale du fait d'une augmentation de la fécondité à des âges plus élevés (« over catch-up »). Nous compléterons d'abord l'analyse du lien entre calendrier des naissances et intensité de devenir mère (section 1.2.4) en intégrant des naissances de rang supérieur. Les différentes probabilités d'agrandissement (« parity progression ratios ») obtenues ainsi permettront ensuite de calculer des indices synthétiques de fécondité différentiés par caractéristiques socio-économiques.

Une deuxième partie consiste à utiliser ces informations pour projeter la descendance finale pour les cohortes qui sont actuellement en âge fécond. Cette partie sera réalisée en collaboration avec le démographe américain Joshua Goldstein (professeur à l'université de Californie, Berkeley), expert de la prévision bayésienne de la fécondité des cohortes. Des modèles à simulations multiples, également développés à l'UC Berkeley, se révèlent utiles pour notre projet (modèle « Socsim »).

2.2. Mesurer les transferts entre générations

Un deuxième volet consiste à élargir mon spectre de recherche afin d'intégrer une perspective de cycle de vie. L'objectif est d'analyser les transferts entre générations, en prenant en compte non seulement la fécondité et les politiques familiales, mais aussi d'autres phénomènes démographiques (augmentation de l'espérance de vie, migration) et politiques (politique des retraites, politique de l'éducation etc.).

Afin de générer des données pour analyser les transferts financiers entre générations pour plusieurs pays et pour plusieurs périodes, la méthode des « Comptes de Transferts Nationaux » (National Transfer Accounts : NTA), développée à l'Université de Californie à Berkeley, est appliquée. Les Comptes de Transferts Nationaux reposent sur une méthodologie internationale développée par un ensemble de 200 chercheurs issus de 46 pays, réunis sous la direction de Ronald Lee et Andrew Mason. L'objectif est de créer une méthode commune de comptabilité générationnelle pour mesurer les transferts publics, les transferts privés et les allocations d'actifs entre les âges et entre les générations.

La méthode des Comptes de Transferts Nationaux est un système de comptabilité qui décompose les comptes nationaux par âge, fournissant un ensemble complet de mesures spécifiques, par âge, des activités économiques. Les Comptes de Transferts Nationaux reposent sur le principe de cycle de vie économique, qui correspond à la différence entre les profils par âge de consommation totale et les profils par âge du revenu du travail et du capital. Les classes d'âge qui contribuent plus par leur travail qu'elles ne consomment, c'est-à-dire les actifs, financent les classes d'âge qui consomment plus qu'elles ne produisent par leur travail, c'est-à-dire les jeunes et les retraités. Ce financement repose sur des transferts publics, des transferts privés et la réallocation d'actifs privés et publics. Les Comptes de Transferts Nationaux proposent une mesure de chacune de ces composantes en recourant à des données d'enquêtes individuelles et à des données issues de la statistique publique.

La méthode permet de mesurer plusieurs indicateurs d'équité entre générations. Elle donne tout d'abord la possibilité de comparer les classes d'âge entre elles et d'analyser l'évolution du rapport entre classes d'âge au fil du temps. Elle permet également de comparer la situation de générations successives au même âge. Une des possibilités de cette méthode consiste donc à pouvoir discuter l'émergence des problématiques intergénérationnelles et leur dépendance vis à vis de la conjoncture socio-économique et démographique.

Une première partie de ce projet de recherche consiste à appliquer la méthode des comptes de transferts nationaux aux données françaises. Une deuxième partie consiste à évaluer l'effet du soutien intergénérationnel sur le bien-être des différents groupes de la population et de comparer les résultats de plusieurs pays européens. L'approche internationale servira à discuter l'impact du système de redistribution publique sur l'équité entre générations.

Je fais partie d'une équipe française, dirigée par Hippolyte d'Albis, qui est en charge d'établir des Comptes de Transferts Nationaux pour la France (les autres membres sont Ikpidi Badji, Carole Bonnet, Xavier Chojnicki, Najat El Mekkaoui, Jérôme Hubert, Julien Navaux et Jacques Pelletan). Un contrat de recherche a été fiancé par le Commissariat général à la stratégie et à la prospective et un premier rapport de recherche a été publié en 2013.[20] Un premier article est actuellement soumis à la *Review of Income and Wealth*[21].

Je suis chargée de mesurer les transferts publics vers les enfants. Pour cela, je mobilise la base de données « Budget des Familles », couvrant la période 1979 à 2011 (en attendant la vague 2016). Pour mesurer les transferts publics vers les enfants, je développe une méthode permettant d'attribuer les différents transferts de la politique familiale, qui sont généralement renseignés au titre du ménage dans l'enquête Budget des Familles, aux individus. Pour chaque transfert, l'éligibilité légale de chaque membre du ménage est donc à prendre en compte (critères d'attribution pour congé parental, allocations familiales, etc.).

Je fais également partie de l'équipe internationale qui complétera les données en apportant des informations exhaustives par âge relatives à la situation économique des individus, à la façon dont ils font usage de leur temps et à leur bien-être subjectif. Cette équipe réunit économistes et démographes de l'Ecole d'Economie de Paris (Hippolyte d'Albis, Claudia Senik, Andrew Clark, Elena Stancanelli et moi-même), du VID (Vienna Institut of Demography) et de l'Université Sapienza de Rome. Je suis l'investigatrice principale et la responsable du budget de l'équipe française. Le contrat de recherche est financé par le Joint Programming Initiative, EU Framework Programme for Research and Innovation (voir section 3.4. pour une description de cette responsabilité collective).

Afin de créer un « compte de transferts et de bien-être nationaux » (National Well-being and Transfer Account : NWTA), je mobiliserai, dans un premier temps, les données EU-SILC en développant des indicateurs de bien-être économique comparables entre pays. En outre, la vague 2013 des données EU-SILC transversales comporte un module relatif au bien-être subjectif, fournissant des informations sur la perception subjective de la situation de vie.

Afin d'évaluer les institutions de soutien intergénérationnel dans les pays européens, nous prévoyons de procéder en deux étapes. Dans un premier temps, nous combinerons des informations par âge relatives aux dimensions importantes du bien-être (la situation économique des individus, la façon dont ils font usage de leur temps, leur santé et leur bien-être subjectif ainsi que des informations relatives à la conception des systèmes de soutien intergénérationnel). Dans une seconde étape, nous conduirons une analyse détaillée de la façon dont les différentes dimensions du bien-être évoluent au cours de la vie, nous identifierons les principaux déterminants qui influencent les variables du bien-être à chaque étape de la vie et nous explorerons la relation entre bien-être et soutien intergénérationnel.

Notre ambition est d'identifier dans quelle mesure le vieillissement de la population modifie le rôle de la famille en matière de financement des transferts intergénérationnels. L'objectif ultime est de formuler des implications politiques en termes de refonte des transferts sociaux dans les pays européens. Plus précisément, nous entendons acquérir une meilleure compréhension de la manière dont le soutien intergénérationnel peut être adapté afin d'être

[20] H. d'Albis, C. Bonnet, N. El Mekkaoui, A. Greulich, J. Navaux, J. Pelletan, A. Solaz, E. Stancanelli, H. Toubon, F.-C. Wolff, H. Xuan (2013) *: «Etude portant sur la répartition des prélèvements et des transferts entre les générations en France. »* Rapport de recherche pour le Commissariat général à la stratégie et à la prospective.
[21] "Who pays for the consumption of young and old – measuring intergenerational equity in France with the National Transfer Accounts." Avec J. Navaux, C. Bonnet, H. d'Albis

durable en situation d'évolution démographique et, dans le même temps, aider les dépendants de la meilleure façon possible sans surcharger ceux qui fournissent le soutien. Mon objectif principal, en lien avec mes thèmes de recherche précédents, consiste à identifier la façon dont les différentes dimensions du bien-être sont liées au fait d'avoir un enfant ainsi que la façon dont les situations économiques et le bien-être varient entre groupes socio-économiques et entre femmes et hommes à travers le cycle de vie.

2.3. Mesurer les changements familiaux

La troisième perspective de recherche consiste à continuer et à approfondir mon travail méthodologique en cherchant à améliorer les mesures sociodémographiques dans les données d'enquêtes européennes. Les variations des structures familiales sont encore très difficiles à tracer dans les enquêtes standards. Une des raisons est la mobilité (physique) qui augmente surtout pour les jeunes adultes. Un premier angle d'attaque consiste donc à évaluer comment les trajectoires conjugales des jeunes adultes sont aujourd'hui mesurables avec différentes sources de données.

Ma participation au projet de recherche ANR intitulé « Big_Stat: Big Statistical Data for a Mobile Society - Des données statistiques massives pour observer une société mobile » s'inscrit dans cette logique. Ce projet, lancé fin 2016, réunit plusieurs équipes de différentes institutions (Ined, INSEE, différentes universités) afin de mobiliser des méga-données statistiques (des données issues de fichiers administratifs couvrant toute la population), et d'évaluer les points forts et les points faibles de plusieurs sources de données qui seront diffusées en 2016 par l'Institut national de la statistique et des études économiques français (INSEE) : données administratives, recensement, enquêtes en population générale et entretiens non directifs. L'équipe française est dirigée par Laurent Toulemon.

L'axe thématique portera sur la famille et les comportements démographiques qui conduisent à une plus grande mobilité individuelle et sociale, rendant plus difficile de définir et d'observer la réalité des situations familiales et des situations de logement. Plus précisément, il s'agit des relations conjugales des jeunes adultes, qui ne sont pas toujours clairement définies et stabilisées dans les bases de données (couples cohabitant, collocation, couples dit 'mobiles' avec plusieurs lieux de résidence, familles recomposées …).

Les différentes définitions de la vie en couple étant mises en regard des conditions sociales et professionnelles des jeunes adultes, une application avec les données EU-SILC se prête à ce sujet dans un premier temps. Plus précisément, je compte analyser la stabilité des unions entre jeunes adultes, différentiée en fonction de la scolarisation et de l'intégration au marché du travail. L'objectif est de vérifier l'hypothèse de l'émergence d'une nouvelle forme de cohabitation pour les étudiants et les jeunes adultes se trouvant dans une situation instable ou incertaine, fragilisés par les contraintes imposées par la nécessité d'une mobilité géographique individuelle. Les données EU-SILC me permettent d'observer les jeunes couples vivant en union consensuelle (avec et sans cadre juridique) pour 31 pays pour les années 2001 à 2015.

Les unions reposant sur un cadre juridique incluent à la fois les couples mariés et les partenaires enregistrés (PACS, etc.), tandis que les unions ne reposant pas sur un cadre juridique correspondent « de fait » aux partenaires vivant dans un même foyer. Grâce aux données transversales, il est possible de comparer les caractéristiques socio-économiques (éducation, statut d'activité, revenu, occupation, NUTS, etc.) des jeunes individus vivant en union consensuelle avec celles des individus vivant seuls, avec leurs parents, partageant un appartement avec des amis, etc. La base de données longitudinales permet de modéliser les déterminants socio-économiques de la formation d'une union consensuelle, tandis que la vaste couverture géographique autorise une approche multiniveaux permettant de prendre en compte des caractéristiques institutionnelles (telles que les solutions juridiques alternatives au mariage, par exemple, mais aussi, et en particulier, les exigences du marché du travail pour les jeunes adultes).

Les résultats basés sur les données EU-SILC vont ensuite être confrontés aux résultats basés sur d'autres sources de données, notamment des données de recensement, afin d'identifier de possibles biais dans les bases et afin de proposer des améliorations en ce qui concerne la mesure et la collecte de données.

Autre que le travail sur différentes bases de données, mon intégration aux équipes de recherche qui sont réunis par l'ANR « Big_Stat » me permettra d'élargir mon spectre d'analyse en intégrant des aspects au-delà de l'analyse quantitative des comportements démographiques. Il est vrai que dans mes travaux présentés dans cette synthèse, les décisions en matière de fécondité sont modélisées principalement en tant que choix rationnel des couples basé sur des coûts et des bénéfices économiques. En s'appuyant sur des échantillons larges, mes travaux se limitent aux déterminants quantifiables des décisions de fécondité. Par conséquent, certains aspects y restent peu abordés. C'est le cas des schémas culturels et des normes sociales en ce qui concerne la conception de la parentalité et du couple, mais aussi d'informations plus intimes à titre individuel/du ménage. Parmi ces déterminants difficilement quantifiables figurent, par exemple, la qualité de la relation amoureuse et son développement à travers le temps : Regnier-Loilier et Debrest (2016), dans leur étude basée sur des entretiens réalisés auprès des répondants à l'enquête longitudinale 'Études des relations familiales et intergénérationnelles (Érfi, Ined-Insee)' s'intéressent aux personnes qui n'ont pas eu d'enfant alors qu'ils en avaient exprimé l'intention auparavant. A côté de l'instabilité professionnelle, la difficulté institutionnelle de concilier vie familiale, vie professionnelle et des soucis de santé, ce sont souvent des tensions au sein du couple qui sont évoquées comme raison de ne pas réaliser les intentions de fécondité – une raison qui échappe à l'observation quantitative.

Bien que l'analyse de ces facteurs ne relève pas du champ de mes recherches, je trouve important de reconnaître qu'une analyse qualitative en ce domaine revêt une importance significative et complémentaire à l'analyse économique et démographique. Faciliter les échanges entre chercheurs couvrant les aspects économiques, démographiques, sociologiques, culturels, psychologiques et médicaux de la fécondité fait partie de mes objectifs prioritaires pour les prochaines années.

3. Expérience scientifique et activités professionnelles

3.1. Profil académique

En 2006, j'ai obtenu une Maîtrise en Sciences Économiques à l'Université Ludwig Maximilian de Munich (Allemagne), après avoir obtenu une licence à l'Université de Toulouse 1 dans le cadre du programme Erasmus. J'ai ensuite complété ma formation par un Doctorat en Economie à Paris, en étant encadrée, sous forme d'une cotutelle franco-allemande, par Jacques le Cacheux (Université de Pau et des Pays d'Adour, Sciences Po Paris) et Anita Pfaff (Université Augsbourg, Allemagne). Pendant mon doctorat (externe), j'ai été d'abord accueillie par l'Institut de recherches économiques et sociales (IRES) et ensuite par l'Ined (Institut National d'Etudes Démographiques) à Paris. La thèse, soutenue en 2009, traite l'impact ambigu du développement économique sur la participation des femmes au marché de l'emploi en mobilisant l'économétrie des données de panel.

Mes recherches ont ensuite été entamées dans le cadre d'un post-doctorat (2009-2011) à l'Ined (unité de recherche « démographie économique ») et ont été poursuivies au Centre d'Economie de la Sorbonne (CES), ou j'ai été recrutée en 2011 comme maîtresse de conférences. Pendant mon post-doctorat, j'ai participé au projet de recherche international «REPRO (« reproductive decision making in a micro-macro perspective »), en coopération avec des chercheurs des instituts d'études démographiques Ined (France), Nidi (Pays Bas), Max Planck (Allemane), VID (Autriche), Università Bocconi (Italie), DRI (Hongrie), SSB (Norvège) et l' Université Essex(Grande-Bretagne), financé par la Commission Européenne (Seventh Framework Programme under the Socio-economic Sciences and Humanities theme ; Grant Agreement: SSH-CT-2008-217173).

Au Centre d'Economie de la Sorbonne, j'ai d'abord intégré l'équipe 'institutions' (2011-2013), puis l'équipe 'micro-économie appliquée' (2013-2016). Depuis septembre 2016, je fais partie de l'équipe 'sciences du comportement'. Je suis actuellement en délégation à 50% à l'Ined (financée par le labex iPOPs) et accueillie par l'unité de recherche 'fécondité, famille, sexualité' (septembre 2016 – août 2018).

Mes recherches menées depuis ma thèse m'ont permis d'élargir mes compétences en économie en développant mon expertise en démographie. Ma thèse sur les déterminants macro-économiques de l'emploi des femmes m'a sensibilisée à l'importance de prendre en compte les interactions entre sphères économiques, démographiques, sociales et familiales quand il s'agit d'analyser les déterminants et les conséquences des inégalités entre femmes et hommes. Le partage des responsabilités professionnelles et familiales entre femmes et hommes émerge comme un facteur clé pour divers résultats socio-économiques et démographiques, et la possibilité de ce partage dépend à son tour d'un ensemble d'éléments économiques, institutionnels et culturels.

Mon orientation vers l'économie démographique m'a permis d'élargir mon spectre d'analyse en intégrant à l'approche économique, des aspects d'autres disciplines, notamment de la démographie. Pendant mon post-doctorat, mes recherches étaient principalement consacrées aux déterminants macro-économiques de la fécondité dans des pays développés. Mon intégration au Centre d'Economie de la Sorbonne m'a ensuite permis de compléter mes compétences en macro-économie et en démographie avec des techniques économétriques de la microéconomie appliquée, mobilisées pour analyser des différentiels socio-économiques des comportements de fécondité des couples.

Pour la majorité des projets de recherche, j'ai travaillé en collaboration avec des collègues, français et internationaux, de divers horizons scientifiques (économistes spécialisés dans la modélisation théorique, démographes et sociologues). Pour tous mes projets de recherche, j'ai l'ambition de proposer une approche holistique qui combine les outils d'analyse quantitative de l'économie, de la démographie et de la sociologie. Un autre aspect d'une grande importance pour moi est, à côté de l'interdisciplinarité, la démonstration des implications politiques de nos résultats scientifiques (voir section 3.3.).

3.2. Enseignement et encadrement des étudiants

Mes activités en matière d'enseignement m'ont permis à approfondir mes connaissances non seulement en économie, mais aussi dans le domaine de l'analyse quantitative en démographie (des concepts ainsi que des techniques statistiques spécifiques, comme par exemple le diagramme de Lexis, le calcul des taux de fécondité et de mortalité standardisés qui sont non-biaisés par la structure d'âge d'une population, la distinction entre effets « tempo » et effets « quantum » dans le calcul de nombreuses mesures démographiques etc.). J'ai d'abord été « teaching assistant » (chargée de TD) pour un cours en démographie (niveau L2) à IUP Sciences Po Paris (responsables du cours : François Héran et Aline Désesquelles, Ined), puis j'ai remplacé Aline Désesquelles comme enseignante du cours magistral. J'ai également encadré des mémoires pour les étudiants de ce cours. J'ai ensuite élaboré mon propre cours magistral en « *Population Economics* » à l'IUP (niveau L2, + encadrement des 'teaching assistants') ainsi qu'à Paris 1 (niveau M1, + suivi des mémoires).

La sensibilisation des étudiants aux aspects multidisciplinaires me tient particulièrement à cœur. A cet effet, j'ai, à titre d'exemple, élaboré, un plan spécifique pour mon cours magistral en « *Histoire Economique* » (L3) à Paris 1 qui présente les déterminants de la croissance économique pendant la Révolution Industrielle en Europe. J'y mets un accent particulier sur le rôle des dynamiques démographiques (la « transition démographique ») et de la redistribution des ressources économiques (entre riches et pauvres, mais aussi entre femmes et hommes), qui ne peuvent pas seulement être considérées comme conséquences mais doivent aussi être considérées comme déterminantes de la croissance économique. Les étudiants sont ensuite invités à présenter des articles scientifiques sur ce sujet. Les articles discutant des interactions entre genre, dynamismes démographiques et dynamismes économiques figurent parmi les plus choisis. Je donnerai ce cours en anglais à partir de septembre 2017.

Parmi les étudiants qui ont suivi mon cours en « *Population Economics* » en M1 à Paris 1 (programme diplôme universitaire « PSME »), plusieurs ont choisi l'économie démographique et ses aspects de genre comme sujet de mémoire. J'ai encadré ces mémoires et pour ceux qui ont décidé de prolonger leurs analyses en doctorat, j'ai encadré l'écriture de leur projet de recherche. Pouvoir encadrer des thèses dans ce domaine figure parmi mes objectifs les plus importants pour les prochaines années. Mon lien avec l'Ined me permettra de fournir à mes futurs doctorants non seulement un encadrement intellectuel mais aussi un soutien institutionnel important (accès aux stages et bourses, possibilité d'intégration dans les projets de recherche ANR et internationaux, association aux unités de recherche).

En 2015/16 j'ai eu une décharge d'enseignement de 96 HETD pour un congé de maternité. Je suis actuellement en délégation Ined/iPOPs à mi-temps pour la période entre septembre 2016 et juillet 2018, ce qui me donne droit à une décharge d'enseignement de 96 HETD. Dans le cadre de ce service réduit, j'assure, autre que le cours magistral en « *Histoire Economique* » en L3 (36 HETD, 200 étudiants), le cours magistral « *Economie du Genre* » en M1 (10 étudiants, 9 HETD) et le cours magistral « *Introduction Générale à l'Economie* » en L1 (63 HETD, 350 étudiants). Je suis responsable de l'équipe pédagogique de ma division pour ce cours en L1. Les étudiants de ma division sont divisés en une dizaine de groupes de TD. Dans ce cadre, je coordonne les différents enseignants des travaux dirigés, organise leur recrutement et l'attribution aux différents groupes, et m'engage à leur fournir un soutien pédagogique. Ce soutien me semble indispensable étant donné les particularités d'enseignement en premier semestre de première année. Les enseignants doivent en effet gérer, au-delà de l'enseignement, l'apprentissage des méthodes de travail ainsi que l'adaptation des étudiants au monde universitaire. Ma fonction consiste donc à établir un dialogue avec les enseignants, et en particulier ceux qui viennent d'arriver, tout au long du semestre. Ceci me permet de les conseiller en cas de problème, question etc., mais aussi de les consulter pour avoir un retour régulier sur le déroulement des séances et des contrôles continus. Dans le même but de fournir un soutien aux jeunes enseignants, j'anime régulièrement un atelier pour les nouveaux doctorants sur les méthodes pédagogiques au Centre d'Economie de la Sorbonne. Entre 2011 et 2015, j'ai également été « enseignant référent » pour les étudiants en première année. Dans cette fonction, mon rôle consistait à apporter un soutien pédagogique aux étudiants qui rencontrent des difficultés.

En juin 2017, je serai professeur invité au Population Center de l'Université Berkeley en Californie (UBC) pour animer un séminaire de démographie formelle, co-sponsorisé par le « Center on the Economics and Demography of Aging (CEDA) ». Ce séminaire, qui se déroulera sur plusieurs jours, s'adresse aux étudiants diplômés de niveau supérieur, des stagiaires postdoctoraux, des maîtres de conférences et d'autres chercheurs seniors.

Finalement, mon intégration au sein des institutions internationales (voir section suivante) a permis à plusieurs de mes étudiants d'y exercer leur première expérience professionnelle. Je considère qu'aider les étudiants à développer leurs possibilités d'intégration professionnelle fait partie de mes responsabilités d'enseignant-chercheur.

3.3. Conseil scientifique

Le questionnement politique qui est présent dans mes travaux de recherche me mène à effectuer régulièrement des activités de consultante auprès de diverses organisations internationales (OCDE, Banque Mondiale, Commission Européenne). Dans le cadre de ces activités, j'ai présenté mes résultats scientifiques à plusieurs reprises aux représentants des Ministères des Affaires Familiales (France, Allemagne, Turquie, Russie, Pologne, Chine, Japon, Corée du Sud)

Comme une partie de mon travail doctoral porte sur l'emploi des femmes dans les pays en développement, j'ai été sollicitée à titre d'experte scientifique par le Centre de Développement de l'OCDE (2007-2011). Mon travail a contribué à l'élaboration d'un rapport du Centre[22] et nos résultats ont été publiés dans une revue internationale avec comité de lecture.[23] Dans ce cadre, j'ai analysé les déterminants et les conséquences de la représentation des femmes sur le marché du travail informel.

Suite à mes publications scientifiques sur la fécondité en Europe, la Banque Mondiale m'a demandé à trois reprises de constituer une équipe de recherche afin de contribuer à l'écriture des rapports de la Banque Mondiale (2013-2016). Ces rapports portent sur les défis de la baisse de la fécondité, du vieillissement démographique et de l'égalité entre femmes et hommes dans les pays de l'Europe et de l'Asie Centrale. Nos recherches scientifiques sur ces sujets, menés en coopération avec Olivier Thévenon, Mathilde Guergoat-Larivière, Aurélien Dasré et Ceren Inan, ont servi de documentation de référence pour ces rapports phares (World Bank « flagship reports »).[24] J'ai également été invitée à présenter nos résultats à des représentants des gouvernements de Russie, Pologne, Allemagne et Japon – autant de pays préoccupés par des niveaux de fécondité inférieurs aux taux de remplacement – ainsi qu'à la Commission européenne et à l'OCDE.

Suite à mon travail sur les politiques familiales en France et en Allemagne, j'ai été sollicitée en 2015 par l'OCDE (Direction de l'emploi, du travail et des affaires sociales) pour analyser les déterminants individuels et institutionnels des schémas de partage du travail rémunéré des parents conjoints dans les pays européens. Mes résultats ont été présentés au chapitre 4 d'un rapport de l'OCDE[25] et ont servi de documentation de référence pour le ministère allemand des Affaires Familiales, lequel a pour objectif de promouvoir l'égalité au sein des couples dans les familles allemandes. Mes travaux encouragent les décideurs allemands à s'appuyer sur les importantes réformes ayant vu le jour depuis le milieu des années 2000 pour permettre aux pères tout comme aux mères de combiner carrière et enfants. Avec ces objectifs en vue,

[22] D. Kucera, T. Xenogiani, avec la collaboration d'A. Luci (Greulich), edité by J. Jütting and J. de Laiglesia (2009): *"Women in informal employment. What do we know and what can we do?,"* in "Is Informal Normal? Towards More and Better Jobs in Developing Countries." OECD Development Centre (2009).

[23] A. Luci (Greulich), J. Jütting, C. Morrisson (2012): "Why do so many women end up in bad jobs? A cross country assessment for developing countries." *The European Journal of Development Research* Vol 24, N° 4

[24] *"The Drivers of Aging in Europe and Central Asia"* in "Golden Aging : Prospects for Healthy, Active, and Prosperous Aging in Europe and Central Asia." Washington, DC: World Bank. World Bank (2015)
"What's Next for Old Europe? Aging with Growth in Central Europe and the Baltics" Washington, DC: World Bank. World Bank (2015)

[25] *"Dare to share. Promoting equal partnership in paid and unpaid work."* OECD Directorate for Employment, Labour and Social Affairs (2016).

mes travaux placent l'expérience de l'Allemagne au cœur d'une comparaison internationale et s'inspirent par exemple des expériences de la France et des pays nordiques, qui possèdent depuis longtemps des politiques visant à soutenir l'équilibre travail-famille et à renforcer l'égalité des genres.

Finalement, je suis régulièrement sollicitée par les médias, français ainsi qu'internationaux, sur les politiques familiales en Europe (Spiegel, Sankei Shimbn, Slate, Sciences & Vie, Radio France Culture, Radio France Internationale, le Figaro, la Dépêche, Le Monde, l' Obs., etc.). Je participe également très régulièrement à des conférences internationales de niveau reconnu et à des séminaires sur invitation. Au cours des dernières années académiques, j'ai présenté mes travaux dans 22 colloques et 16 séminaires, dont 26 hors France.

3.4. Responsabilités collectives

J'ai assuré la coresponsabilité de l'organisation logistique et le suivi de plusieurs conférences internes et externes. J'ai notamment participé à l'organisation d'un colloque avec appel international à contribution au titre d''Household Economics', en honneur de Gary Becker, qui a eu lieu à l'Ined en mars 2010, et j'ai assuré l'organisation d'un colloque avec appel international à contribution au titre de 'Gender Economics', en honneur de Cathérine Sofer, qui a eu lieu au CES en juin 2014. J'ai également contribué régulièrement à la programmation du séminaire 'genre' qui a lieu une fois par mois au CES.

En termes de recherche de financements extérieurs, j'ai contribué à l'Ined ainsi qu'à Paris 1 à répondre à différents appels d'offres (BQR, Commission Européenne, ANR). Deux candidatures ont étés retenues récemment.

Il s'agit, premièrement, du projet ANR « Big_Stat - des données statistiques massives pour observer une société mobile » (300 000 € pour la période 2016-2020), coordonné par l'Ined (Laurent Toulemon), qui mobilise des chercheurs de l'Ined, de l'Insee et de différentes universités françaises. Les objectifs scientifiques de ce projet de recherche sont décrits dans la section 3.2. Notre méthode de collecte de données, ainsi que les données traitées, vont être mises en ligne pour permettre aux autres chercheurs de répliquer nos résultats ainsi que de faire progresser la méthode des Comptes de Transferts Nationaux. J'ai également prévu, en collaboration avec le professeur Didier Breton de l'Université de Strasbourg, d'installer une plateforme en ligne qui met à disposition des données pour les étudiants et d'organiser, en coopération entre l'Université Paris 1, de Strasbourg et l'Ined, des ateliers pour familiariser les étudiants en économie et démographie avec ces nouvelles sources de données.

Il s'agit, deuxièmement, du projet transnational « More Years, Better Lives - The Potential and Challenges of Demographic Change » (600 000€ pour 2017-2020 ; Joint Programming Initiative, funded by Horizon2020, the EU Framework Program for Research and Innovation ; Grant Agreement number 643850). Le projet est coordonné par l'Academie des Sciences en Autriche (Alexia Fürnkrnaz-Prskawetz), qui mobilise des chercheurs du Vienna Institut of Demography, de l'Ecole d'Economie de Paris et du CES ainsi que de l'Université Sapienza de Rome. Je suis l'*investigatrice principale de l'équipe française* (autres membres : Hippolyte d'Albis, Claudia Senik, Andrew Clark et Elena Stancanelli) et *responsable du budget* pour cette équipe (200 000€). Avec ce budget, il est envisagé de financer un assistant de recherche sur trois ans, de couvrir des missions des membres de l'équipe français, d'organiser une conférence avec des experts internationaux à Paris ainsi que d'acheter du matériel (ordinateurs, équipement du laboratoire expérimental). Les objectifs scientifiques de ce projet de recherche sont décrits dans la section 3.3. Afin de garantir les meilleures normes scientifiques, nous pouvons faire appel à un conseil consultatif scientifique international dont font partie Ronald D. Lee (professeur de démographie et d'économie à l'Université de Californie, Berkeley), Andrew Mason (professeur d'économie à l'Université d'Hawaï et chercheur principal du département Études sur la population et la santé de l'East-West Center d'Honolulu, Hawaï), Emilio Zagheni (professeur adjoint, département de Sociologie, université de Washington, Seattle), Gøsta Esping-Anderson (Université Pompeu Fabra, Barcelone), Pieter Vanhuysse (Université du Danemark du Sud) et Jonathan Gershuny (Université d'Oxford).

En ce qui concerne mes expériences dans le domaine de recrutement et d'évaluation, j'ai été membre du comité de recrutement pour professeurs agrégés de l'enseignement du second degré (PRAG) à l'UFR d'économie de Paris 1 en 2014. En 2014, j'ai participé à une commission d'évaluation du projet pour le Centre National de Sciences en Pologne. En 2016, j'ai été membre du jury du recrutement des doctorants à l'Ined. J'établis également régulièrement des rapports pour des revues internationales avec comité de sélection (World Development, Economie et Statistique, European Journal of Population, Population, Demography, Demographic Research, European Journal of Sociology etc.).

Finalement, je suis, depuis décembre 2016, la correspondante du laboratoire CES au GIS Institut du Genre. Le GIS réunit 34 partenaires institutionnels en s'appuyant sur des UMR et des équipes explicitement engagées dans la recherche sur le genre. J'y représente le Centre d'Economie de la Sorbonne et je m'engage à faciliter l'échange et la coordination entre les chercheurs de mon laboratoire et ceux d'autres laboratoires en France qui travaillent sur les questions de genre.

CONCLUSION

En raison de la baisse des niveaux de fécondité en Europe à la fin du XXe siècle, beaucoup de gouvernements européens considèrent le niveau de fécondité dans leur pays comme trop faible. Au niveau macroéconomique, la baisse de la fécondité a largement contribué au vieillissement de la population qui est devenu un défi majeur en Europe. Au niveau individuel, avoir des enfants représente pour beaucoup de personnes un projet de vie important. Les niveaux de fécondité qui stagnent en-dessous du niveau de remplacement (2.1 enfants par femme dans les pays développés) indiquent que beaucoup de personnes ne parviennent pas à réaliser leurs intentions de fécondité, ce qui réduit leur bien-être.

Les travaux présentés dans cette synthèse analysent les déterminants macro-économiques et institutionnels des niveaux de fécondité dans les pays développés, ainsi que les différentiels socio-économiques dans le comportement de fécondité au sein des pays européens. Une attention particulière est accordée aux interactions entre caractéristiques individuelles (éducation, statut d'activité, etc.), celles du partenaire, le contexte économique et les différents instruments de la politique sociale.

L'ensemble de mes travaux montre que le lien entre éducation, statut de l'emploi et fécondité dépend fortement du contexte familial et économique dans lequel l'individu, ou le couple, se trouve.

Durant les trente glorieuses, les différentiels traditionnels de fécondité étaient caractérisés par une corrélation négative entre fécondité et statut socio-économique dans la plupart des pays européens (Johnson, 1960). Si on se concentre sur les facteurs économiques, cette association négative était principalement due à une incompatibilité entre le nombre d'enfants, l'autonomisation économique des femmes et l'ambition des parents concernant l'éducation de leurs enfants qui est coûteuse en temps et en argent (Mincer 1958, Becker 1960).

Mes recherches indiquent que les différentiels socio-économiques ont changé dans la plupart des pays européens pendant les dernières deux décennies du fait des importantes transitions économiques et institutionnelles. Les différentiels varient aujourd'hui considérablement entre pays européens. Dans un premier groupe de pays ou l'emploi des deux parents est institutionnellement facilité, une association positive entre fécondité et statut socio-économique commence à émerger. Dans un deuxième groupe de pays, où les parents ont des difficultés à combiner vie familiale et vie professionnelle, mes recherches indiquent que la majorité des couples est contrainte à ne pas agrandir la famille, même si certains catégories socio-économiques sont plus concernées que d'autres.

Mon travail met donc en évidence que, même si les « différentiels socio-économiques de fécondité » (c'est-à-dire les différences au niveau du nombre d'enfants et d'âge à la première naissance entre parents des différentes catégories d'éducation, de statut professionnel et de revenu) évoluent dans quasiment tous les pays européens, ils ne diminuent pas forcément. Ceci peut être considéré comme problématique sachant que la plupart des européens en âge de procréer déclarent aujourd'hui vouloir deux enfants, et ce relativement indépendamment de leur classe socio-économique (Sobotka et Beaujouan 2014, Testa 2014). Pour les pays ayant un taux de fécondité autour du seuil de remplacement, mes travaux suggèrent qu'il y a néanmoins un certain nombre d'individus (qui ont tendance à appartenir aux classes « populaires ») qui sont contraints de ne pas réaliser (toutes) leurs intentions de fécondité, tandis que des familles plus aisées ont des moyens financiers leur permettant d'élargir la taille de leur famille, éventuellement même au-dessus de la taille qu'elles avaient initialement prévue. Pour les pays ayant un taux de fécondité en dessous du seuil de remplacement, mes travaux suggèrent que toutes les catégories, mais surtout la classe « moyenne », ont tendance à se restreindre à un enfant.

Mes travaux montrent qu'aujourd'hui dans les pays européens, un déterminant important pour pouvoir réaliser ses intentions de fécondité est de pouvoir financer sa famille. Indépendamment de la catégorie socio-professionnelle du partenaire, ce sont les familles où la femme est également insérée au marché du travail, avant et après la naissance d'un enfant, qui arrivent le plus à réaliser leurs intentions de fécondité. La stabilité économique, si importante pour la fondation et l'élargissement d'une famille, est donc mieux assurée si les deux partenaires réussissent une carrière professionnelle continue.

La politique familiale joue évidemment un rôle essentiel, car certains dispositifs (crèches, congé parental court et rémunéré en fonction du salaire) facilitent et encouragent l'insertion professionnelle des deux partenaires. Toutefois, engager un partage égalitaire des responsabilités professionnelles et familiales entre femmes et hommes n'est pas seulement une affaire de politique familiale : d'autres institutions comme le marché du travail et les normes sociales ont aussi un impact considérable. Faciliter la réalisation des intentions de fécondité pour toutes les classes sociales nécessite un policy mix[26] cohérent qui propose des solutions aux parents non seulement pour faire garder les enfants et se partager le congé parental, mais aussi pour stabiliser et rémunérer correctement l'emploi des deux partenaires ainsi que pour rendre le travail compatible avec une vie familiale.

Le défi scientifique que je me suis donné pour mes travaux futurs consiste à intégrer les différentiels socio-économiques et leur dépendance institutionnelle dans les modèles de prévision démographique, à intégrer une perspective de cycle de vie dans mes recherches ainsi qu'à développer des mesures pour mieux prendre en compte les nouveaux changements familiaux dans les pays développés. Mes projets de recherche ouvrent des perspectives pour les cinq prochaines années et pour la suite, non seulement en termes scientifiques, mais aussi en termes d'incidence politique. L'expérience scientifique et administrative que j'ai acquise au cours des dernières années me permet de mener à bien ce programme de recherche et de le développer avec le soutien de coopérations internationales et interdisciplinaires. Mes recherches intégrées recèlent le potentiel d'encadrer de jeunes chercheuses et chercheurs de niveau doctorat et post-doctorat ; économistes, démographes et sociologues quantitativistes. Les jeunes chercheuses et chercheurs profiteront de l'expertise des membres de nos équipes et contribueront à l'acquisition de nouvelles connaissances au carrefour de la démographie et de l'économie. Le fait de pouvoir encadrer leurs travaux, de les guider et de les voir construire un projet scientifique basé sur l'échange de nos idées représente pour moi l'un des principaux éléments qui m'ont motivée à présenter cette habilitation à diriger des recherches.

[26] Dosage macroéconomique **:** La combinaison de manière optimale des principaux instruments de la politique publique.

REFERENCES

Adsera, A. (2004): "Changing fertility rates in developed countries: the impact of labor market institutions." *Journal of Population Economics*, 17(1), 17–43.

Adsera, A. (2011): "Labor Market Conditions and Fertility in Europe." *European Journal of Population*, vol. 27, n° 1, pp. 1-32.

Arellano M., Bond S. (1991): "Some test of specification for panel data." *Review of Economic Studies*, 58(2), 267–297.

Arellano M., Bover O. (1995): "Another look at the instrumental variable estimation of error component models." *Journal of Econometrics*, 68(1), 29–51.

Arpino B, Esping-Andersen G. (2015): "How do Changes in Gender Role Attitudes towards Female Employment Influence Fertility. A Macro-Level Analysis." *European Sociological Review*, Vol 31, Issue 3.

Baizan P., Arpino B, Delclos C.E. (2015): "The Effect of Gender Policies on Fertility: The Moderating Role of Education and Normative Context." *European Journal of Population*, pp 1-30.

Balbo N., Billari F.C., Mills M. (2013): "Fertility in Advanced Societies: A Review of Research." *European Journal of Population* , vol. 29, n° 1, pp. 1-38.

Becker, G. S. (1960): "*An Economic Analysis of Fertility*", Demographic and Economic Change in Developed Countries, a Conference of the Universities, National Bureau Committee for Economic Research, Princeton University Press.

Becker G., Lewis H. G. (1973): "On the interaction between quantity and quality of children. *Journal of Political Economy*, 81, S143–S162.

Billari, F.C. (2004): "Becoming an adult in Europe: A macro(/micro)-demographic perspective." *Demographic Research*, Special Collection 3, art. 2, pages 15-44.

Billari F.C., Kohler H.P. (2004): "Patterns of low and lowest-low fertility in Europe." *Population studies*, Volume 58, Issue 2, pages161-176.

Blau D. M., Philip K. R. (1988): "Child-care costs and family labor supply." *The Review of Economics and Statistics* 70, no. 3.

Blossfeld, H.-P. (Ed.) (1995*): "The new role of women: Family Formation in Modern Societies."* Boulder: Westview Press.

Blundell R., Bond S. (1998): "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics*, 87, 115–143.

Bongaarts J., Feeney G. (1998): "On the quantum and tempo of fertility." *Population and Development Review*, 24(2), 271–291.

Bongaarts J., Sobotka T. (2012): "A Demographic Explanation for the Recent Rise in European Fertility." *Population and Development Review*, vol. 38, n° 1, pp. 83-120.

Bourdieu, P. (1996): "On the family as a realized category." *Theory, Culture and Society*. 13(3), 19-26.

Breton D., Prioux F. (2005) : « Deux ou trois enfants? L'influence de la politique familiale et de quelques facteurs sociodémographiques. » *Population*-F 60 (4): 489{522.

Butz W. P., Ward M. P. (1979): "The emergence of countercyclical U.S. fertility." *American Economic Review*, 69(3), 318–328.

D'Addio A., Mira d'Ercole M. (2005) : *"Trends and Determinants of Fertility Rates in OECD Countries: The Role of Policies."* Social, employment and migration working papers, no. 27, OECD, Paris.

Easterlin R.A., Pollak R.A., Wachter M.L (1980): *"Toward a more general economic model of fertility determination: endogenous preferences and natural fertility."* In R.A. Easterlin (Ed.) Population and Economic Change in less developed countries. Chicago: University of Chicago Press.

Edon C., Kamionka T. (2011) : « Modélisation dynamique de la fécondité et de la participation au marché du travail des femmes en couple », *Revue économique*, 3/2011 (Vol. 62), p. 429-440.

Esping-Andersen, G. (2007): "Family Formation an Family Dilemmas in contemporary Europe.e Bilbao: Fundacion BBVA.

Fraser, N. (1994): "After the family wage: Gender equity and the welfare state." *Political Theory*, 22(4), 591-618.

Galor O., Weil D.N. (1996): "The Gender Gap, Fertility and Growth." *American Economic Review* 86, 374-387.

Gauthier A., Hatzius J. (1997): "Family benefits and fertility: An econometric analysis." *Population Studies*, 51(3), 295–306.

Goldschneider F., Bernhardt E., Brandén M. (2013): "Domestic Gender Equality and Childbearing in Sweden." *Demographic Research*, vol. 29, art. 40, pp. 1097-1126.

Goldstein J.R., Sobotka T., Jasilioniene A. (2009): "The End of "Lowest-Low Fertility?" *Population and Development Review*, vol. 35, n° 4, pp. 663-699.

Hazan M., Zoabi H. (2015): "Do highly educated women choose smaller families?" *The Economic Journal*. Volume 125, Issue 587, pages 1191–1226.

Héran, F. (2010) : « Réflexions d'un non-économiste sur l'analyse économique des migrations », *Regards croisés sur l'économie*, 8 (2), p. 13-27.

Héran, F. (2012) : *« Parlons immigration en trente questions »*, Paris, La Documentation française, 96 p.

François H., Pison G. (2007) « Deux enfants par femme dans la France de 2006 : la faute aux immigrées ? » *Population et Sociétés* 432, Institut National d'Études Démographiques (Ined).

Hotz V.-J., Kerman J.-A., Willis R.-J. (1997): *"The economics of fertility in developed countries: A survey."* In: M. Rosenzweig & O. Stark (Eds.), Handbook of population economics (1A ed.,pp. 275–347). Amsterdam: Elsevier.

Hotz V.J., Miller R.A. (1988): "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply." *Econometrica*, Vol. 56, No. 1. pp. 91-118.

Johnson-Hanks J., Bachrach C., Morgan S.P., Kohler H.P. (2011): *"Understanding Family Change and Variation: Toward a theory of Conjunctural Action."* Springer.

Kalwij, A. (2010): "The impact of family policy expenditures on fertility in Western Europe." *Demography*, 47(2), 503–519.

Klasen S. Lenze J. (2016): "Does women's labour force participation reduce domestic violence? Evidence from Jourdan." *Feminist Economics* Vol. 23 (1).

Klesment M., Puur A., Rahnu L., Sakkeus L. (2014) : "Varying Association between Education and Second Births in Europe: Comparative Analysis Based on the EU-SILC Data." *Demographic Research*, vol. 31, pp. 813-860.

Kohler H.-P., Billari F. C., Ortega J. A. (2002): “The emergence of lowest-low fertility in Europe during the 1990s.” *Population and Development Review*, 28(4), 641–681.

Kohler H. P., Philipov D. (2001) : “Variance effects in the Bongaarts–Feeney formula”. *Demography*, 38(1), 1–16.

Kravdal Ø., Rindfuss R. R. (2008): “Changing Relationships between Education and Fertility: A Study of Women and Men Born 1940 to 1964.” *American Sociological Review*, vol. 73, n° 5 854-873.

Lee R., Mason A., eds., (2011): *“Population Aging and the Generational Economy: A Global Perspective*”, Edward Elgar, Northampton, Massachusetts.

Lee R., Mason A., (2010): “Some macroeconomic aspects of global population aging.” *Demography* 47(Suppl): S151–S172.

Liefbroer A.C., Corijn M. (1999): “Who, what, where and when ? Specifying the impact of educational attainment and labour force participation on family formation.” *European Journal of Population*, 15, 45-75.

Lesthaeghe, R. (1978): *“The decline of Belgian fertility.1800-1970*.” Princeton Legacy Library.

Lesthaeghe, R. (2010): “The unfolding story of the second demographic transition.” *Population and Development Review*, 36(2), 211–251.

Lundberg S. Pollak R. (1996): “Bargaining and distribution in marriage.” *Journal of Economic Perspectives*, 10(4), 139-158.

Matysiak A., Vignoli D. (2008): “Fertility and women’s employment: A meta-analysis.” *European Journal of Population*, 24(4), 363–384.

Matysiak A., Vignoli D. (2013): “Diverse Effects of Women's Employment on Fertility: Insights from Italy and Poland.” *European Journal of Population*, n° 29, pp. 273-302.

McDonald, P. (2000a): “Gender Equity in Theories of Fertility Transition.” *Population and Development Review* 26(3), 427-439.

McDonald, P. (2000b): “Gender Equity, Social Institutions and the Future of Fertility.” *Journal of Population Research*, 17(1), 1-16.

Mincer, J. (1958): “Investment in Human Capital and Personal Income Distribution.” *Journal of Political Economy*, n° 66, pp. 281-302.

Moffitt, R. (1984): “Profiles of Fertility, Labour Supply and Wages of Married Women: A Complete Life-Cycle Model." *Review of Economic Studies*, Oxford University Press, vol. 51(2), pages 263-278.

Myrskylä M., Goldstein J. (2013): “Probabilistic Forecasting Using Stochastic Diffusion Models, with Applications to Cohort Processes of Marriage and Fertility,” *Demography*, 2013, 50(1): 237-260.

Myrskylä M., Goldstein J., Cheng Y. (2012): “New Cohort Fertility Forecasts for the Developed World: Rises, Falls, and Reversals,” *Population and Development Review*, 2013, 39(1):31-56.

Myrskylä M., Kohler H.P., Billari F. (2009): “Advances in Development Reverse Fertility Declines. “ *Nature*, vol. 460, n° 6, pp. 741-743.

Neyer G., Lappegard G., Vignoli D. (2013): “Gender Equality and Fertility: Which Equality Matters ?” *European Journal of Population*, n° 29, pp. 245-272.

Pailhe A., Solaz A. (2012): "The influence of employment uncertainty on childbearing in France: A tempo or quantum effect?" *Demographic Research*, Vol 26, Article 1, p 1-40.

Ponthieux S., Meurs D. (2004) : « Ecarts de salaires entre les femmes et les hommes en Europe. » *Revue de l'OFCE***,** n°90, juillet, pp 153-192.

Regnier-Loilier A., Debrest Ch. (2016) : *« Décrypter la « non-réalisation » des intentions de fécondité. L'apport d'une approche croisée quantitative et qualitative. »* Travail en cours, Ined.

Rendall M., DeRose A., Evans A., Gray E., Hanappi D., Kreuter F., Lappegard T., Reeder L, Ronsen M., Toulemon L. (2014): "*Employment Impacts on Partnership and Parenthood Entry in Different Family-Policy Regimes."* European Population Conference.

Schmertmann C., Zagheni E., Goldstein J., Myrskylä M. (2014): "Bayesian Forecasting of Cohort Fertility," *Journal of the American Statistical Association*, 2014, 109(506).

Schmitt, C. (2012): "Labour Market Integration, Occupational Uncertainties and Fertility Choices in Germany and the UK." *Demographic Research*, vol. 26, art. 12, pp. 253-292.

Sobotka T, Beaujouan E. (2014): "Two Is Best? The Persistence of a Two-Child Family Ideal in Europe." *Population and Development Review*, vol. 40, n° 3, pp. 391-419.

Sofer C., Thibout C., (2015) : « La division du travail selon le genre est-elle efficiente ? Une analyse à partir de deux enquêtes Emploi du temps**. »** *Économie et statistiques*, 2015, n° 478-479-480, pp. 273-304.

Testa, M.R. (2012): "*Family Sizes in Europe: Evidence from the 2011 Eurobarometer Survey."* European Demographic Research Papers, n° 2, Vienna Institute of Demography of the Austrian Academy of Sciences.

Testa, M. R. (2014): "On the Positive Correlation between Education and Fertility Intentions in Europe: Individual-and Country-Level Evidence." *Advances in life course research*, 21: 28-42.

Thévenon, O. (2015): "Do 'Institutional Complementarities' Foster Female Labour Force Participation? " *Journal of Institutional Economics*, Vol. 12, Issue 2, pp. 471-497.

Toulemon, L. (2004) : « La fécondité des immigrées : nouvelles données, nouvelle approche. » *Population et Sociétés* n° 400.

van de Kaa, D. (1987) : "*Europe's Second Demographic Transition."* Numéro 1 Volume 42, Numéro 1 de Population bulletin, Population Reference Bureau.

Willis, R. (1973): "A new approach to the economic theory of fertility behaviour." *Journal of Political Economy*, 81, S14–S64.

Wood J., Vergauwen J., Neels K. (2015): "*Economic Conditions and Variation in First Birth Hazards in 22 European Countries between 1970 and 2005*." dans: "Population change in Europe, the Middle-East and North-Africa : beyond the demographic divide." Matthijs, Koenraad (edit.), p. 45-80, Universiteit Antwerpen Bibliotheek.

Zuanna G.D., Micheli G.A. (ed.) (2004): "*Strong family and low fertility: a paradox? New perspectives in interpreting contemporary family and reproductive behaviour."* Studies of population , Springer Netherlands.

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THEMES DE RECHERCHE

Economie démographique, fécondité, emploi des femmes, politiques familiales, économétrie des données de panel

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Depuis 2011 — **Maîtresse de Conférences en Economie - Université Paris 1 Panthéon Sorbonne**
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2009-2011 — **Post-doc - Ined (Institut National d'Etudes Démographiques), Paris**
Projet de recherche "reproductive decision-making in a macro-micro perspective" pour la Commission Européenne (Seventh Framework Programme under the Socio-economic Sciences and Humanities theme; Grant Agreement: SSH-CT-2008-217173)

2008-2009 — **Chargée de recherche - Ined (Institut National d'Etudes Démographiques), Paris**
Projet de recherche "The costs of raising children and the effectiveness of policies to support parenthood in European countries" pour la Commission Européenne

2006-2008 — **Chargée de recherche – Ires (Institut des Recherches Economiques et Sociales), Paris**
Projet de recherche "Politiques Familiales en Europe" pour la CNAF

2006 — **Chargée de recherche – IMK (Macroeconomic Policy Research Institute), Düsseldorf**
Projet de recherche "Comparative analysis of the role of labour market protections, wage subsidies and minimum wages for employment opportunities in Europe"

FONCTIONS DE CONSULTANTE SCIENTIFIQUE

2013-2016 — **BANQUE MONDIALE (Human Development Economics Department)**
Projets de recherche "Women's economic empowerment and fertility": le vieillissement démographique en Europe en Asie Centrale ; la fécondité et la violence domestique en Turquie.

2015 — **OCDE (Social Policy Division), Paris**
Projet de recherche "Sharing patterns among couples – a comparative analysis based on the European Survey of Income and Living Conditions".

2007-2011 — **OECD (Development Centre), Paris**
Projets de recherche "Employment inequalities between men and women in developing countries" et "Is informal normal –women's labour market activities in developing countries".

FORMATION

2006-2009 — ***Doctorat en Economie***
Cotutelle franco-allemande : Université de Pau et des Pays de l'Adour (Prof. Jacques Le Cacheux) et Universität Augsburg (Prof. Anita Pfaff)
Sujet de thèse: "Women's labour market participation interacting with macroeconomic growth and family policies": Magna cum laude (0,6)

2001-2006 — ***Master en Economie***
Universität München LMU (Germany) et Université Toulouse UT1 (France)
Sujet de mémoire: "The impact of female education, employment and income on macroeconomic growth": Prix pour la meilleure mémoire de la promotion

PUBLICATIONS

ARTICLES DANS DES REVUES A COMITE DE LECTURE

A. Greulich, O. Thévenon, M. Guergoat-Larivière (2017): "Employment and second childbirths in Europe." *Population,* à paraître. (CNRS cat.2, HCERES cat. A)

H. D'Albis, P. Gobbi, A. Greulich (2017): "Having a Second Child and Access to Childcare: Evidence from European Countries." *Journal of Demographic Economics*, à paraître. (revue pas encore classée car fondée en 2015 ; ancien *Louvain Economic Review,* CNRS cat. 3)

A. Greulich, A. Dasré (2017): "Quality of Periodic Fertility Measures in EU-SILC." *Demographic Research*, Vol. 36, Art. 17, pages 525-556 (classée AERES section 19)

H. D'Albis, A. Greulich, G. Ponthière (2017): "Education, Labour, and the Demographic Consequences of Births Postponement in Europe." *Demographic Research,* Vol. 36, Art. 23, pages 691-728. (classée AERES section 19)

M. Rendall, A. Greulich (2016): "Multiple imputation for demographic hazard models with left-censored predictor variables. Application to employment duration and fertility in the EU-SILC." *Demographic Research*, Vol. 35, Art. 38, pages 1135-1148. (classée AERES section 19)

A. Greulich, A. Dasré, C. Inan (2016): "Two or Three Children? Turkish Fertility at a Crossroads" *Population and Development Review*, 42(3): 537-559, September 2016. (CNRS cat. 2, HCERES cat. A)

A. Greulich (2016): « Rebond de la fécondité » dans les pays développés, automatisme ou apanage de quelques rares privilégiés ? » *Revue d'Economie Financière* n° 122, pages 57-68. (cnrs cat. 4, HCERES cat. C)

A. Luci-Greulich, O. Thévenon (2014): "Does economic development 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960-2007)", *European Journal of Population,* Vol. 30, pp.187-221. (CNRS cat. 3, HCERES cat. B)

A.Luci-Greulich, O. Thévenon (2013): "The impact of family policy packages on fertility trends in developed countries." *European Journal of Populatio*n, Vol. 29 N° 4, pp.387-416. (CNRS cat. 3, HCERES cat. B).

O. Thévenon, A. Luci (Greulich) (2012): "Reconciling work, family and child outcomes: What implications for family support policies?" *Population Research and Policy Review*, (2012) 31: 855. *(*CNRS cat. 4, HCERES cat. C).

A. Luci (Greulich), J. Jütting, C. Morrisson (2012): "Why do so many women end up in bad jobs? A cross-country assessment for developing countries." *The European Journal of Development Research* Vol 24, N° 4. (CNRS cat. 4, HCERES cat. C)

A. Luci (Greulich) (2010): „Finanzielle Familienunterstützung und deren Auswirkung auf die Arbeitsmarktbeteiligung von Müttern in Deutschland und Frankreich. Hat Frankreich die Nase vorn?" (The impact of financial support for families on mothers' labour supply) *Journal of Social Policy Research* (*Zeitschrift für Sozialreform)* 56 (2010), 1, S. 3-28.

A. Luci (Greulich) (2009): "Female labour market participation and economic growth." *International Journal of Innovation and Sustainable Development,* Vol. 4, nos 2/3.

OUVRAGES ET CHAPITRES D'OUVRAGE

H. d'Albis, A. Greulich, G. Ponthière (2017) : *« Avoir un enfant plus tard: un risque démographique ? »* Chapitre 7 dans « Quatrième volume d'Economiques aux éditions Albin-Michel ».

A. Greulich (2016) : *"The impact of family policies on fertility trends",* Chapitre 13 dans "As problematicas de natalidade em Portugal", edité par V. Cunha, D. Vilar, K. Wall, J. Lavinha et P. Trigo Pereira, Imprensa de Ciencias Sociais, Lisboa.

H. d'Albis, A. Greulich, G. Ponthière (2015) : *"Avoir un enfant plus tard. Enjeux sociodémographiques du report des naissances."* Opuscule du CEPREMAP N°39.

A. Greulich-Luci (2012): *"Gender and macroeconomics: How growth is linked to female labour market participation and family policies."*, LAP LAMBERT Academic Publishing, 256 pages (ISBN-10: 3659134546).

ARTICLES PUBLIES DANS D'AUTRES REVUES

H. d'Albis, A. Greulich (2013) : « Pour une politique familiale efficace », *Problèmes Economiques, Dossier Journées de l'Economie de Lyon 2013 (JECO)*, pp. 53-59.

A. Luci (Greulich) (2012): « Pourquoi est-il vraiment nécessaire de remettre en cause la fiscalité familiale? » *Revue Forum* 3/2012.

A. Luci (Greulich), O. Thévenon (2011): "Does economic development explain the fertility rebound in OECD countries?" *Population & Sociétés,* 09/2011. (ISSN 0184 77 83)

A. Greulich (2008): « Les politiques familiales en France et en Allemagne. Quelles différences ? Quelles pistes de réforme ? », *Horizons Stratégiques* n° 7/2008, CAS du Premier Ministre, France. (ISSN 1958-3370)

RAPPORTS DE RECHERCHE

A.Greulich, A . Dasré, C. Inan (2016): *"Combating domestic violence against women in Turkey. The role of women's economic empowerment."* Rapport de recherche pour la Banque Mondiale.

A. Greulich (2015): *"Sharing patterns among partners – a comparative analysis for European countries."* Rapport de recherche pour l'OCDE.

A.Greulich, A . Dasré, C. Inan (2014): *"Fertility in Turkey, Bulgaria and Romania – how to deal with a potential low-fertility-trap?"* Rapport de recherche pour la Banque Mondiale.

A. Greulich, O. Thévenon, M. Guergoat-Larivière (2014): *"Starting or enlarging families? The determinants of low fertility in Euro*pe" Rapport de recherche pour la Banque Mondiale.

H. d'Albis, C. Bonnet, N. El Mekkaoui, A. Greulich, J. Navaux, J. Pelletan, A. Solaz, E. Stancanelli, H. Toubon, F.-C. Wolff, H. Xuan (2013) : *«Etude portant sur la répartition des prélèvements et des transferts entre les générations en France. »* Rapport de recherche pour le Commissariat général à la stratégie et à la prospective.

D.Brochard, MT. Létablier, MN Auberger, A. Greulich (2013): *« Les dispositifs d'entreprises en direction des familles»* Rapport de recherche pour la CFDT.

A. Luci (Greulich) (2011): "*Frauen auf dem Arbeitsmarkt in Deutschland und Frankreich - Warum es Französinnen besser gelingt, Familie und Beruf zu vereinbaren."* (Reconciliation possibilities in France and Germany) Rapport de recherche pour la Fondation Friedrich Ebert.

O. Thévenon, A. Luci (Greulich), M.T. Létablier, A. Math (2009): "*The costs of raising children and the effectiveness of supporting parenthood policies in European countries: A Literature Review*." Rapport de recherche pour la Commission Européenne.

J. Fagnani, A. Math, C. Meilland, A. Luci (Greulich) (2008) : « *La comparaison des politiques familiales dans 12 pays européens. L'exploitation d'une base de données de ménage ou cas-types.* », Rapport de recherche pour la CNAF.

CONTRIBUTIONS A DES OUVRAGES COLLECTIFS

"Dare to share. Promoting equal partnership in paid and unpaid work" OCDE Directorate for Employment, Labour and Social Affairs (2016).

"The Drivers of Aging in Europe and Central Asia" dans "Golden Aging : Prospects for Healthy, Active, and Prosperous Aging in Europe and Central Asia." Washington, DC: World Bank. World Bank (2015).

"What's Next for Old Europe? Aging with Growth in Central Europe and the Baltics" Washington, DC: World Bank. World Bank (2015)

"Women in informal employment. What do we know and what can we do?," in "Is Informal Normal? Towards More and Better Jobs in Developing Countries." OCDE Development Centre Publication (2009) (ISBN 978-92-64-05923-8)

„Kombilöhne – Zwischen Illusion und Wirklichkeit" (Wage subsidies – illusion or reality) IMK Report Nr. 8 (2006).

COMPTE RENDU CRITIQUE

Angela Greulich (2017): "Jonas Wood: Essays on socio-economic differentiation in European fertility. The Impact of Economic Context and Social Policy. University Press Antwerp, 2016". *Population* (à paraître).

DOCUMENTS DE TRAVAIL EN LIGNE

"Development, Fertility and Childbearing Age: A Unified Growth Theory" avec Hippolyte d'Albis et Grégory Ponthière; Paris School of Economics working paper 2017-06 (soumis à Journal of Economic Growth).

"Multiple imputation for demographic hazard models with left-censored predictor variables" avec Michael Rendall; Maryland Population Research Center MPRC working paper PWP-MPRC-2014-011 (publié dans *Demographic Research*).

"Having a Second Child and Access to Childcare: Evidence from European Countries" avec Paula Gobbi et Hippolyte d'Albis; Centre d'Economie de la Sorbonne Working paper 2016-17 (publié dans *Journal of Demographic Economics*).

"Fertility transition in Turkey– who is most at risk of deciding against child arrival? avec Aurélien Dasré et Ceren Inan; World Bank Policy Research Working Paper WPS7310 (publié dans *Population and Development Review*).

"Securing women's employment: a fertility booster in European countries?" avec Mathilde Guergoat-Larivière et Olivier Thévenon; Centre d'Economie de la Sorbonne Working paper 2016-24 (publié dans *Population*).

"Measuring fertility with the European Survey of Income and Living Conditions – A quantification of biases" avec Aurélien Dasre; Centre d'Economie de la Sorbonne Working paper 2017-02 (publié dans *Demographic Research*).

TRAVAUX EN COURS

"Development, Fertility and Childbearing Age: A Unified Growth Theory." avec H. d'Albis et G. Ponthière (soumis à Journal of Economic Growth)

"Observing the number of children with EU-SILC – a quantification of biases." avec A. Dasré (soumis à Population)

"Who pays for the consumption of young and old – measuring intergenerational equity in France with the National Transfer Accounts." Avec J. Navaux, C. Bonnet, H. d'Albis (soumis à Review of Income and Wealth)

"Sharing patterns among partners – a comparative analysis for European countries." (soumis à Review on Income and Wealth)

"Combatting domestic violence in Turkey. The role of women's economic empowerment." avec A. Dasré et C. Inan (soumis à Demography)

"The importance of employment stability for fertility – a multiple-imputation approach with European survey data" avec M. Rendall

"The later, the more? Une analyse comparative du lien entre calendrier et intensité de la fécondité" avec L. Toulemon et J. Goldstein.

COLLOQUES INTERNATIONAUX (avec comité de sélection)

04/2017 **Population Association of America (PAA), Chicago (Etats-Unis)**
"Combating domestic violence in Turkey. The role of women's economic empowerment."

01/2017 **The Alpine Population Conference, La Thuile (Italie) (Organisation: Université Bocconi)**
"Education, Labour, and the Demographic Consequences of Births Postponement in Europe"

08/2016 **European Population Conference (EAPS), Mayence (Allemagne)**
"Life course and female employment"

05/2016 **AIDELF, Strasbourg (France)**
"Quantifier les biais de mesure de fécondité dans EU-SILC"

03/2016 **Population Association of America (PAA), Washington (Etats-Unis)**
"Having a Second Child and Access to Childcare: Evidence from European Countries"

07/2015 **International Association for Feminist Economics (IAFFE), Berlin (Allemagne)**
"Fertility transition in Turkey"

04/2015 **Population Association of America (PAA), San Diego (Etats-Unis)**

	"Multiple imputation for demographic hazard models with left-censored predictor variables"
01/2015	**The Alpine Population Conference, La Thuile (Italie) (Organisation: Université Bocconi)** "Determinants of the transition to a second child in Europe"
06/2014	**European Population Conference (EAPS), Budapest (Hongrie)** "Socioeconomic differentials in the transition to have a second child in Europe"
04/2014	**Population Association of America (PAA), Boston (Etats-Unis)** "Starting or enlarging families? The determinants of low fertility in Europe"
08/2013	**IUSSP International Population Conference, Busan (Corée du Sud)** "Fertility and Family Policies in Europe"
05/2013	**Shanghai Forum, Shanghai (Chine)** Economic and Political Challenges in View of Demographic Changes in Developed Countries
04/2013	**Population Association of America (PAA), Nouvelle Orléans (Etats-Unis)** "The impact of income on fertility – breaking up stylized facts"
06/2012	**International Association for Feminist Economics (IAFFE), Barcelone (Espagne)** "Does fertility respond to family policies? A macro-micro analysis for OECD countries"
05/2012	**IUSSP- International Seminar on Patterns of Economic Development, Social Change, and Fertility Decline in Comparative Perspective: Analysis and Policy Implications, Shanghai (Chine)** "The impact of income on fertility – breaking up stylized facts"
04/2011	**Population Association of America (PAA), Washington (Etats-Unis)** "Do fertility trends respond to family policies in OECD countries?"
01/2011	**The Alpine Population Conference, La Thuile (Italie) (Organisation: Université Bocconi)** "The impact of family policy packages on fertility trends"
09/2010	**European Population Conference (EAPS), Vienne (Autriche)** "Evaluating the significance of family policies for women's fertility decisions and labour market outcomes in OECD countries on the basis of a holistic approach. Compatibility matters."
06/2010	**European Society for Population Economics (ESPE), Essen (Allemagne)** "The impact of economic development and female employment on fertility. What explains the rebound?"
04/2010	**Population Association of America (PAA), Dallas (Etats-Unis)** "Does economic development drive the fertility rebound in OECD countries?"
06/2009	**International Association for Feminist Economics (IAFFE), Boston (Etats-Unis)** "Female labour market participation and economic growth. Various Interactions."
06/2009	**European Society for Population Economics (ESPE), Seville (Espagne)** "The impact of macroeconomic growth on women's labour market participation: Does panel data confirm the "feminisation U" hypothesis?"

SEMINAIRES DE RECHERCHE SUR INVITATION

06/2017	**Third annual workshop in formal demography, UC Berkeley, Population Center (Etats-Unis) :** "A differentiated analysis of the link between tempo and quantum of births"
03/2017	**EUROSTAT 5th European User Conference (Mannheim, Allemagne) :** "Bias in fertility measures in the European Union's Statistics of Income and Living Conditions"
05/2016	**CREA, Université Luxembourg (Faculty of Law, Economics and Finance) :** "Having a Second Child and Access to Childcare: Evidence from European Countries"
01/2015	**Université Lisbonne (Social Science Institute) :** "Impact of Family Policies on Fertility Trends in Developed Countries"
05/2014	**Séminaire Interne de Microéconomie Appliquée (SIMA), Université Paris 1 :** "Starting or enlarging families? The determinants of low fertility in Europe"
03/2014	**Paris Seminar in Demographic Economics (U. Paris 1, INED, U. Dauphine) :** "Socioeconomic differentials in the transition to a second child in Europe"
09/2013	**Séminaire joint de l'Université Paris 1 et l'Université Caire à Paris :** "Economic and Political Challenges in view of Demographic Changes in Developed Countries"
05/2013	**Université Fudan (Shanghai, Chine) :** "Economic and Political Challenges in view of Demographic Changes in Developed Countries"
07/2012	**Séminaire joint de l'Université Paris 1, Ferdi et l'Université Fudan Shanghai à Paris :**

	"Determinants of the fertility rebound in certain highly developed countries"
04/2012	**Institut Allemand, Université Paris 3 - France :** „Emploi des femmes et fécondité – une comparaison entre la France et l'Allemagne"
11/2011	**OFCE et Sciences Po Paris - France :** « Interactions entre fécondité et croissance économique »
10/2011	**Université Paris 1 (CES) :** "The impact of family policy packages on fertility trends in developed countries."
03/2011	**Séminaire joint de l' IZA, de Sciences Po Paris et de l'OFCE, Paris :** "Explaining labour market and Welfare State dualization in France and Germany"
03/2010	**Université Paris 1 (CES) :** "Does economic development drive the fertility rebound in OECD countries?
03/2009	**INED – Institut national d'études démographiques, Paris** « L'Impact des Politiques de Soutien aux Parents »
2008	**Ecole d'Economie de Paris, UPPA, OFCE Sciences Po Paris, Université Paris 1 (CES) :** "Women's labour market participation interacting with macroeconomic growth and family policies"

INTERVENTIONS MEDIATIQUES ET AUDITIONS

03/2017	**Slate.fr** : 100 idées pour la présidentielle : « plaidoyer pour reformer le congé parental » (tribune)
12/2016	**Sankei Shimbn** (journal hebdomadaire japonais) et **japan-forward.com** : Lessons from Europe? What Japan Can Learn from European Family Policies. (interview dans un article)
06/2016	**Spiegel** (journal hebdomadaire allemand) : Work-life balance – advantages and pitfalls in France (interview publié dans un article)
12/2015	**France Stratégie :** « France-Allemagne : regards croisés sur l'intégration » (audition)
09/2015	**Sciences & Vie :** « L'évolution de la fécondité en Europe » (interview publié dans un article)
06/2015	**OECD Social Policy Division, German Family Ministry :** "Sharing patterns of couples in Europe" (audition)
03/2015	**Commission Européenne (DG Employment) et Banque Mondiale :** "Aging with Growth in Europe and Central Asia"(audition)
11/2014	**Secrétariat d'État parlementaire allemande :** ""Female Employment and Fertility – what can Germany learn from the French social and labor market policy" (audition)
10/2014	**Association des femmes entrepreneurs allemandes à Paris :** "Female Employment and Fertility – France and Germany compared" (audition)
05/2014	**Association japonaise de services de garde :** "Female employment and fertility: institutional background in Japan, France and Germany" (audition)
12/2013	**Fondation Friedrich Ebert :** „Gender and family policies – the various positions of political parties in Europe." (audition)
11/2013	**TEVA :** « Maternité et carrière » (interview dans une émission de télévision)
06/2013	**Ministère des Affaires Etrangères, Paris - Délégation Japonaise :** "Family Policies and Fertility: What can Japan learn from France?" (audition)
06/2013	**Deutsche Welle** (station de radio allemande): " Family policies in France" (interview à la radio)
06/2013	**Banque Mondiale et Ministères d'Affaires Sociales à Moscou et Varsovie :** "Economic and Political Challenges in view of Demographic Changes in Developed Countries" (audition)
05/2013	**Ministère français des droits de la femme, Paris :** « Interactions entre emploi des femmes et croissance » (audition)
04/2013	**Fondation Friedrich Ebert**, **Athènes – Grèce :** "Gender aspects of the European economic crisis" (audition)
10/2012	**Ambassade de l'Allemagne à Paris :** „Family and gender policies in France" (audition)
06/2012	**Radio France Internationale :** « La maternité en Allemagne – pourquoi les Allemandes font-elles si peu d'enfants ? » (interview à la radio)
06/2012	**INED – Délégation chinoise :** "Family Policies in France – Overview and Challenges" (audition)
03/2012	**Friedrich Ebert Foundation Berlin – Allemagne** : „Flexibiliser les heures de travail pour mieux concilier vie professionnelle et vie familiale ?" (audition)
02/2012	**Radio France Culture**: « Le modèle économique allemand – peut il servir comme modèle pour la France ? » (audition)

12/2011	**Figaro, La Dépêche : «** France-Allemagne : ce qui nous sépare, ce qui nous rapproche. » (interview)
09/2011	**Le Monde, Nouvel Obs., Echos, La Recherche :** « Le travail des femmes favorise la remontée de la fécondité » (article)
06/2011	**Sénat Paris:** « Le couple franco-allemand : Réconcilier travail et vie familiale – comparaison France/Allemagne » (audition)
06/2011	**Fondation Friedrich Ebert Berlin – Allemagne** : « L'emploi des femmes en France et en Allemagne » (audition)
04/2011	**Conseil économique social et environnemental:** « L'intégration des femmes dans le monde du travail: Quelles politiques de conciliation vie professionnelle et vie familiale? » (audition)

ENSEIGNEMENT

Université Paris 1 Panthéon - Sorbonne - Département de l'Economie :

Depuis 2017	Economie du Genre (M1, CM avec 9 HETD) (+ encadrement des mémoires)
Depuis 2012	Histoire économique (L3, CM avec 36 HETD)
Depuis 2011	Introduction générale à l'économie (L1, CM avec 63 HETD, TD avec 18 HETD)
2012 - 2013	Population Economics (M1, CM avec 36 HETD) (+ encadrement des mémoires)
2009	Economie et Politique Européenne (L2, TD avec 18 HETD)

Sciences Po (IEP) Paris :

Depuis 2010	Panel Data Econometrics in Population Economics (L2, CM avec 36 HETD)
2010 - 2012	Population Dynamics - Measurement, Theories and Facts (L2, CM avec 36 HETD)) (+ encadrement des mémoires)

Université Paris X Nanterre :

2009	Micro-économie (L2, TD avec 18 HETD)
Cours supplémentaires :	Journées PLEASE (2014), Atelier pédagogique pour doctorants à Paris 1 (2015, 2016), Ecole Nationale des Ponts et Chaussées (2015)

RAPPORTS DE LECTURE

World Development, Vienna Yearbook of Population Research, Comparative Population Studies, Population et Societés, Economie et Statistique, European Journal of Population, Population, Demography, Journal of Family Issues, Population Studies, Demographic Research, European Journal of Sociology

RESPONSABILITES COLLECTIVES

Coordination et financement des projets de recherche :	*Investigatrice principale* de l'équipe française du projet transnational « More Years, Better Lives » (Joint Programming Initiative, funded by Horizon2020, the EU Framework Programme for Research and Innovation ; Grant Agreement number 643850) et *responsable du budget* (200 000€ pour 2017-2020).
Responsabilités représentatives:	Correspondante du laboratoire CES au GIS Institut du Genre
Organisation des séminaires :	Ecole d'été en démographie à l'Université Strasbourg (prévu pour 2018), 'Gender economics' à l'Université Paris 1 (juin 2014), 'Household economics' à l'Ined (mai 2011)
Commissions de recrutement :	Doctorants de l'Ined –iPOPs (2016) Professeur agrégé PRAG Université Paris 1 (2014)
Responsabilités pédagogiques :	Membre du jury : pré-soutenance des doctorants, soutenance des mémoires M1 Encadrement des mémoires (L2 Sciences Po, M1 Paris 1) Enseignant référent pour les étudiants en L1 à l'Université Paris 1
Evaluation des projets de recherche :	Poland National Science Centre, 2014

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10 mars 2017

Je soutiens fortement la candidature d'Angela Greulich à une Habilitation à Diriger des Recherche, et m'en porte garant. Son travail passé et ses projets scientifiques sont de très grande qualité. Ses collaborations témoignent d'une très bonne insertion dans son milieu de recherche.

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LISTE DES TRAVAUX ET PUBLICATIONS LES PLUS REPRESENTATIFS QUI SONT REFERENCES DANS CE RAPPORT DE SYNTHESE

Section 1.1.:

A. Luci-Greulich, O. Thévenon (2014): "Does economic development 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960-2007)", *European Journal of Population,* Vol. 30, pp.187-221. (CNRS cat. 3)

A. Luci-Greulich, O. Thévenon (2013): "The impact of family policy packages on fertility trends in developed countries." *European Journal of Populatio*n, Vol. 29 N° 4, pp.387-416. (CNRS cat. 3).

O. Thévenon, A. Luci (Greulich) (2012): "Reconciling work, family and child outcomes: What implications for family support policies?" *Population Research and Policy Review*, (2012) 31: 855. *(*CNRS cat. 4).

A. Greulich (2016): « Rebond de la fécondité » dans les pays développés, automatisme ou apanage de quelques rares privilégiés ? » *Revue d'Economie Financière* n° 122, pages 57-68. (CNRS cat. 4)

Section 1.2.

H. D'Albis, P. Gobbi, A. Greulich (2017): "Having a Second Child and Access to Childcare: Evidence from European Countries." *Journal of Demographic Economics*, à paraître (revue pas encore classée car fondée en 2015 ; ancien *Louvain Economic Review*, CNRS cat. 3)

A. Greulich, O. Thévenon, M. Guergoat-Larivière (2017): "Employment and second childbirths in Europe." *Population,* à paraître (CNRS cat.2)

H. D'Albis, A. Greulich, G. Ponthière (2017): "Education, Labour, and the Demographic Consequences of Births Postponement in Europe." *Demographic Research,* Vol. 36, Art. 23, pages 691-728 (revue classée en section 19).

A. Greulich, A. Dasré, C. Inan (2016): "Two or Three Children? Turkish Fertility at a Crossroads" *Population and Development Review*, 42(3): 537-559. (CNRS cat. 2)

A. Greulich, A. Dasré (2017): "Quality of Periodic Fertility Measures in EU-SILC." *Demographic Research*, Vol. 36, Art. 17, pages 525-556 (revue classée en section 19).

M. Rendall, A. Greulich (2016): "Multiple imputation for demographic hazard models with left-censored predictor variables. Application to employment duration and fertility in the EU-SILC." *Demographic Research,* Vol. 35, Art. 38, pages 1135-1148 (revue classée en section 19).

A. Luci-Greulich, O. Thévenon (2014): “Does economic development ‘cause’ a re-increase in fertility? An empirical analysis for OECD countries (1960-2007)”, *European Journal of Population,* Vol. 30, pp.187-221. (cnrs cat. 3)

Eur J Population
DOI 10.1007/s10680-013-9309-2

Does Economic Advancement 'Cause' a Re-increase in Fertility? An Empirical Analysis for OECD Countries (1960–2007)

Angela Luci-Greulich · Olivier Thévenon

Received: 28 December 2011 / Accepted: 19 December 2013

Abstract In the light of the recent reversal of fertility trends in several highly developed countries, we investigate the impact of economic development and its components on fertility in OECD countries from 1960 to 2007. We find that the strong negative correlation between GDP per capita does no longer hold for high levels of per capita economic output; the relation and fertility instead seems to turn into positive from a certain threshold level of economic development on. Survival of an inverse J-shaped association between GDP per capita and fertility is found when controlling for birth postponement, omitted variable bias, non-stationarity and endogeneity. However, gaps between actual and predicted fertility rates show implicitly the importance of factors influencing fertility above and over per capita income. By decomposing GDP per capita into several components, we identify female employment as co-varying factor for the fertility rebound that can be observed in several highly developed countries. Pointing out to important differences with regard to the compatibility between childbearing and female employment, our results suggest that fertility increases are likely to be small if economic development is not accompanied by institutional changes that improve parents' opportunities to combine work and family life.

Keywords Fertility · Economic development · Female employment

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1 Introduction

Over the last decades, in many OECD countries fertility rates dropped drastically while at the same time average income levels continued to increase. However, in a limited number of highly developed countries, fertility rates have been somewhat re-increasing since the early 2000s, simultaneously with continuing economic development.

The reversal of the fertility trend along the process of economic development in many, but not all highly developed countries suggests that the impact of economic development on fertility is ambiguous. Knowing whether further economic advancement is likely to sustain a 'rebound' of fertility in highly developed countries is of major political, social and economic interest. As fertility affects population growth and the age structure of the population, changes in fertility in the immediate future have far-reaching consequences on economic development, productivity growth and aspects of welfare systems.

Most recently, Myrskylä et al. (2009) found a so-called 'inverse J-shaped' relation between the human development index (HDI) and total fertility rates (TFR) for over 100 countries, suggesting an increase in fertility rates from a certain level of human development on. However, the use of a composite measurement of human development masks the particular contributions of each of the indicator's components (GDP per capita, life expectancy and school enrolment) and thus does not reveal *why* in some, especially highly developed countries, a rise in fertility comes along with increases in human development.

We want to find out more about how the reversal of fertility trends is related to economic advancement in highly developed countries. Therefore, we first empirically estimate the impact of GDP per capita on fertility, using data for 30 OECD countries that spans the years 1960–2007. In order to identify the driving factors behind the re-increase in aggregated fertility rates observed in several highly developed countries, we decompose GDP per capita in a second step and estimate the impact of labour productivity, working hours and employment on fertility while taking into account the gender composition of each of these possible determinants.

Our empirical analysis confirms a change in the relationship between GDP per capita and fertility, implying that an increase in GDP per capita 'causes' a sharp decrease in fertility rates at lower levels of per capita GDP, while this association disappears at high levels of economic output. Our results even suggest a slight positive association between fertility and GDP per capita levels, in line with the inverse J-shaped relation suggested by earlier studies. Nevertheless, this 'regime switch' happens for the few most economically advanced countries only once they achieve relatively high levels of GDP per capita. Moreover, actual fertility is often at much higher (resp. lower) levels than the value predicted by GDP per capita, which suggest that other institutional factors matter besides economic development.

We further investigate this issue by decomposing GDP per capita in labour productivity, working hours and employment components in the regression analysis. We find that fertility rates are positively correlated with increases in female employment rates, which suggests that increases in fertility are likely to be observed in those highly developed countries where economic development goes hand in hand with increasing opportunities for women to combine work with family life. This finding explains why countries with similarly high levels GDP per capita can nevertheless have very different fertility rates, as the association between GDP and fertility seems to depend on the institutional setup helping parents (and especially women) to combine childbearing and work. Thus, increases in GDP per capita may not be sufficient to lift fertility to a significant higher level if not accompanied by changes in institutions which facilitate this combination.

Our article is organised as follows. Section 2 presents an overview of the existing theoretical literature on the impact of economic development and fertility, while Sect. 3 discusses hitherto existing empirical findings. Section 4 presents our data, Sect. 5 the empirical strategy and Sect. 6 the estimation results. Section 7 concludes by summarising the main findings and identifying directions for future research.

2 The Impact of Economic Development on Fertility in Theory

The impact of economic development on fertility is found to be rather ambiguous not only on the empirical side but also in theory. An increase in income per capita can either bring an increase in the demand for children because the explicit costs are more easily borne (‘income effect’) or a decrease in the demand for children.

To explain the negative impact of income on fertility, the main arguments are provided by the so-called ‘new home economic theory’. Becker (1960, 1981) interprets fertility reduction as a rational behaviour of households by explaining that the impact of an increase in income on fertility is subject to a *quality–quantity* trade-off. A household income increase raises not only the indirect but also the direct costs of children, because in modern societies parents place more focus on children’s ‘quality’ to raise the chances of their children, which induces a substitution effect against the number of children in favour of the ‘quality’ per child (education) and the living standards of the household (Becker and Lewis 1973; Willis 1973). Jones et al. (2008) suggest furthermore that advances in ‘education technology’ and the accompanied rise in education costs are other important factors explaining the decrease in fertility that comes along with economic development. Becker et al. (1990) examine formally a negative effect of increasing returns of investments in individual human capital on fertility. Under these assumptions, families find it optimal to have fewer children, and to provide each child with a higher level of human capital. This high level of human capital leads, at the aggregate level, to economic growth, which explains why economic development goes hand in hand fertility decline. This latter might also be heightened by limits in intergenerational altruism which imply that an individual’s future utility of consumption and savings is reduced by the number of descendants. In such circumstances, technological progress is likely to induce both a higher growth rate of consumption and a lower rate of fertility (Barro and Becker 1989; Doepke 2004).

Another argument in favour of a negative impact of economic development on fertility stresses an increase in the ‘opportunity costs’ of having children which is essentially borned by women. These costs are derived from the increase in women’s educational achievement and thus the increase in women’s earnings potentials which come along with economic development from a certain level of development on (Boserup 1970; Goldin 1994; Cagatay and Özler 1995; Galor and Weil 1996; Mammon and Paxson 2000; Luci 2009). Increasing earning potentials incite women to participate in the labour market. In the absence of possibilities to combine work with family life, women are likely to 'substitute' work for children, as staying at home to care for children implies an implicit wage loss for women. This wage loss represents indirect costs of having children. As economic development is likely to increase these indirect costs, economic development is expected to decrease fertility due to a 'substitution effect' between fertility and female employment (Becker 1965; Willis 1973; Hotz et al. 1997). Women postpone childbirth until a period of life when raising children is less damaging to the career opportunities of women and/or reduce their completed number of children (Blossfeld 1995).

However, this decrease in fertility happens only if women (or parents in general) have to choose between work and family life. If parents are given the possibilities to combine both, that is for example by substituting parental care with purchased services, the negative effect of economic development and of female employment on fertility might be weakened (Day 2004).

Martinez and Iza (2004) argue that this negative effect weakens all the more in the case of decreasing *relative* costs of child care services. This decrease in relative costs, which has been initiated by skill biased technological change, has been observed in several highly developed countries over the last two decades. Increasing relative wages for female skilled labour make child care costs more bearable and might therefore lead to a turn from negative to positive in the association between economic development and female employment on the one side and fertility on the other side. The professionalization of the sector of child-minders in some advanced countries is likely to increase the cost of childcare services and therefore alters the relative benefit that households may get from externalising childcare. However, salaries of childcare workers are still significantly lower than the average wage and are combined with childcare subsidies. This makes the use of formal childcare a profitable option for a large fraction of working parents (OECD 2007).

In this context, the connection between economic development, technological and societal change and female employment is crucial for explaining fertility trends. The changing context of institutions and norms regarding childbearing, gender relations and the division of work is also one dimension to be considered in order to understand the impact of economic development on fertility (Lesthaeghe and Surkyn 1988; Jones et al. 2008; Philipov et al. 2009). Thus, the increasing use of contraceptives and changes in the norms concerning childbearing age are parameters that, one the one hand, enable households choose more freely in terms of timing and number of births. On the other hand, changing attitudes toward female employment and the care of young children also facilitate the adaptation of childbearing behaviours (Lesthaeghe 2010; Goldstein et al. 2009). These changes have also been accompanied in many economically advanced countries with the development of policies supporting families with children and working parents who get now more opportunities to combine work and family life than few decades ago (OECD 2007, 2011; Thévenon 2011).

To sum up, the income effect produced by an increase in income per capita is expected to gain in relative importance for fertility after a certain stage of development is attained, when institutions are developed that alleviate direct and indirect costs of having children. These institutions that come along with economic development reflect not only new political or economic but also social dimensions such as modern attitudes and norms toward the family and gender roles, which allow women to combine work, childbearing and child-raising (Philipov et al. 2009).

In addition, parts of the re-increase in fertility may also be explained by an end of the process of birth postponement (Goldstein et al. 2009). Birth postponement does not always reduce parents 'demand' for the total number of children. Consequently, increased education and later transition to employment for women leads to a postponement of childbirth (tempo effect), but does not necessarily affect the total number of children a woman has (quantum effect) (Rindfuss et al. 1980; Lesthaeghe 2001; Bongaarts 2002). Period measures like TFR thus tend to decrease with birth postponement and re-increase once this process has come to an end (Sobotka 2004). Estimations of tempo (and/or parity)-adjusted fertility rates help at limiting the variations of fertility rates due to the changes in the timing of births. They show decrease and recent upswing of fertility rates which are weaker than the trends given by the traditional measure of period fertility (Bongaarts and Sobotka 2012).

3 Previous Empirical Findings on the Impact of Economic Development on Fertility

The existence of divergent relations between economic growth and fertility rates are also assessed empirically. Butz and Ward (1979) observe that fertility rates in the US were pro-cyclical until the 1960s, but started to decline in a period of persistent economic growth from the 1960s until the late 1970s. The study by Butz and Ward (1979) has been challenged, however, for several reasons. While some studies such as Mocan (1990) still provide figures of persistent counter-cyclical fertility patterns, other studies raise objections to the empirical strategy pursued by Butz and Ward (1979) and propose different estimates that do not confirm the negative impact of real wages and income on fertility rates at higher levels of income (McDonald 1983; Krämer and Neusser 1984; Macunovich 1995). Moreover, Butz and Ward's (1979) prediction of continuous fertility decline with further economic advancement only applies to a limited number of countries. In many OECD countries, the negative correlation between fertility and economic advancement has weakened within the last decade and in some highly developed countries, a reversal of fertility trends and a rebound of fertility rates back to replacement levels can be observed simultaneously with continuous economic growth.

Most recently, Myrskylä et al. (2009) argue that a fundamental change occurred during the last quarter of the last century in the relation between fertility and human development. On the basis of both cross-sectional and longitudinal data covering more than 100 countries for the years 1975–2005, Myrskylä et al. (2009) estimate the impact of human development (measured by the United Nations HDI) on TFR. They use a graphical analysis to identify the potential level of HDI that turns the correlation between human development and fertility from negative to positive

(HDI = 0.85–0.9). This critical level is then tested by including it as a parameter in a maximum likelihood function. For the year 1975 Myrskylä et al. (2009) find a strictly negative correlation between HDI and fertility for all countries. Yet, for the year 2005, they find a negative correlation between HDI and TFR only for countries with a HDI level below that minimum. For countries with a HDI level above that minimum, Myrskylä et al. (2009) find that the two variables are positively correlated. This suggests that in highly developed countries like the USA, Norway and Ireland, human development implies a rebound of fertility, whereas at low and medium development levels, human development continues to decrease fertility.

Furuoka (2009) provides a further empirical test of the critical level of HDI that leads to a turn in the correlation. The test for the threshold effect of HDI on fertility constructs asymptotic confidence intervals for the threshold parameter. Like Myrskylä et al. (2009), Furuoka (2009) splits the sample in two regimes in order to test linear correlations. Furuoka (2009) contests the study by Myrskylä et al. (2009) by finding that in countries with a high HDI, higher levels of HDI still tend, albeit weakly, to be associated with lower fertility rates. Moreover, Harttgen and Vollmer (2012) revisit this topic with revised data and find that the reversal in the HDI-TFR relationship is neither robust to UNDP's recent revision in the HDI calculation method nor to the decomposition of HDI into education, standard of living and health sub-indices.

Besides ambiguous findings, both Myrskylä et al. (2009) and Furuoka (2009) assume a linear relation between economic advancement and fertility trends, but allow for a change in slope or even in the sign of the association. However, both studies use a composite measure of human development, containing GDP per capita, life expectancy and school enrolment. The combination of the three components makes it difficult to interpret the estimated coefficients for two reasons. Firstly, due to limited HDI-data availability, in both studies the analysis of the fertility rebound is focused on cross-country variations only. Secondly, it is unclear which of the HDI components initiates the fertility rebound. In addition, as life expectancy and school enrolment are correlated with GDP per capita, interpretation problems arise because of multi-collinearity. Consequently, it is unclear what elements behind human development drive the fertility rebound in highly developed countries.

The most recent empirical studies jointly suggest that the impact of development on fertility turns from negative to positive from a certain development stage on in highly developed countries. What is still unclear is at which level of development one can expect the correlation to turn and which components of development do exactly drive the fertility rebound.

We therefore empirically investigate to what extent fertility variations are connected with trends in GDP per capita and which specific components of GDP are most likely to cause an increase in fertility levels, such as the slight upswing of fertility rates observed recently in the most economically advanced countries.

4 Data Discussion

In order to identify the driving factors of the fertility rebound, we consider it appropriate to focus our analysis on OECD countries only, as the rebound is mainly observable in highly developed countries. A closer look at the separate HDI components for OECD countries shows that for this limited group of countries, the variation is highest for GDP per capita in comparison with life expectancy and school enrolment. We therefore find it appropriate to focus our measure of development on GDP per capita for this particular group of highly developed countries that differ quite weakly in terms of life expectancy and school enrolment. In addition, using GDP per capita as determinant of fertility instead of HDI allows focussing on within-country variations, as observations of GDP per capita are available on a yearly basis.

When estimating the impact GDP per capita on fertility, we use a large macroeconomic panel data set from OECD databases that includes observations from 30 OECD countries[1] over four decades (1960–2007). We use TFR as standard measure for fertility, but also try to distinguish in how far economic development influences the tempo and the quantum effect of fertility. We are aware of the fact that TFR as a period measure only gives an accurate estimation of completed fertility levels if there is no change in the timing of births across cohorts. In the opposite case, such as when there is an increase in the mean age of mothers at childbirth, the number of births in a given period is reduced. Consequently, the postponement of birth to older ages reduces TFR and the end of postponement increases TFR (Bongaarts and Feeney 1998; Bongaarts 2001, 2002; Kohler et al. 2002; Goldstein et al. 2009). As *TFR* is sensitive to changes in the timing of childbirth, we also use tempo-adjusted fertility rates (*adjTFR*), which come from the Human Fertility Database and cover the years 1961–2005, but are only available for a subset of 18 OECD countries.[2] Taking tempo changes into account, tempo-adjusted fertility rates are usually higher than TFR. Tempo-adjusted fertility rates are available as 3-year moving averages. By weighting *TFR* by changes in women's mean age at childbirth, the *tempo-adjusted TFR* focuses on the quantum-component of fertility changes (Bongaarts and Feeney 1998; Sobotka 2004). However, *adjTFR* only corresponds to a pure quantum measure of fertility on the assumption of uniform postponement of all stages, i.e. an absence of cohort effects (Kohler and Philipov 2001). Consequently, *adjTFR* implies only an imperfect control for tempo effects. To intensify the control for birth postponement, we integrate two different measures of women's age at childbirth as control variables.

Finally, we analyse the role of different GDP components (labour productivity, working hours, employment and its gender composition) for re-increases in fertility. This allows answering the question why in certain countries, GDP increases go hand in hand with increases in fertility. For this purpose, we focus on the time period 1995–2007, therefore ending our time window before the on-going economic recession, for which the effects on fertility are not our concern here.

Table 4 in the appendix provides an overview of all data used in this study.

[1] Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, USA.

[2] OECD countries without: Australia, Belgium, Canada, France, Germany, Greece, Korea, Luxembourg, Mexico, New Zealand, Switzerland, Turkey.

4.1 Trends in Total Fertility Rates in OECD Countries

The dominant feature regarding fertility trends is the sharp decline in TFR in OECD countries over the last four decades. Looking back to the early 1970s, the fall appears substantial with an average *TFR* that fell from 3.23 children per woman in 1970 to 1.71 in 2008, e.g. a level well below the 2.1 threshold required to replace the population with no contribution from immigration (Fig. 1 panel 1). In 2008, only a few countries had a fertility rate around or above the so-called replacement rate level (United States, Ireland, New Zealand, Iceland, and Mexico and Turkey).

As a result of fertility decline, 'lowest-low' fertility countries (with *TFR* below or around 1.3 on average since 2000) include Austria, Czech Republic, Germany, Greece, Hungary, Korea, Japan, Poland, Portugal, Slovak Republic, Spain and Switzerland.

Despite this overall decline in fertility, many countries have recently experienced a reversal of trends, with an increase in fertility rates (Fig. 1 panel 2). The 'rebound' has been especially high (above 0.3 children per women, comparing TFR in 2008 with the minimum since 1970) in Denmark, Sweden, Czech Republic, United States, Finland, France, United Kingdom, Belgium, Netherlands, Spain, Norway and New Zealand. The timing and pace of this change varies from country to country. Only a few countries experienced such a reversal in trends in the mid-1990s (Belgium, France, Ireland, Italy, Netherlands, Spain and the US), while a significant increase (by above 0.2 children per woman) has occurred since 2000 in Sweden, Czech Republic, United Kingdom, Greece, Spain, New Zealand and Ireland). Nevertheless, most OECD countries have seen such an increase since 2000, though often very slight, the only exceptions being Germany, Korea, Mexico, Portugal, Switzerland, and Turkey. Fertility rates continue to decline in this latter set of countries, but the pace of decrease slowed down.

4.2 Trends in GDP per Capita in OECD Countries

GDP per capita is measured at purchasing power parity (PPP) in constant 2005 US $. On average in all 30 OECD countries, GDP per capita at PPP increased from $11,915 in 1970 to $28,134 in 2007. Constant-price measures of GDP are considered here in order to filter out the increase in GDP per capita that is due to price inflation without relating to any increase in the consumption basket.

In all countries, the increase is more or less continuous with common breaks around 1975, 1980, 1990 and 2000 due to economic shocks that affected all countries at about the same time. Countries with high GDP levels are Luxembourg, and somewhat closer to the average level Norway, the United States and Sweden, with highest levels in the decade after 2000. The lowest levels of GDP per capita can be observed in Korea, Turkey and Mexico in the 1970s, followed at some distance by Poland in the 1990s and Portugal in the 1970s.

The descriptive analysis suggests that whereas until the late 1980s in all observed countries economic advancement went hand in hand with fertility decline, since the early 1990s the picture is threefold: generally speaking, countries with the lowest

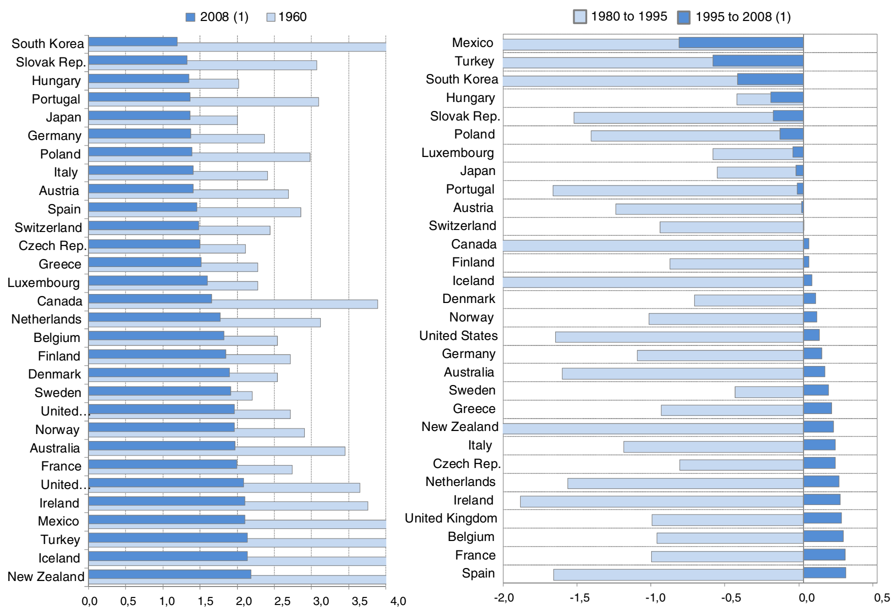

Fig. 1 Fertility trends in OECD countries *Panel 1* TFR in 1960 and 2008 *Panel 2* relative change 1980–1995, 1995–2008 source OECD family database (2010) (1) Year 2007 for Canada, Czech Republic, Estonia and Slovenia

income levels record continuously declining fertility rates. Countries with medium income levels record stagnant fertility levels below replacement levels and countries with the highest income levels record a fertility rebound. This observation supports the hypothesis of a reversal of fertility trends along the process of economic development in OECD countries and suggests a convex impact of economic advancement on fertility.

Figure 2 plots the observations of GDP per capita against those of total fertility and shows an inverse J-shaped pattern between the two variables. This suggests that at low-income levels, economic growth lowers fertility whereas form a certain higher level of income on, income growth increases fertility. In this data plot, countries that risk over-accentuating the inverse J-shaped pattern are dropped. This concerns Luxembourg, which has an outstandingly high level of GDP per capita among OECD countries, especially in the 2000s. This also concerns Korea, Mexico and Turkey, as these emerging countries have outstandingly low levels of GDP per capita and high levels of fertility, especially in the 1960s and 1970s.

5 Empirical Strategy

Our empirical analysis looks at the extent to which fertility levels are a predictable function of per capita GDP. Hereby, we especially test whether a change in the sign

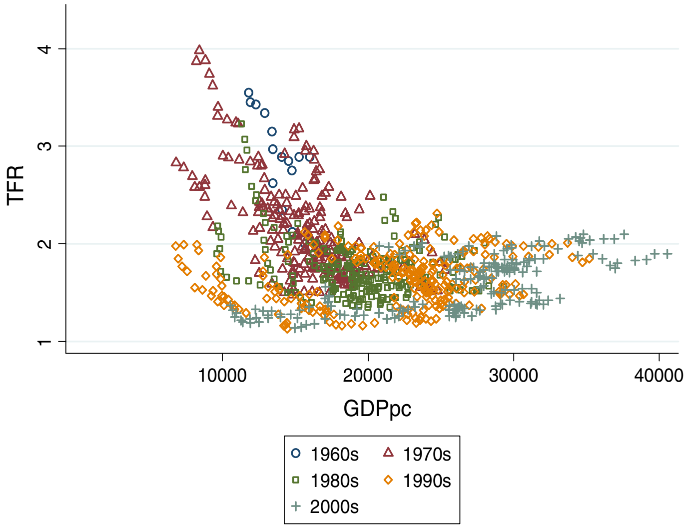

Fig. 2 GDP per capita against TFR for 26 OECD countries, 1960–2007 data source: OECD Family Data Base (2010)

of the association between economic advancement—as measured by levels of GDP per capita—and fertility trends can be identified and be part of the explanation of the slight fertility rebound observed in some of the most highly developed countries. In addition, we analyse the role of different GDP components for re-increases in fertility.

In this perspective, we first test the assumption that, from some level of per capita income upward, TFRs may switch from a decreasing to an increasing function of per capita GDP.[3] Testing this assumption requires to disentangle as much as possible the influence of GDP from those of the other determinants of fertility and GDP that may be linked over time. To do so, the estimation takes into account possible unobserved determinants of fertility by including country-specific time trends in the model. There are limits, however, in the extent to which time trends can accurately account for unobservable changes, for example if GDP per capita follows the same trend, possibly confounding the relation between GDP and fertility. This can occur if countries are exposed to the same processes, albeit not necessarily with the same strength, influencing both GDP per capita and fertility. One may think, for example, of the important development of policies reconciling work and family in OECD countries (Thévenon 2011) or of the evolution of cultural norms concerning childbearing (Lesthaeghe 2010). Such circumstances would

[3] Other assumptions regarding this relationship are of course possible. For instance, one can anticipate the relationship between GDP per capita and fertility to change from a certain point in time onward, which may correspond to a certain situation of institutional background. Hence, we aim at controlling as much as possible for time-varying unobserved characteristics. However, this control is not perfect due to the correlation between trends of these characteristics and those of GDP per capita (thanks to anonymous reviewers for having drawn our attention on this issue).

create 'cross-section dependence' between countries. This dependence cannot be properly wiped out by controlling for time trends, and thus there remains a risk of obtaining biased estimation coefficients measuring the effect of GDP per capita on fertility. Testing of the cross-section independence of the residuals obtained by the model is then a mean to check whether results are affected by this issue (Pesaran 2004). In this latter case, a strategy to account for these common unobserved factors is the Common Correlated Estimator proposed by Pesaran (2006), which includes cross-section averages of the dependent and independent variations in the regression equation.[4] However, conditions for a satisfactory application are not fully met here, which will lead us to interpret results with caution.[5] For this reason, these results will not be shown in the tables included in the core text, but are included in the Annexes.

Against this Backdrop, Our Empirical Procedure Consists of Four Steps (I–IV).

I. Alternative specifications are tested to measure the effect of an increase in GDP per capita on fertility, including models with linear as well as nonlinear specifications. This allows testing for a change in the magnitude or sign of the relation between per capita GDP and fertility levels. By applying pooled OLS with robust standard errors, a linear specification is first estimated, with TFR as endogenous variable and the log of GDP per capita (*lnGDPpc*) as exogenous variable. Then, we test an 'exponential' specification where the log of total fertility rates (*lnTFR*) is modelled as a function of GDP per capita (*GDPpc*). A third specification with TFR expressed as a quadratic function of the log of GDP per capita is estimated as follows:[6]

$$\mathrm{TFR}_{i,t} = \alpha + \beta_1 * \ln\, GDPpc_{i,t} + \beta_2 * \ln\left(GDPpc_{i,t}\right)^2 + \alpha_i T + \varepsilon_{i,t}. \qquad (1)$$

This model allows for a change in the sign of the effect of an increase in GDP per capita on fertility levels, which is compatible with a reversal of fertility trends. A positive estimated coefficient β_2 would suggest that the correlation between TFR and GDP per capita is first negative up to certain threshold level of GDP per capita and then turns into positive for higher levels of GDP per capita. As it will be shown, the quadratic model turns out to be better suited than the linear and the exponential specification to represent the existing nonlinear relation between fertility and economic development.

The robustness of the quadratic model is then checked by applying a fixed effects estimation with robust standard errors, which allows capturing unobserved time-

[4] Country-specific influences of these averages are then estimated to approximate the incidence of unobserved factors which may vary across countries. This allows for more flexibility as the impact of the unobserved common factors can differ across country while the evolution of these factors may be nonlinear or even non-stationary.

[5] In particular, to be unbiased, the CCE estimator requires that the number of unobserved factors is not larger than $K + 1$ (K being the number of independent variables and equal to one here); or it requires that the factors loadings of independent and dependent variables (i.e. TFR and *GDPpc*) to be uncorrelated, which is not likely to be the case (Sarafidis and Wansbeek 2012).

[6] For the linear and the quadratic model, we use the natural logarithm of GDP per capita (*lnGDPpc*) which is standard in most macro-econometric works, as the logarithmic form reduces absolute increases in the levels of GDP per capita and therefore captures proportional rather than absolute differences in the distribution of GDP per capita levels.

constant variables which may affect fertility (i.e. country-specific characteristics linked to historical geography, population build-up or certain norms/attitudes, etc.). Controlling for these country-specific factors also moves the focus on within-country variations, so as to assess the impact of GDP per capita increases on fertility over time. As mentioned before, a key question is also to separate the influence of GDP on fertility levels from those of the period which comes along with an increase in per capita GDP. This period effects might, for instance, capture changes in attitudes, life-style or institutions that may also affect how GDP per capita influence fertility rates. The inclusion of 10 year-period effects in the quadratic fixed effects model helps us disentangle the pure effect of GDP from those of other time-varying unobserved factors. Period effects ($\alpha_i T$) are, in addition, assumed to be country-specific as the influence of time can vary across countries. As shown in the next section on results, this approach, however, does not properly account for the correlation between time trends and GDP per capita, which ends in cross-section dependence of error terms. A common correlated estimator is then applied to sort out this issue, but there are limits in the extent to which this procedure (or other procedure to deal with unobserved common factors) can be applied here.

Subsequently, to further test the existence of a nonlinear relation and—more precisely—to identify a structural break in the correlation between the two variables, we express TFR as a piecewise linear function of *lnGDPpc*. By applying fixed effects with robust standard errors, we estimate the impact of GDP per capita on fertility rates as follows:

$$\mathrm{TFR}_{i,t} = \alpha + \alpha_i + \beta_{\mathrm{pre}} * \ln GDPpc_{i,t}^{\mathrm{pre}} + \beta_{\mathrm{post}} * \ln GDPpc_{i,t}^{\mathrm{post}} + \varepsilon_{i,t} \qquad (2)$$

(α_i = country fixed effects), where the coefficients β_{pre} and β_{post} measure the effects of economic development on the total fertility rate at GDP per capita levels below and at or above a critical value $\mathrm{GDPpc}^{\mathrm{crit}}$. The hypothesis of a reversal of the relation implies that $\beta_{\mathrm{pre}} < 0$ and $\beta_{\mathrm{post}} > 0$.

For testing this hypothesis, we estimate $\mathrm{GDPpc}^{\mathrm{crit}}$ via an iterative search process, using all countries that attained a log value of GDPpc above 10 (which is the lower bound for the critical point suggested by figure A, as well as by the quadratic OLS estimation). The statistical estimate of $\mathrm{GDPpc}^{\mathrm{crit}}$ is obtained using maximum likelihood, by including $\mathrm{GDPpc}^{\mathrm{crit}}$ as a parameter in the likelihood function of Eq. (2).[7]

II. In a second step, we apply several robustness checks for the quadratic model in order to capture possible biases caused by unobserved variables, endogeneity and non-stationarity (2 stage least squares, random effects, between effects (BE), first difference estimator, system GMM).

Endogeneity is controlled for by applying 2SLS. In the absence of more accurate instruments to handle with possible endogeneity, lagged values of GDP per capita

[7] The log-likelihood function is actually maximised by using a two-stage grid-search algorithm that in the first stage varies the value of $\mathrm{lnGDPpc}^{\mathrm{crit}}$ from 9.5, 9.6, 10.0, 10.8, …, and in a second stage refine the search with a step size of 0.01 in the neighbourhood of the best-fitting first stage of $\mathrm{lnGDPpc}^{\mathrm{crit}}$. The likelihood profile is available on request.

serve as instrumental variables as a second best option.[8] Granger Causality (Granger 1969) has also been tested (see Table 5 in the appendix) and the test suggest that *lnGDPpc* ‘Granger causes’ *TFR*, whereas *TFR* does not ‘Granger cause’ *lnGDPpc*: i.e. lagged values of the *lnGDPpc* provide statistically significant information about actual values of *TFR* but at the same time, lagged values of *TFR* do not provide statistically significant information about actual values of *lnGDPpc*.

We compare the FE model to a BE model, which is based on time averages of each variable for each country. We also apply a random effects model (RE) which also controls for unobserved country heterogeneity but captures both within and between-country variation. The FE model turns out to be superior to the BE- and the RE-model.

For most countries, neither *TFR* nor GDP per capita follow clear time trends for the observed period. Graphical tests (correlogram, partial correlogram), an augmented Dickey Fuller (1979) and a Phillips and Perron (1988) test for unit root in time series and a Levin et al. (2002) test for unit root in panel data suggest the existence of an autocorrelation in some, but not all of the time series of TFR and lnGDPpc (results available on request). As the tests suggest that all series are difference stationary, we apply a First Difference Estimator. The differencing process implicitly controls for fixed effects and removes the unit root from the residual autocorrelation that can come from non-stationarity of data series.

We finally use a one-step system generalised method of moments estimator, which not only considers unobserved heterogeneity and non-stationarity, but at the same time also endogeneity. In addition, system GMM allows controlling for the dynamics of adjustment (see Box in the appendix for more details about System GMM estimation).

III. We then test the robustness of the quadratic model and the piecewise regression by controlling for birth postponement. For this purpose, first add two measures of women’s age at childbirth as control variables as exogenous variables and then use tempo-adjusted fertility rates as endogenous variable, again by applying fixed effects with robust standard errors.

IV. Finally, we aim at getting a deeper insight in the economic mechanisms behind fertility increase. For this purpose, we decompose *GDP per capita* into its three standard components, which are labour productivity, average working hours per worker and the employment ratio.[9] Because we are now particularly interested in the specific determinants of the fertility *rebound*, and also because of limitation in data availability,

[8] More precisely, we use lagged variables of *lnGDPpc* as instruments for *lnGDPpc* and lagged variables of $lnGDPpc^2$ as instruments for $lnGDPpc^2$ We perform the IV-regression in two steps (two-stage least squares estimator) by using 1-year lags as well as 5-year lags. The use of lagged exogenous variables lessens the risk of obtaining biased and inconsistent estimators due to inverse causality between the endogenous and the exogenous variables. It is for example likely that variations of fertility that lead back to changes in the economic environment appear time-lagged. At the same time, it is less likely that *TFR* observed in 1984 impacts *GDP per capita* levels of the year 1980. However, the use of lagged exogenous variables does not completely rule out the problem of inverse causality between fertility and *GDP per capita*. *TFR* of 1984 may affect *GDP per capita* of 1980 due to birth postponement, for example. Women who delay childbirth from 1980 to 1984 in favour of labour market participation actually do influence GDP levels measured in 1980 by the fact that they have a child in 1984 only.

[9] Labour productivity = GDP/sum of working hours; avrg. working hrs. per worker = sum of working hours/active population; employment ratio = active population/total population.

we focus on linear impacts of the decomposition variables on fertility and consider the time period 1995–2007 by applying the FE model. The decomposition we propose is done with a sequence of different steps. The first step is to estimate the impact of our three decomposition variables on *TFR* (with country fixed effects):

$$\begin{aligned}\mathrm{TFR}_{i,t} = {} & \alpha + \alpha_i + \beta_1 * \ln(\text{labour productivity})_{i,t} \\ & + \quad \beta_2 * \ln(\text{avrg.hrs.per worker}) + \beta_3 * \ln(\text{employment ratio}) + \varepsilon_{i,t}\end{aligned}. \quad (3)$$

The second step is to split the employment ratio into two variables, which are the employment rate (ages 25–54) and the ratio of the active population.[10] We limit the observed age group in order to better capture the impact of the employment variables on fertility. We estimate the impact of our four decomposition variables on TFR as follows:

$$\begin{aligned}\mathrm{TFR}_{i,t} = {} & \alpha + \alpha_i + \beta_3 * \ln(\text{labour productivity})_{i,t} + \beta_4 * \ln(\text{avrg.hrs.per worker}) \\ & + \beta_5 * \ln(\text{employment rate}) + \beta_6 * \ln(\text{ratio active population}) + \varepsilon_{i,t}\end{aligned}. \quad (4)$$

The third step is to use our decomposition variables disaggregated by gender and estimate our model as follows:

$$\begin{aligned}\mathrm{TFR}_{i,t} = {} & \alpha + \alpha_i + \beta_1 * \ln(\text{labour productivity})_{i,t} \\ & + \beta_2 * \ln(\text{avrg.hoursper worker\_men}) + \beta_3 * \ln(\text{avrg.hours.per worker}_{\text{women}}) \\ & + \beta_4 * \ln(\text{employment rate\_men}) + \beta_5 * \ln(\text{employment rate\_women}) \\ & + \beta_6 * \ln(\text{ratio active population\_men}) \\ & + \beta_7 * \ln(\text{ratio active population\_women}) + \varepsilon_{i,t} \quad (5)\end{aligned}$$

6 Estimation Results

6.1 The Impact of GDP per Capita on Fertility

I. We start with testing alternative models capturing the relation between GDP per capita and fertility, i.e. we test a linear against several nonlinear specifications. Regression results are shown in Table 1.

In comparison to the linear and the exponential specification (column 1 et 2), the goodness of fit *(R^2)* is highest for the quadratic model (column 3). The quadratic model allows a change in the sign of the association between GDP per capita and TFR.[11] The fact that the estimated coefficient for $lnGDPpc^2$ is significantly positive

[10] Ratio active population = active population (ages 25–54)/total population (ages 25–54).

[11] However, the goodness of fit of the exponential model cannot be directly compared to the goodness of fit of the linear and quadratic model, as the form of the endogenous variable of the exponential model (*lnTFR*) differs from the other two models (*TFR*). We therefore also test the linear and the quadratic model using *lnTFR* as endogenous variable while keeping GDP in its logarithmic form. For this specification (not presented here), R^2 of the linear model is 0.33, while R^2 of the quadratic model is 0.41. The goodness of fit of the quadratic model, using *lnTFR* as endogenous variable and GDP per capita and its squared form as exogenous variable is 0.34. The form of the quadratic model presented in column 3 of Table 1 is thus confirmed in having the highest goodness of fit.

Table 1 Specification tests

Type of regression	(1) Pooled OLS (robust SE)	(2) Pooled OLS (robust SE)	(3) Pooled OLS (robust SE)	(4) Fixed effects[1] (robust SE)	(5) Fixed effects (robust SE)
Endogenous variable	TFR	lnTFR	TFR	TFR	TFR
Specification	Linear model	Exponential model	Quadratic model	Quadratic model	Piecewise regression
Regressors					
GDPpc		0.0000166*** (−11.30)			
lnGDPpc	−1.013*** (−14.38)		−15.63*** (−9.45)	−16.95*** (−12.80)	
lnGDPpc^2			0.760*** (9.09)	0.818***£ (12.19)	
lnGDPpc (pre 10)					−2.02*** (−24.30)
lnGDPpc (post 10)					0.13** (3.08)
Constant	11.87*** (16.89)	0.943*** (28.57)	81.92*** (10.02)	89.58*** (13.69)	19.9*** (−0.73)
N	1050	1050	1050	1050	1050
nb. of countries	30	30	30	30	30
Time period	1960−2007	1960−2007	1960−2007	1960−2007	1960−2007
R^2	0.359	0.200	0.460 (overall)	0.542 (within)	0.544 (within)
R^2 adj.	0.359	0.200	0.459	0.542	0.544
Estim. minimum lnGDPpc			10.28	10.39	10
Estim. minimum GDPpc US$ (PPP)			29.228	31.746	22.000
Estim. minimum TFR			1.56	1.69	
Test of cross-section independence of residuals abs. (*p* value)[2]	0.45 (0.00)	0.52 (0.00)	0.47 (0.00)	0.45 (0.00)	0.41 (0.00)

t statistics in parentheses, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

(1) The model includes country-specific time dummies for each period of 10 years

(2) Pesaran (2004) CD test, the null hypothesis assuming that all residuals are cross-section independent. Absolute correlation and *p* value of the test are reported; a *p* value below 0.05 leads to the rejection of cross-section independence

reveals the existence of a minimum point in the relation between *TFR* and *lnGDPpc*. This suggests that the correlation between TFR and GDP per capita is first negative up to certain threshold level of GDP per capita and then turns into positive for higher levels of GDP per capita.

The quadratic specification is then tested by a Fixed Effects estimation (column 4), which confirms a convex impact of GDP per capita on TFR. The estimation controls for the influence of time with country-specific dummies for each period of 10 years. Hence we estimate how fertility rates evolve with GDP per capita within countries, irrespectively of the effect of time.[12] The fact that the FE regression results are significant indicates that the hypothesis of a convex impact of *lnGDPpc* on *TFR* is confirmed when focusing only on within-country variation over time (and not caused by cross-country distortions). The higher goodness of fit as well as the higher significance of the fixed effects estimation compared to a BE estimation (see BE-results in Table 6, column 2, in the appendix) suggests that the convex impact of economic development on fertility is actually dominated by within-country variation. Yet, potential bias in these estimates cannot be ignored since a Pesaran (2004) test applied to regression residuals suggests that the assumption of cross-section dependence cannot be rejected. For this reason, the model is re-estimated with cross-section averages of dependent and independent variables that are expected to wipe out the incidental common correlated factors (Table 6, column 5). The influence of GDP per capital on fertility rates is still convex but yields prediction of a turning point at a much lower level of per capita income.

Thus, for the quadratic model, the FE estimation results (Table 1, column 4) indicate that the critical GDP per capita level is located at US\$ 31 746 (PPP) and a fertility level of 1.69 children per woman in the absence of country-specific characteristics (column 4). Slightly lower estimates of these critical values are given by the pooled OLS estimation, with a minimum TFR estimated at 1.56 and a corresponding GDP per capita at US\$ 29 230 (PPP) for the quadratic model (column 3). This suggests that economic development decreases fertility until a relatively high income level, but then, economic growth is associated with a re-increase in fertility rates. Nevertheless, fertility rates are also found to depend on unobserved time-varying factors which are approximated here by country-specific time trends, but the rejection of cross-section independence of the residuals suggests that they do not completely account for unobserved variables that are correlated with GDP per capita.[13]

[12] Fertility and economic outcomes may also follow a non-stationary evolution path, in which case there is some risk of getting spurious regression results. To deal with this issue and to test the robustness of our results, we also carry out First Difference and System GMM estimations, which take into account non-stationarity. The results are presented in Table 6 in the appendix.

[13] By contrast, the Common Correlated estimator shown in the Annex (Table 6) seems to provide a better control for these unobserved variables with a slightly lower correlation of residuals for which the assumption cross-section independence is no longer rejected (column 5). Here the model also foresees a switch to a positive impact of GDPpc on fertility rates, which is however predicted to happen at much lower level of income per capita (US\$ 8929) once correlated factors are controlled for. In practice, for all countries which experienced an upturn in fertility rates, this upturn happened at much higher levels of GDP per head which makes this estimate very implausible (see Figs. 3, 4).

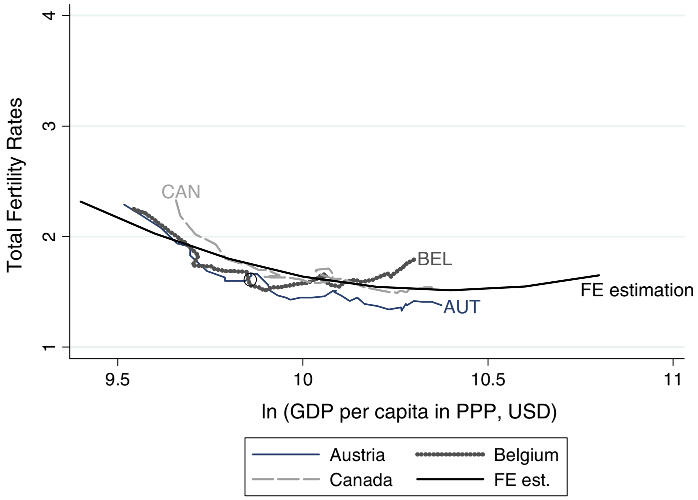

Fig. 3 Fixed effect estimation (based on 30 countries, 1960–2007) against observed within-country variation in Austria, Canada and Belgium (1960–2007). Data source: OECD Family Database (2010) and authors’ estimates

Then, results of the piecewise linear regression (with fixed effects) also confirm the change from a negative association between economic advancement and aggregated fertility levels to a positive relations from a certain level of GDP per capita onward (column 5).[14] The estimated GDP-breakpoint is lower here (US$ 22 000 PPP) than for the quadratic function, since the log-likelihood function is actually maximised for an estimated *lnGDPpc* at 10.[15]

We illustrate the FE results of the quadratic model (column 4), as the quadratic model gives information about the estimated breakpoint levels of GDP per capita and TFR. Figures 3 and 4 compare our estimated pattern between GDP per capita and TFR with true within-country variations of selected OECD countries.

The curved line presents the FE results graphically. The line confirms a flattening relation between economic development and fertility and shows that the estimated pattern between *TFR* and *lnGDPpc* is presumably ‘*inverse J-shaped*’. The declining branch on the left-hand side is longer than the rising branch at the right-hand side, i.e. increases in GDP per capita lead to increases in fertility only from a relatively high level of income on. In addition, Fig. 3 compares the FE estimation results with real within-country variations in countries which are close to the estimated path: Austria, Canada and Belgium. We can observe that in Belgium, the fertility rebound

[14] Similar results are obtained when regressions are run separately on two sub- samples, one for *lnGDPpc* higher than 10 and one for *lnGDPpc* lower than 10 (results available on request).

[15] Note that the estimated GDP per capita-breakpoint varies largely between the different applied estimation models (see last rows of Tables 1, 6). The predicted minimum never falls outside the observed range of GDP per capita-values (max. GDP pc observed: 65 000 USD) and therefore the trend reversal is not a statistical artefact. However, for most of the models, the location of the predicted minimum is on a relatively high level of GDP per capita, especially for the FE estimation (GDP pc levels above 31 746 US$ are observed for 7 out of 30 countries), and the predicted fertility upswing is relatively slight (see Figs. 3, 4: inverse J-shaped pattern).

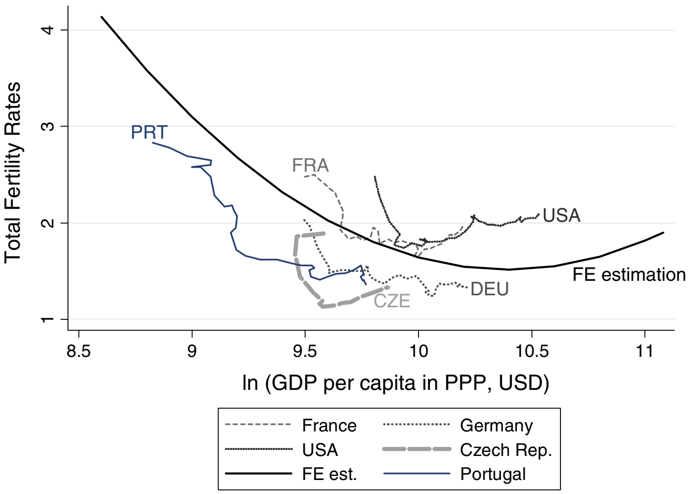

Fig. 4 FE estimation (based on 30 countries, 1960–2007) against observed within-country variation (1960–2007) in France, Germany, Portugal, the Czech Republic and the USA. Data source: OECD Family Database (2010) and authors' estimates

is larger than suggested by the FE results and happened at a quite low level of GDP per capita. In Austria, the impact of immediate further economic growth on fertility is quite inconclusive and the pattern as a whole is situated on a lower fertility level.

Figure 4 illustrates the cases of countries which mostly deviate from the expected path concerning the level of fertility. However, irrespective of periodical fluctuations, the pattern between fertility and income is rather inverse J-shaped in all these countries, which confirms that economic growth decreases fertility up to a certain relatively high level of income, and then increases it. The critical level of GDP per capita actually varies from country to country, these differences being smoothed by the FE estimation. The fertility rebound coming along with a certain level of economic development is particularly observable in France, the United States and the Czech Republic, whereas in Germany and Portugal, the impact of immediate further economic growth on fertility is quite inconclusive.

Figures 3 and 4 lead to the following conclusion: in Eastern and Southern European countries and Germany, economic development comes along with a lower level of fertility than suggested by our empirical results, whereas in countries like France, for example, the regression analysis suggests a lower level of fertility given the country's increase and level of GDP per capita. It is striking that the German pattern is almost parallel to the French one. This means that in these two countries, changes in fertility are almost identically related to changes in income. Yet, the German pattern as a whole is situated on a much lower fertility level than the French one. Moreover, recent economic growth (on highest GDP per capita levels) has induced a much more significant fertility rebound in France than in Germany.

We conclude from Figs. 3 and 4 that in general, our empirical results prove a change in fertility trends going with the process of economic development in OECD countries. Hence, we identify fertility to have a strong negative association with first stages of economic development, while it fades up to a quite high level of GDP per capita from which the relationship seems to reverse. This result is thus consistent with the inverse J-shaped profile suggested by former analysis by Myrskylä et al. (2009), but the switch to a positive relation is found here to happen at quite high GDP per capital level as so far experienced by only few countries (Sweden, Netherlands, United States, Ireland, Luxembourg, Iceland, Norway).

This implies that further economic development is likely to increase fertility in many OECD countries in the future, even though very large increases in per capita economic output would be necessary to raise significantly fertility levels in the current low fertility countries. Moreover, the empirical model estimated so far does not succeed in explaining why in some OECD countries, the inverse J-shaped pattern is situated at quite different fertility levels. The issue remains unclear why in some countries, economic growth increases fertility more significantly than in other countries. The actual GDP per capita level from which fertility rates started to re-increase also varies significantly among countries.

In countries like France, Belgium and New Zealand, it seems that other factors beyond economic advancement are responsible for the relatively high fertility levels and the significant fertility rebound that occurred already at relatively low GDP per capita levels. At the same time, in Japan, Germany, Austria and Eastern and Southern European countries, low fertility levels cannot, or not only, be explained by insufficient economic advancement. Even though our analysis suggests that in these countries too further economic growth increases fertility, it seems likely that fertility increases at a much lower level.

This leads to the question which elements *above and beyond* GDP per capita could make the difference between those two groups of countries. A country typology by Thévenon (2011) shows that the first group provides comparatively high assistance to working parents with young children, whereas the second group is characterised by a relatively limited assistance to families and rather low support for a combination of work and family life. This suggests the benefit we may get by looking further to the relations between female employment and other GDP components with fertility trends.

II. However, before investigating the impact of certain labour market factors on fertility, which are captured by GDP per capita, we now apply some further robustness checks for the quadratic specification. Table 6 in the appendix presents regression results for 2SLS, BE, RE, FDE, CCE and System GMM. Most estimations confirm a convex impact of economic development on fertility with a clear shift in the correlation between the two variables from negative to positive. Only the BE estimator does not confirm a significant breakpoint, implying that the convex impact of *lnGDPpc* on *TFR* is clearly dominated by within-country variation (besides the higher R^2 for the FE model). The estimated break point varies with the applied estimation method. Nevertheless, the important result from the robustness checks is that the inverse J-shaped relation between per capita output and fertility rates is confirmed when running procedures that are designed to best control for potential endogeneity of GDP per capita and for non-stationarity of time series data.

III. We now control whether the convex impact of GDP per capita on TFR still holds when taking into account tempo effects of fertility. This is necessary as the

Table 2 Control for birth postponement

Type of regression	Fixed effects (robust SE)						
Endogenous variable	Total fertility rate (TFR)				Tempo-adjusted total fertility rate (adjTFR)		
Specification	(1) Quadratic model	(2) Quadratic model	(3) Quadratic model	(4) Piecewise regression	(5) Quadratic model	(6) CCE	(7) Piecewise regression
Regressors							
InGDPpc	−19.42*** (−17.36)	−15.81*** (−8.74)	−14.19*** (−7.51)		−13.95*** (−8.45)	−14.71* (−2.36)	
$InGDPpc^2$	0.933*** (16.70)	0.779*** (8.58)	0.701*** (7.45)		0.678*** (8.12)	0.713* (2.27)	
InGDPpc (pre 10)				−1.10*** (0.137)			−1.15*** (−16.52)
InGDPpc (post 10)				0.27*** (0.107)			−0.01 (−0.29)
MAB	0.0323* (2.27)						
MA1B		−0.0580*** (−3.35)	−0.577*** (−4.26)	−0.59*** (0.132)			
$MA1B^2$			0.00965*** (4.04)	0.102*** (0.002)			
Constant	102.0*** (18.11)	83.51*** (9.30)	82.11*** (9.09)	21.3*** (1.73)	72.63*** (8.94)	−23.44 (−0.39)	12.30*** (0.63)
N	845	582	582	582	406	406	406
nb. of countries	30	30	30	30	18+	18	18+
Time period	1960−2007	1960−2007	1960−2007	1960−2007	1961−2006	1961−2006	1961−2006
Test of cross-section independence of residuals abs. (*p* value)					0.43 (0.13)	0.34 (0.02)	0.44 (0.00)
R (within)	0.538	0.493	0.508	0.546	0.433		0.475
R^2 adj.	0.522	0.464	0.479	0.607	0.405	0.88	0.476

t statistics in parentheses, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

+ OECD countries without: Australia, Belgium, Canada, France, Germany, Greece, Korea, Luxembourg, Mexico, New Zealand, Switzerland, Turkey delay in childbirth can be a main determinant of decreases in TFR and the end of birth postponement can be a main determinant for a re-increase of TFR. For this purpose, we first keep *TFR* as endogenous variable and add the mean age of mothers at childbirth (*MAB*) as well as the age of mothers at first childbirth (*MA1B*) as control variables to the FE model. We introduce these two control variables in their linear as well as in their quadratic form because changes in the timing of births can have a nonlinear impact on TFR. In a second step, we use tempo-adjusted TFR (*adjTFR*) as endogenous variable. The tempo-adjusted fertility rate is intended to measure fertility levels within a given period in the absence of postponement. Data on *adjTFR* is available as 3-year moving averages, which smoothes out short-term fluctuations, but covers only 18 OECD countries. We test the quadratic model and the piecewise regression by applying fixed effects. Regression results are shown in Table 2.

All specifications with TFR estimated as a quadratic function of *lnGDPpc* confirm a significantly convex impact of economic development on fertility when indicators of mothers' mean age at childbirth are included (column 1–3).[16] Column 1 suggests that an increase in mothers' mean age at childbirth slightly increases TFR when taking into account the effect of economic development on fertility.[17] This implies that the possibility of birth postponement can contribute to explain why there is a re-increase in fertility at higher stages of economic development. However, as the GDP variables are still significant, it seems that the tempo effect alone is not sufficient to explain the fertility rebound. Column 3 suggests that the average age of mothers' at *first* childbirth has a convex impact on TFR, just like *lnGDPpc*. This suggests that when women start delaying childbirth, fertility rates decrease, but once the birth postponement process stagnates at a relatively high average age of mothers at first childbirth (around 30), TFR re-increase. Once again, we see here that birth postponement actually plays a role in explaining the fertility re-increase that is observed along the process of economic development, but other factors captured by GDP per capita also contribute to the rebound.

The reversal of the impact of economic development, from negative to non-negative or positive, is also confirmed when controlling for the mean age of women at their first birth for the piecewise regression (column 4).

The convex impact of GDP per capita on fertility is also confirmed once we use tempo-adjusted fertility rates as endogenous variable, for which residuals can also be reasonably assumed as cross-sectionally independent (column 5 and 6). The estimation by piecewise linear modelling (column 7) fails to corroborate this finding, however, in a context where data cover a sub-sample of countries only, and

[16] Because data on mean age at birth are available for only a limited time period which also varies across countries, the panel becomes highly unbalanced, which makes it impossible to run tests of cross-section independence for the residuals.

[17] The rate of change of *MAB* is found to have a significantly negative impact on *TFR*, however, while the convex impact of *lnGDPpc* on *TFR* stays unchanged (results available on request). This indicates that the mean age of mothers at childbirth might have an ambiguous impact on *TFR* for our covered time period. Introducing *MAB* and its square as exogenous variables yields insignificant results for both *MAB*-coefficients (results available on request). However, column 3 shows that the impact of *MA1B* on *TFR* is actually convex.

Table 3 GDP decomposition

Type of regression	Fixed effects (robust SE)			
Endogenous variable	Total fertility rate (TFR)			
Specification	Linear model			
Regressors				
lnGDPpc	−9.226***			
	(−6.41)			
lnGDPpc^2	0.456***			
	(6.32)			
ln(labour productivity)		−0.219***	−0.252***	−0.160***
		(−3.48)	(−4.74)	(−3.29)
ln(avrg. hours per worker)		−0.380	−0.524	
		(−0.72)	(−1.21)	
ln(avrg. hours per worker men)				0.366
				(1.40)
ln(avrg. hours per worker women)				−0.951**
				(−2.91)
ln(employment ratio)		0.632***		
		(4.02)		
ln(employment rate 25–54)			1.392***	
			(7.79)	
ln(employment rate 25–54 men)				0.553
				(1.72)
ln(employment rate 25–54 women)				0.520***
				(3.61)

Table 3 continued

Type of regression	Fixed effects (robust SE)			
Endogenous variable	Total fertility rate (TFR)			
Specification	Linear model			
ln(ratio active population)			−1.785***	
			(−7.78)	
ln(ratio active population men)				3.150***
				(2.57)
ln(ratio active population women)				−4.986***
				(−3.79)
Constant	48.43***	2.945	7.987**	9.594**
	(6.74)	(0.67)	(1.87)	(2.64)
N	368	356	356	315
No. of countries	30	30	30	27*
Time period	1995–2007	1995–2007	1995–2007	1995–2007
R^2 (within)	0.232	0.091	0.327	0.326
R^2 adj.	0.161	0.001	0.259	0.247

t statistics in parentheses, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

$^+$ OECD countries without: Japan, Turkey, USA where the reversal trends regarding the adjusted tempo fertility rates are much smoother than those of the TFR.

We conclude that economic advancement does not only affect the timing of fertility but seems also to affect the 'quantum'-component of fertility. In this case, the reversal of the relation between economic development and TFR from negative to positive is not only a mechanical consequence of the process of birth postponement coming to its end. The results above suggest rather that inherent dimensions of economic development are at play to enable an upturn of fertility trends.

IV. Finally, to investigate *w*hat exactly *behind* economic advancement increases fertility from a certain level of development on, we now decompose GDP per capita into a number of more specific variables. Due to the limited observable time period and due to our particular interest in the fertility re-increase, we analyse *linear* impacts of the decomposition variables on TFR by focussing on the time period 1995–2007. Estimation results are again presented for the FE model with robust standard errors.

Column 1 of Table 3 shows that economic development measured by GDP per capita continues to have a convex impact on fertility when limiting the observed time period to the years 1995–2007. This may be due to the fact that the different components of GDP have ambiguous linear impacts on TFR. In fact, decomposing GDP per capita shows that labour productivity and the ratio of the active population is significantly negatively correlated with fertility, while the employment variables are positively correlated with fertility (columns 2–4). Among the employment variables, a particularly strong association is found between TFRs and women's employment (observed for women aged 25–54—column 4), pointing to the fact that female employment is a key factor for the fertility rebound in OECD countries.[18] Countries with increasing female employment rates are thus likely to experience a fertility rebound. However, unobserved factors may play an important role for the positive within-country association between female employment and fertility, as for example increasing investments in policies supporting the compatibility of family and career for women. This consideration is supported by our finding that women's average working hours are negatively associated with fertility: long average working hours negatively affect the aggregated rate of fertility, in spite of a positive association between this latter and female employment rates.

This again suggests that institutions increasing the compatibility between women's labour market participation and childbearing play an important role for the positive association between female employment and fertility.

[18] Granger Causality tests (Granger 1969) suggest that female employment Granger causes TFR, whereas TFR does not Granger cause female employment. However, Granger causality is not sufficient to imply true causality when the true relation involves three or more variables (Granger 1969). Nevertheless, GMM results taking into account endogeneity issues (and capturing both within- and between-country variation) confirm a significantly positive impact of female employment on TFR (Granger tests and GMM results available on request).

7 Discussion

This study shows that the influence of economic development on fertility trends has changed radically in OECD countries. Our empirical findings confirm a convex impact of economic advancement on fertility rates in OECD countries over the last decades, while there is, in a first stage, a strong negative association between fertility rates and the increase in GDP per capita, the relation weakens and even seems to turn into positive at high level of per capita GDP. We find that this inverse J-shaped pattern of fertility along the process of economic development is actually dominated by within-country variation. This implies that recent economic advancement has been coming along with a slight re-increase in fertility rates in some of the most economically advanced countries. This finding is robust when controlling for postponement of birth. However, while our results unambiguously show that the negative association between GDP per capita and fertility rates weakens with economic advancement, the extent economic development actually produces (or will produce in the near future) a re-increase in fertility is more uncertain. Unobserved factors which co-vary with GDP and influence fertility are important to account for, but their control in the estimation presented here remains non-perfect.

Our finding suggests that further economic development is likely to induce a fertility re-increase in the richest societies, but this increase will be small if driven by increase in GDP per capita only. The Fixed Effects estimation illustrated above suggests that GDP per capita has to reach US$ 66,000 for fertility to increase back to replacement level (2.1 children per women) if we disregard country-specific factors and trends that affect fertility besides economic development (for comparison, the GDP per capita level reached on average US$ 28,100 in the OECD in 2007).

Besides, we also find that several OECD countries do not follow the estimated path of fertility along the process of economic development due to country-specific factors. Some countries demonstrate significantly lower actual fertility rates than the one predicted from GDP trends. Eastern and Southern European countries as well as Germany, Japan and Korea are clearly in that situation. By contrast, Northern European and English-speaking countries and France exhibit higher fertility rates than their expected values. We conclude that economic development is likely, but not sufficient to lift fertility to a higher level in all OECD countries without additional institutional changes.

To gain a deeper insight in the factors that 'cause' the recent increase in fertility rates, we decompose GDP per capita into a number of more specific variables (labour productivity, working hours, and employment) and estimate their impact on fertility. Hereby, we find a positive association between female employment and fertility for within-country variations. This implies that a change in the impact of economic development on fertility from negative to positive is only likely to happen in those countries where economic development has come along with increases in female employment.

The growing participation of women in the labour market is one of the big development changes of the past decades that concern most OECD countries since the 1960s. Its correlation with fertility has changed over time, however. While higher fertility rates were clearly observed in countries with lower rates of female employment in the early 1980s, the opposite seems now to operate with higher fertility rates observed in countries where female employment rates are also higher (OECD 2011). Our finding of a positive association between female employment and fertility is in line with Ahn and Mira's (2002) results, but different from those by Engelhardt et al. (2004) and Engelhardt and Prskawetz (2004), for example, who find for six OECD countries and the years 1960–2000 that the correlation between female labour market participation and fertility is significantly negative only up to the year 1975 and gets insignificant afterward. Kögel (2004) even find a persistent but weakened negative association between female employment and fertility rates. Based on a larger database that includes more countries and more recent time periods, we find a significantly positive association between female employment and fertility even when focussing on within-country variations only. It should be emphasised that this association observed at the 'macro' country level does not always hold at the 'micro' individual level. Matysiak and Vignoli (2008) do a meta-analysis of existing studies of the relationship between women's employment and fertility at the micro-level and show that most micro studies find that women with a continuous career have lower completed fertility than those with interrupted employment spells. The strength of the association is stronger where the male breadwinner model prevails.

Making this coincidence possible implicitly points out the role of unobserved but time-variant institutional factors such as labour market institutions and policy support that enable parents to combine work and family life.

The role of these factors role is accentuated by our observation that countries which combine high fertility and female employment rates generally facilitate a combination of work and family life. Differences in institutional settings among countries with high fertility remain quite large in the OECD (Thévenon 2011). To date, high female employment rates (ages 25–54) over 80 % along with high fertility rates can especially be observed in Finland, Norway, Sweden, Denmark and Iceland. These are countries with high income levels and high public assistance to working parents with young children at the same time. Parental leave schemes are comparatively generous and child care services are also provided area-wide. English-speaking countries support a combination of work and child rearing mainly by in-work benefits, flexible working hours, and both in-cash and in-kind support which target primarily low-income families and preschool children. In contrast, those countries with low fertility and female employment levels, like Eastern and Southern European countries or Germany, are characterised by a relatively low support for work and family reconciliation. France contrasts with these countries with higher female full-time employment rates and at the same time higher fertility rates than Germany, even though Germany has somewhat higher GDP levels. A key difference stands also in the support granted to households with children under preschool to combine work and family. Thus, our results suggest that changes in the impact of economic development on fertility reflect changes in institutional patterns helping parents to balance work and family life.

Further investigation of the relations between economic growth, labour market institutions, the design of work-life balance policies, societal norms and fertility trends is now required to better understand the variety of cross-national patterns. Our estimation results suggest that economic advancement increases fertility in countries that enable female employment, but they do not allow any statements concerning the role of public or private reconciliation instruments, as these are only part of our GDP measures but are not modelled explicitly in this study. An in-depth analysis of the linkages between fertility, institutional settings like norms and family policies, and women's labour market participation has proved to be a fruitful research area (Luci-Greulich and Thévenon 2013).

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Appendix

The IV-estimation results are based on 5-year lags as instruments for the exogenous variables. The estimated coefficients based on 1- to 4-year lags do not differ much and thus are not presented in particular.

The Hausman (1978) test comparing the fixed effects to the RE model suggests that the difference of the estimation results of the fixed and the RE models is systematic. The fact that the p value is below 0.05 (0.0371) implies that the hypothesis that the unobserved country effects are not correlated with the error term in the RE model must be rejected. Hence, for our data the fixed effect specification is superior to a RE specification in controlling for unobserved country heterogeneity.

The estimated critical GDP per capital level which leads to a turn in the correlation between fertility and *lnGDPpc* is strikingly low for the First Difference Estimator. This is due to the fact that the first difference of the natural logarithm of GDP per capita approximates the year-to-year relative changes of GDP per capita. Hence, the First Difference Estimator estimates the impact of GDP per capita growth on fertility variations and therefore risks obtaining biased estimates due to an 'underdevelopment' effect. Low levels of GDP per capita are likely to go hand in hand with steeper increases (due to convergence mechanism) and thereby might be rather associated with fertility declines than with fertility increases, referred as a period of demographic transition. This is likely to bias the estimated critical level of GDP per capita. Furthermore, as the First Difference Estimator is not based on level variations, the estimated constant differ largely from the constants estimated by the other estimation methods presented in Tables 2 and 6 and makes it impossible to calculate the minimum level of TFR. Consequently, the First Difference Estimator confirms a convex impact of GDP per capita on TFR while controlling for non-stationarity, but does not permit clear statements about the exact turning point in the correlation between the two variables.

See Tables 4, 5, 6 and Fig. 5.

Table 4 Summary statistics

Variable	Definition	nb. of obs.	nb. of countries	Time period	Mean	Std. dev.	Min.	Max.	Source
TFR	TFR (average number of births per woman)	1418	30	1960–2007	2.19	0.96	1.08	7.26	OECD Family Data Base
adjTFR	Tempo–adjusted TFR, 3 years MA	519	18	1961–2006	1.97	0.32	1.34	3.43	Bongaarts & Feeney Human Fertility Database
GDPpc	Gross domestic product per capita in purchasing power parities (in constant 2005 USD)	1072	30	1960–2007	19812.53	8234.63	2859.90	65001.25	OECD FDB
lnGDPpc	Natural logarithm of *GDPpc*	1072	30	1960–2007	9.80	0.46	7.96	11.08	own calculation
MAB	Mean age of mothers at childbirth	1097	29	1960–2007	27.79	1.40	24.55	31.20	OECD FDB
MA1B	Age of mothers at first childbirth	702	26	1960–2007	25.79	2.09	20.70	30.70	OECD FDB
Labour productivity	GDP/sum of working hours	693	30	1980–2007	26.28	12.29	2.66	78.29	OECD FDB
Avrg hours per worker	Average working hours per worker = sum of working hours/active population	711	30	1980–2007	1800.89	247.41	1334.00	2922.73	OECD FDB
Avrg hours per worker men	Average working hours per male worker = sum of working hours men/active population men	508	27	1980–2007	2198.20	160.94	1871.34	2891.76	OECD FDB
Avrg hours per worker women	Average working hours per female worker = sum of working hours women/active population women	508	27	1980–2007	1814.64	238.13	1244.73	2653.42	OECD FDB
Employment ratio	Active population/total population	787	30	1980–2007	44.18	6.49	27.87	70.08	OECD FDB
Employment rate 25–54	Number of employed persons/working age population (ages 25–54)	710	30	1980–2007	75.72	7.73	53.21	91.60	OECD FDB
Employment rate 25–54 men	Number of employed men/working age population men (ages 25–54)	710	30	1980–2007	87.98	4.32	73,01	97.30	OECD FDB

Table 4 continued

Variable	Definition	nb. of obs.	nb. of countries	Time period	Mean	Std. dev.	Min.	Max.	Source
Employment rate 25–54 women	Number of employed women/working age population women (ages 25–54)	710	30	1980–2007	63.48	14.21	25.59	89.60	OECD FDB
Ratio active population	Active population (ages 25–54)/total population (ages 25–54)	710	30	1980–2007	63.24	2.85	54.65	69.63	OECD FDB
Ratio active population men	Active population men (ages 25–54)/total population men (ages 25–54)	710	30	1980–2007	63.50	2.93	54.05	70.69	OECD FDB
Ratio active population women	Active population women (ages 25–54)/total population women (ages 25–54)	710	30	1980–2007	62.99	2.85	55.20	69.61	OECD FDB

Table 5 Granger causality

Endogenous variable Type of regression	TFR Pooled OLS	InGDPpc Pooled OLS
Regressors		
$(TFR)_{t-1}$	1.261*** (43.03)	−0.0139 (−1.32)
(TFR)	−0.285*** (−9.91)	0.00963 (0.93)
$In(GDPpc)_{t-1}$	0.306*** (3.88)	1.342*** (47.42)
$In(GDPpc)_{t-2}$	−0.268*** (−3.43)	−0.353*** (−12.60)
Constant	−0.357*** (−5.62)	0.131*** (5.80)
N	990	1012
	0.992	0.997

t statistics in parentheses, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6 Robustness checks

Type of regression	(1) V (2SLS)	(2) Between effects	(3) Random effects	(4) First difference	(5) CCE[1]	(6) System GMM[2]	(7) System GMM with limited lags	(8) System GMM with limited and increased lags
Regressors								
InGDPpc	−14.49*** (−12.29)	−19.14* (−2.05)	−16.89*** (−20.86)	−13.75*** (−11.18)	8.09*** (−4.25)	−15.98*** (−25.97)	−2.369** (−3.00)	−13.62*** (−4.56)
InGDPpc2	0.708*** (11.63)	0.960 (1.98)	0.813*** (19.45)	0.716*** (11.10)	0.44*** (−4.51)	0.788*** (24.58)	0.110** (2.81)	0.711*** (4.62)
Lagged TFR								0.537*** (7.15)
Constant	75.81*** (13.28)	97.10* (2.18)	89.14*** (22.72)	0.036*** (−11.12)	62.63* (2.42)	82.62*** (28.03)	14.93*** (3.55)	65.81*** (4.54)
nb of observations	900	1050	1050	1020	1050	224	164	164
nb. of countries	30	30	30	30	30	30	30	30
Time period	1960–2007	1960–2007	1960–2007	1960–2007	1960–2007	1960–2007	1960–2007	1960–2007
R^2	0.424	0.327 (between)	0.4580 (overall)	0.110				
R^2 adj.	0.422	0.327		0.108	0.977			
Test of cross-section independence of residuals abs. correlation (p value)[3]					0.37 (0.30)			
	1 (5 years lags)					81	8	16
nb. of estim. param.	3	3	3	3		3	3	4
Hausman (p value)			0.0371					
Sargan (p value)						0	0.447	0.172
Sargan-diff. (p value)						0	0.251	0.189

Table 6 continued

Type of regression	(1) V (2SLS)	(2) Between effects	(3) Random effects	(4) First difference	(5) CCE[1]	(6) System GMM[2]	(7) System GMM with limited lags	(8) System GMM with limited and increased lags
Instruments for first differences equation						L.(lnGDFpc lnGDFpc2)	L7.(lnGDFpc lnGDFpc2)	L5.(L.TFR L2.lnGDFpc L2.lnGDFpc2)
Instruments for levels equation						D.(lnGDFpc lnGDFpc2)	DL6.(lnGDFpc lnGDFpc2)	DL4.(L.TFR L2.lnGDFpc L2.lnGDFpc2)
Estim. minimum lnGDFpc	9.97	9.96	10.39	9.6	9.1	10.14	10.77	9.58
Estim. min. GDFpc US$	25,964	21,349	32,450	14,794	8,929	25,500	47,500	14,444
Estim. minimum TFR	1.57	1.7	1.42	(−66.05)		1.6	2.17	0.58

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(1) Common correlation estimator with country dummies and common correlated effects

(2) System GMM models are estimated on 5-years observations

The GMM method goes back to Arellano and Bond (1991), who propose a difference GMM estimator that transforms the regressors by first differencing, which removes the fixed country-specific effect. Moreover, the use of lagged levels of the regressors as instruments for the first-differenced regressors controls for endogeneity. However, lagged levels of the regressors are likely to be poor instruments for the first-differences equation. We therefore use an augmented version, which implies an efficiency gain over the basic first-difference GMM: a one-step System GMM estimator that goes back to Arellano and Bover (1995) and Blundell and Bond (1998). The System GMM estimator combines a set of first-differenced equations with equations in levels as a "system", using different instruments for each estimated equation simultaneously. This involves the use of lagged levels of the exogenous variables as instruments for the difference equation and the use of lagged first-differences of the exogenous variables as instruments for the levels equation. In addition, System GMM is a dynamic panel estimator that makes it possible to control for the dynamics of adjustment by including a lagged endogenous variable among the exogenous variables.

However, even though System GMM implies an efficiency gain difference GMM by using additional instruments, the System GMM does not completely resolve the problem of weak instruments, as not only lagged levels are likely to be poor instruments for differences, but differences are also likely to be weak instruments for levels (Roodman 2009; Stock and Yogo 2002). Hence, even though the System GMM model proposes the most comprehensive control for a variety of econometric pitfalls, it does not offer a complete control for endogeneity.

Moreover, the fact that the System GMM method uses more instruments than the difference GMM increases the risk that the estimation model is over-identified (Bowsher 2002; Roodman 2009). In order to reduce the number of instruments, we apply the System GMM estimator to edited data. We obtain quinquennial data by dividing the measured time period into five-year sections as follows: we use five-year means for the observations of the endogenous variable and observations of the beginning year of the respective mean for the exogenous variables for every country. This data transformation reduces the number of periods from over 40 to 10 and therefore implies a significant reduction in the number of instruments (from over 800 to around 100 depending on the number of exogenous variables). Moreover, the transformation of the data into quinquennial data allows us to limit time trends, because five-year intervals are less likely to be serially correlated than annual data. In addition, the transformed data makes it possible to intensify the control for endogeneity: for example, if a country's observation of *TFR* is the mean of the years 1980-1984, the corresponding observation of *lnGDPpc* is from 1980, which limits capturing impacts of fertility on GDP per capita.

However, the use of around 100 instruments still implies a significant risk of obtaining a severe overfitting bias (Bond 2002) and reduces the power of the Sargan test to detect invalid instruments (Bowsher 2002). In order to further reduce the number of instruments, we limit the number of lags of the instruments for the first difference and for the levels equation instead of using all available moment conditions. Moreover, we increase the length of the lag of the instruments. By doing so, we obtain a limited number of instruments that does not outnumber the degrees of freedom.

We report the number of instruments and the statistics of the Sargan test of over-identifying restrictions. The Sargan test tests the validity of the instruments and has a null hypothesis of "the instruments are exogenous as a group". A p-value above 0.05 makes it possible to accept this hypothesis. The Sargan difference statistics validate the extra moment restrictions imposed by the level equations in the System-GMM specification in comparison to the Difference-GMM specification.

Box Generalised method of moments applied to the analysis of fertility trends

References

Ahn, N., & Mira, P. (2002). A note on the relationship between fertility and female employment rates in developed countries. *Journal of Population Economic, 15*(4), 667–682.

Arellano, M., & Bond, S. (1991). Some test of specification for panel data. *Review of Economic Studies, 58*(2), 267–297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-component models. *Journal of Econometrics, 68*(1), 29–51.

Barro, R., & Becker, G. (1989). Fertility choice in a model of economic growth. *Econometrica, Econometric Society, 57*(2), 481–501.

Becker, G. (1960). An economic analysis of fertility. Demographic and economic change in developed countries. *NBER Conference Series, 11*, 209–231.

Becker, G. (1965). A theory of the allocation of time. *Economic Journal, 75*(299), 493–517.

Becker, G. (1981). *A treatise on the family*. Cambridge: Harvard University Press.

Becker, G., & Lewis, H. G. (1973). On the interaction between quantity and quality of children. *Journal of Political Economy, 81*, S143–S162.

Becker, G., Murphy, K., & Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of Political Economy, 98*(5), 812–837.

Blossfeld, H.-P. (Ed.). (1995). *The new role of women: Family Formation in Modern Societies*. Boulder: Westview Press.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*, 115–143.

Bond, S. (2002). Dynamic panel data models: A guide to micro data methods and practice. *Portuguese Economic Journal, 1*(2), 141–162.

Bongaarts, J. (2001). Fertility and reproductive preferences in post-transitional societies. *Population and Development Review, 27*(Supplement), 260–281.

Bongaarts, J. (2002). The end of the fertility transition in the developed world. *Population and Development Review, 28*(3), 419–443.

Bongaarts, J., & Feeney, G. (1998). On the quantum and tempo of fertility. *Population and Development Review, 24*(2), 271–291.

Bongaarts, J., & Sobotka, T. (2012). A demographic explanation for the recent rise in European fertility. *Population and Development Review, 38*(1), 83–120.

Boserup, E. (1970). *Women's role in economic development*. New York: St. Martin's.

Bowsher, C. G. (2002). On testing over identifying restrictions in dynamic panel data models. *Economic Letters, 77*(2), 211–221.

Butz, W. P., & Ward, M. P. (1979). The emergence of countercyclical U.S. fertility. *American Economic Review, 69*(3), 318–328.

Cagatay, N., & Özler, S. (1995). Feminisation of the labor force: the effects of long term development and structural adjustment. *World Development, 23*(1), 1889–1894.

Day, C. (2004). The dynamics of fertility and growth: baby boom, bust and bounce-back. *Topics in Macroeconomics, 4*(1), 14–132.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366), 427–431.

Doepke, M. (2004). Accounting for fertility decline during the transition to growth. *Journal of Economic Growth, 9*(3), 347–383.

Engelhardt, H., Kögel, T., & Prskawetz, A. (2004). Fertility and women's employment reconsidered: A macro-level time series analysis for developed countries, 1960–2000. *Population Studies, 58*(1), 109–120.

Engelhardt, H., & Prskawetz, A. (2004). On the changing correlation between fertility and female employment over space and time. *European Journal of Population, 20*(1), 35–62.

Furuoka, F. (2009). Looking for a J-shaped development-fertility relationship: Do advances in development really reverse fertility declines?. *Economics Bulletin, 29*(4), 1–8.

Galor, O., & Weil, D. N. (1996). The gender gap, fertility and growth. *American Economic Review, 86*(3), 374–387.

Goldin, C. (1994). *The U-shaped female labor force function in economic development and economic history*. NBER working paper n° 4707.

Goldstein, J. R., Sobotka, T., & Jasilioniene, A. (2009). The end of lowest-low fertility? *Population and Development Review, 35*(4), 663–699.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424–438.

Harttgen K., & Vollmer S. (2012). *A Reversal in the relationship of human development with fertility?* Courant Research Centre: Poverty, equity and growth—Discussion Papers 114, Courant Research Centre PEG.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251–1271.

Hotz, V.-J., Kerman, J.-A., & Willis, R.-J. (1997). The economics of fertility in developed countries: A survey. In M. Rosenzweig & O. Stark (Eds.), *Handbook of population economics* (1A ed., pp. 275–347). Amsterdam: Elsevier.

Jones L., Schoonbroodt A., & Tertilt M. (2008). *Fertility theories: can they explain the negative fertility-income relationship?* NBER Working Paper Series, 14266, Cambridge.
Kögel, T. (2004). Did the association between fertility and female employment within OECD countries really change its sign? *Journal of Population Economics, 17*(1), 45–65.
Kohler, H.-P., Billari, F. C., & Ortega, J. A. (2002). The emergence of lowest-low fertility in Europe during the 1990s. *Population and Development Review, 28*(4), 641–681.
Kohler, H. P., & Philipov, D. (2001). Variance effects in the Bongaarts–Feeney formula. *Demography, 38*(1), 1–16.
Krämer, W., & Neusser, K. (1984). The emergence of countercyclical US fertility: A note. *American Economic Review, 74*(1), 201–202.
Lesthaeghe, R. (2001). Postponement and recuperation: Recent fertility trends and forecasts in six Western European countries. In *Paper presented at the IUSSP seminar on "international perspectives on low fertility: trends, theories, and policies,"* Tokyo, 21–23 March.
Lesthaeghe, R. (2010). The unfolding story of the second demographic transition. *Population and Development Review, 36*(2), 211–251.
Lesthaeghe, R., & Surkyn, J. (1988). Cultural dynamics and economic theories of fertility change. *Population and Development Review, 14*(1), 1–45.
Levin, A., Lin, S. F., & Chu, C. S. (2002). Unit root tests in panel data: asymptotic and finite sample properties. *Journal of Econometrics, 108*, 1–24.
Luci, A. (2009). Female labour market participation and economic growth. *International Journal of Innovation and Sustainable Development, 4*(2/3), 97–108.
Luci-Greulich, A., & Thévenon, O. (2013). The impact of family policies on fertility trends in developed countries. *European Journal of Population,*. doi:10.1007/s10680-013-9295-4.
Macunovich, D. (1995). The Butz-Ward fertility model in the light of more recent data. *Journal of Human Resources, 30*(2), 229–255.
Mammon, K., & Paxson, C. (2000). Women's work and economic development. *Journal of Economic Perspectives, 14*(4), 141–164.
Martinez, D. F., & Iza, A. (2004). Skill premium effects on fertility and female labour supply. *Journal of Population Economics, 17*(1), 1–16.
Matysiak, A., & Vignoli, D. (2008). Fertility and women's employment: A meta-analysis. *European Journal of Population, 24*(4), 363–384.
McDonald, J. (1983). The emergence of countercyclical US fertility: A reassessment of the evidence. *Journal of Macroeconomics, 5*(4), 421–436.
Mocan, N. (1990). Business cycles and fertility dynamics in the United States. *Journal of Population Economics, 3*(2), 125–146.
Myrskylä, M., Kohler, H.P., & Billari, F. (2009). Advances in development reverse fertility declines. Nature, 460(6). doi:10.1038/nature.08230.
OECD. (2007). *Babies and bosses: A synthesis of findings*. Paris: OECD Publishing.
OECD. (2011). *Doing better for families*. Paris: OECD.
Philipov, D., Thévenon, O., Koblas, J., Bernardi, L., & Liefbroer, A. (2009). *Reproductive decision-making in a macro–micro perspective: State of the art.* European Demographic Research Paper 1.
Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346.
Rindfuss, R., Bumpass, L., & St. John, C. (1980). Education and fertility: Implications for the roles women occupy. *American Sociological Review, 45*, 431–447.
Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics, 71*(1), 135–158.
Sarafidis, V., & Wansbeek, T. (2012). Cross-sectional dependence in panel data analysis. *Econometric Reviews, 31*(5), 483–531.
Sobotka, T. (2004). Is lowest-low fertility in Europe explained by the postponement of childbearing? *Population and Development Review, 30*(2), 195–220.
Stock, J. H., & Yogo, M. (2002). *Testing for weak instruments in linear IV regression*. NBER Working Paper No. T0284.
Thévenon, O. (2011). Family policies in OECD countries: A comparative analysis. *Population and Development Review, 37*(1), 57–87. doi:10.1111/j.1728-4457.2011.00390.x.
Willis, R. (1973). A new approach to the economic theory of fertility behaviour. *Journal of Political Economy, 81*, S14–S64.

A.Luci-Greulich, O. Thévenon (2013): "The impact of family policy packages on fertility trends in developed countries." *European Journal of Populatio*n, Vol. 29 N° 4, pp.387-416. (cnrs cat. 3).

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The Impact of Family Policies on Fertility Trends in Developed Countries

L'influence des politiques familiales sur les tendances de la fécondité des pays développés

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Abstract We examine how strongly fertility trends respond to family policies in OECD countries. In the light of the recent fertility rebound observed in several OECD countries, we empirically test the impact of different family policy instruments on fertility, using macro panel data from 18 OECD countries that spans the years 1982–2007. Our results confirm that each instrument of the family policy package (paid leave, childcare services and financial transfers) has a positive influence on average, suggesting that the combination of these forms of support for working parents during their children's early years is likely to facilitate parents' choice to have children. Policy levers do not all have the same weight, however: in-cash benefits covering childhood after the year of childbirth and the provision of childcare services for children under age three have a larger potential influence on fertility than leave entitlements and benefits granted around childbirth. Moreover, we find that the influence of each policy measure varies across different family policy contexts. Our findings are robust after controlling for birth postponement, endogeneity, time-lagged fertility reactions and for different aspects of national contexts, such as female labour market participation, unemployment, labour market protection and the proportion of children born out of marriage.

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Résumé Nous examinons dans quelle mesure les tendances de la fécondité réagissent aux politiques familiales dans les pays de l'OCDE. En relation avec la ré-augmentation des taux de fécondité observés dans plusieurs pays de l'OCDE, nous testons l'influence de différentes mesures de politiques familiales sur la fécondité, sur un panel de 18 pays pour la période allant de 1982 à 2007. Nos résultats confirment que chaque mesure de cet ensemble (congé rémunéré, services d'accueil de la petite enfance et transferts financiers) ont en moyenne une influence positive sur la fécondité, suggérant que la combinaison de ces formes d'aides aux parents qui travaillent avec de jeunes enfants est susceptible de faciliter le choix d'avoir des enfants. Les différents instruments politiques n'ont toutefois pas le même poids : les prestations financières versées au-delà de la naissance et l'offre de service d'accueil pour les enfants de moins de trois ans ont une influence potentielle plus grande que les droits au congé et les aides financières associées à une naissance. De plus, l'effet de chaque mesure varie selon le contexte global constitué par les politiques familiales. Nos résultats sont robustes à différentes procédures testées pour contrôler les effets de recul de l'âge moyen à la naissance des enfants, traiter les problèmes d'endogénéité ou de décalage dans le temps de la réponse des taux de fécondité aux évolutions des politiques. Les variations de taux d'emploi des femmes, de taux de chômage ou de niveau de protection des marchés du travail sont aussi prises en compte.

Mots-clés Politiques familiales · Fécondité · Économie démographique · Emploi des femmes

1 Introduction

After decades of continuous decline, fertility rates have started to increase again in many OECD countries since the early 2000s. The overall rise is rather limited, with a total fertility rate (TFR) that reached a low of 1.63 in 1999 before rising to 1.71 in 2008, on average, in the OECD countries. However, many countries have experienced a more significant 'rebound', notably in Belgium, Denmark, Sweden, Czech Republic, Finland, France, the Netherlands, New Zealand, Norway, Spain, the United Kingdom and the United States. This reversal is arguably one consequence of the 'postponement' of childbearing across cohorts: delayed childbearing among the younger cohorts brought down period fertility rates, but this trend was later reversed, mainly in countries where fertility increased significantly among women aged 30 and above and was not counterbalanced by a further reduction at younger ages (Goldstein et al. 2009).

This paper studies the extent to which the development of government policies towards families with children in the last decades has contributed to these fertility trends. Its main novelty lies in the effort to consider a comprehensive set of family policy instruments and to identify the respective influence of each item of in-cash and in-kind support on fertility by taking into account a country's institutional context. The effect of paid leave entitlements, childcare services and financial transfers to families on fertility trends is analysed for the first time by putting together data on multiple policies for a large set of countries and for a period covering almost three decades. An original dataset has been elaborated for this purpose, covering 18 OECD countries and a period from 1982 up to 2007—the year preceding the ongoing economic crisis. Data series were obtained from combined OECD sources (mainly the family and social expenditures databases).

There is considerable evidence that family policies can influence the timing of births (for a survey, see Sleebos 2003; Gauthier 2007; Thévenon and Gauthier 2011), but less evidence that family policies help to significantly raise completed family size. Some cross-national studies investigate the isolated impact of money transfers, leave and childcare policies and expenditures for families on fertility rates (Gauthier and Hatzius 1997; Adsera 2004; D'Addio and Mira d'Ercole 2005; Hilgeman and Butts 2009; Kalwij 2010), but none of them take into account these dimensions all together (the details of these studies are presented in the last section as we confront their results with our own findings presented in the next sections).

Against this background, we assess the contribution of five different family policy instruments to variations in fertility. The panel structure of our data gives more information, variability and efficiency in comparison to time series or cross-sectional data, as it allows us to study the dynamics of adjustment and to distinguish between within-country and between-country variation.

Our contribution is threefold. First, we have broadened our scope with respect to the previous findings by considering three main types of policy instruments (cash transfers, parental leave and childcare), whereas earlier studies mostly concentrate on only one or two aspects. Two types of in-cash benefits are distinguished to separate the support granted around childbirth and the support provided later to cover the cost of raising children. Childcare is divided into spending and coverage. Thus, we can analyse the influence of different types of family support that supposedly respond to families' needs for time, money and services at childbirth and during the childrearing period. In addition, efforts are made to filter out possible effects on fertility of birth postponement and a country's institutional context (women's emancipation, unemployment, labour market protection, cultural child-bearing norms and the general Welfare state setting).

Second, we update previous results by focusing on a time period that covers the recent upswing in fertility rates. A key issue was thus the extent to which policies have contributed to this reversal of fertility trends.

Third, we apply panel data estimation methods that allow controlling for country- and time-invariant variables which is not possible in time series or cross-sectional studies. Most importantly, the data structure allows us to disentangle the 'causal' impact of policy changes from country-constant characteristics that may affect fertility levels by identifying within-country variations. Moreover, advanced estimation methods for panel data allow us to apply several robustness checks in order to control for potential endogeneity, non-stationarity, omitted variable bias (OVB) and for dynamics of adjustment.

We find that fertility trends are influenced by the long-term support parents receive in-cash but also in-kind, with the provision of childcare services that help parents (especially women) to combine work and family life. Our results confirm the positive influence on fertility of a mix of in-cash and in-kind support and suggest that the development of childcare services has a more significant impact on fertility trends at the aggregate level than policies extending leave entitlements. An increase in fertility seems, thus, to be happening as a by-product of better opportunities to combine work and family.

The second section presents theoretical arguments on why policies might matter by focussing on economic determinants of fertility, while the third section sheds light on cross-national differences in public spending on families and fertility in OECD countries since the early 1980s. The fourth section presents our empirical strategy, the fifth section discusses our results and the concluding sixth section puts our results into perspective.

2 Why Policies Might Matter for Fertility

Can family policies explain why in some developed countries, fertility is re-increasing? To understand the potential impact of family policies on fertility, this section presents the main economic determinants of fertility that exist in the theoretical literature.[1]

First of all, increases in income that come along with economic development affect fertility behaviour, but the impact is ambiguous. An increase in income might alleviate parts of the budgetary constraint that may prevent households from having their desired number of children. Thus, children get more 'affordable' with increasing income, which speaks in favour of a *positive income effect* on fertility (Becker 1960). At the same time, when income increases go hand in hand with increases in individual investments in human capital, families may find it optimal to have fewer children, as to provide each child with a higher level of human capital (*quantity/quality trade off;* Barro and Becker 1989; Doepke 2004). In addition, economic growth is also likely to increase women's education and wages (Galor and Weil 1996). Women might thus substitute childrearing against market labour participation due to increasing opportunity costs of staying at home (*negative substitution effect*, c.f. Mincer 1958). Consequently, higher wage earnings for women can be a causal factor of fertility decline (Blossfeld 1995; Hotz et al. 1997). The fertility decrease occurs all the more when the possibility to substitute maternal care by goods or purchased services is limited (Day 2004).

Family policies potentially contribute to re-increases in fertility as they can reduce the costs of fertility, either in monetary terms or in terms of opportunity costs. In this case, family policies would facilitate the income effect to dominate over the substitution effect.

[1] Family policies might influence fertility not only because they affect the economic determinants of fertility, but also because they impact and reflect the institutional and normative setting of a country and a society. However, a detailed discussion of cultural norms and institutional determinants beyond economic factors is outside the scope of this paper.

In highly developed countries, GDP per capita increases might be associated with fertility increases, as parents not only can bear the costs of children more easily but countries are also more likely to invest in family policies such as public childcare infrastructure, childcare subsidies, in-cash benefits, parental leave, etc.

This prediction meets the empirical findings that economic development (or income increase) reduces fertility only up to a certain point. Beyond a certain GDP level, further economic development is found to stimulate a slight increase in fertility rates (Myrskylä et al. 2009). Luci and Thévenon (2010) show that the fertility rebound, which can be observed even after controlling for birth postponement, has been steeper in those highly developed countries where women's labour market participation has also risen significantly over the last decades. This suggests that the impact of economic development on fertility can be positive if accompanied by better opportunities for women to combine work with family life (Ahn and Mira 2002; D'Addio and Mira d'Ercole 2005; OECD 2011). Thus, fertility trends are likely to depend on the extent to which family policies help households to combine work and family life.

Family policies provide parents with cash and in-kind resources and/or with possibilities to care for their children (due to parental leave). By these means, these policies support families' standard of living, help parents to cope with work and care responsibilities, and may thus help parents to realise their fertility intentions. On the one hand, family policies are able to reduce the direct, i.e. monetary costs of children (housing, education) by the help of financial transfers. On the other hand, policies that enable parents to combine work with childbearing (due to childcare services, parental leave) reduce the indirect costs of children caused by forgone wage opportunities (Willis 1973; Hotz et al. 1997). Hence, in a context of increasing aggregate income coming hand in hand with increasing women's emancipation (especially in terms of labour market participation), employment-protected leave entitlements after childbirth and public childcare services are likely to play a key role in re-increasing fertility rates (Rindfuss et al. 2010; McDonald 2006). These work–life balance policies can encourage mothers to continue working, encourage fathers to take a baby break from work and thus enable parents to share their family roles more equally (Gregory and Miller 2008). Therefore, these policies have a strong potential to reduce the gender wage gap. By this means, work–life balance policies are able to reduce opportunity costs for women, which can encourage fertility (OECD 2011).

3 Family Policies and Fertility in OECD Countries: Data and Trends

To estimate the impact of family policies on fertility trends in developed countries, we use five family policy measures as exogenous variables in our empirical analysis. Policy variables were constructed for 18 OECD countries,[2] for which information is available over the years 1982–2007. Three of the five family policy

[2] Denmark, Netherlands, Spain, Norway, Sweden, Portugal, France, New Zealand, Belgium, United States, Italy, Japan, Australia, United Kingdom, Ireland, Finland, Germany, Austria.

variables measure public expenditure per child. The first two concern benefits paid to families, divided into two categories to separate the support granted around childbirth from that received at a later stage:

- Spending per birth (in percentage of GDP per capita), including maternity, paternity and parental leave benefits as well as birth grants
- Spending on cash benefits per child under age 20 (in percentage of GDP per capita) (tax transfers and spending for childbirth not included)[3]
- Spending on childcare services per child under age three (in percentage of GDP per capita)[4]

Two further family policy variables are used to capture leave and childcare policies:

- The number of paid leave weeks, adding maternity leave weeks and the number of parental leave weeks that women are entitled to take after maternity leave per se
- Childcare enrolment of children under age three (as a percentage of the total number of children of this age group)

For most of our empirical analysis, we use Total Fertility Rates (TFR) as endogenous variable. The TFR by year and country is the best *available* measure to compare fertility trends between countries. However, TFR are likely to be biased measures of fertility, as they are sensitive to changes in women's mean age at childbearing. Birth postponement is likely to lower this period measure even if the completed family size stays unchanged. In order to control for changes in the timing of childbirth, we control our regression results for increases in mothers' age at childbirth. We also use tempo-adjusted fertility rates (adjTFR) besides general TFR as endogenous variable. Table 1 gives an overview of all variables used in our empirical analysis.

The deployment of family policy instruments varies with each country's approach to policy objectives, in which fertility issues may or may not play a part (Thévenon 2011; OECD 2011). Nevertheless, global spending for families with children has increased considerably over the past three decades in most OECD countries as a result of growing concerns on the part of governments to promote families' well-being and to reconcile work and family life. Figure 1 shows that the share of GDP spent by governments for families—disregarding expenditures on compulsory education—rose from an average of around 1.6 % in 1980 to 2.0–2.4 %

[3] The amount spent per child is calculated on the basis of the total number of children under age 20. Since the age limit of children for which a family can receive family benefits varies across countries, it has been set at age 20 to obtain a comparable population basis. Moreover, the levels of family and child benefits are likely to be higher in richer countries, i.e. countries with higher GDP per capita. For this reason, the generosity of support can be more usefully measured by comparing the relative effort made by countries to support families with children, which is given by the proportion of income per capita that countries devote to child benefit. It is also likely that fertility will respond to changes in this relative-to-average income measure over time.

[4] Expenditures per child are calculated on the basis of the total number of children under age three, whether or not they are enroled in childcare. A more accurate measure would be to consider only those children covered by childcare services, but time series on the number of children enroled in childcare services are not available.

Table 1 Summary statistics for 18 OECD countries, 1982–2007

Variable	Obs	Mean	Std. Dev.	Min	Max
Total fertility rate (TFR)	$N = 518$	1.9	0.27	1.16	3.23
	$n = 18$				
	$T = 28$				
Tempo-adjusted fertility rate	$N = 266$	1.85	0.22	1.34	2.36
	$n = 13$				
	$T = 20.4$				
Spending on cash benefits per child (%GDPpc)	$N = 517$	5.8	3.4	0.37	14.44
	$n = 18$				
	$T = 27.2$				
Spending per birth around childbirth (%GDPpc)	$N = 426$	22.07	21.68	0	107.36
	$n = 18$				
	$T = 22.4$				
No. paid leave weeks	$N = 551$	36.22	40.62	0	172
	$n = 18$				
	$T = 28.9$				
Enrolment young children (0–2) in childcare	$N = 341$	22.2	15.17	0.9	66
	$n = 18$				
	$T = 17.9$				
Spending on childcare services per child (0–2) (%GDPpc)	$N = 440$	15.4	14.64	0.06	53.39
	$n = 18$				
	$T = 23.1$				
Female employment rate (25–54)	$N = 500$	65.37	13.11	27.3	89.6
	$n = 18$				
	$T = 26.3$				
Women's avr. working hours	$N = 357$	1735.08	168.09	1244.73	2229.13
	$n = 17$				
	$T = 21$				
Unemployment rate (25–54)	$N = 476$	6.48	3.33	1.16	20.89
	$n = 18$				
	$T = 25$				
Labour market protection	$N = 434$	2	1.03	0.2	4.1
	$n = 18$				
	$T = 22.8$				
Share of non-marital births	$N = 415$	27.27	14.32	1	56
	$n = 18$				
	$T = 21.8$				
Mean age of mothers at 1st childbirth	$N = 359$	27.01	1.42	24.02	30.7
	$n = 18$				
	$T = 27.1$				

Data sources OECD Family, Social Expenditures and Employment Databases

N is the number of observations, n refers to the number of countries (e.g. the observation units), and T is the average number of period for which each variable is available

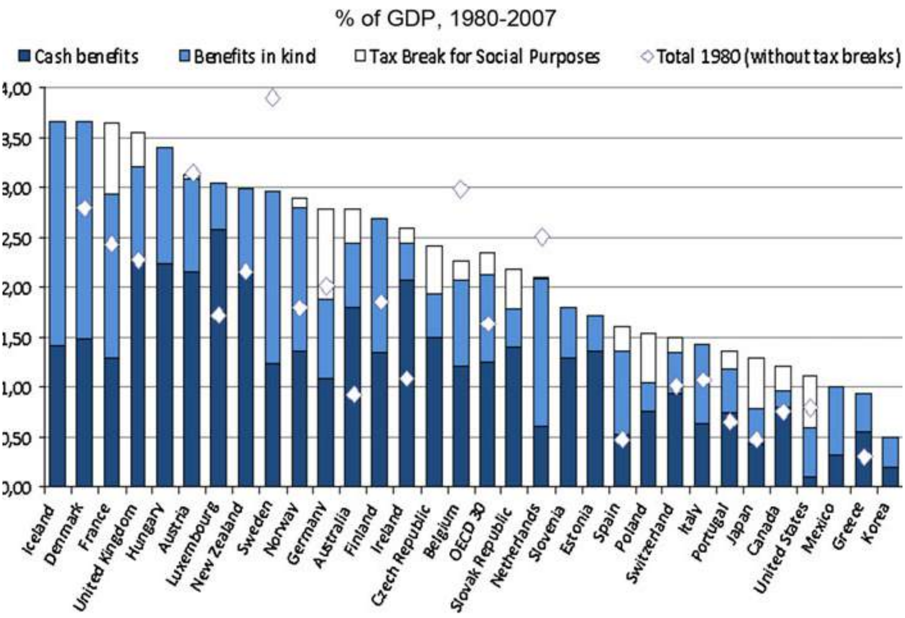

Fig. 1 Public spending on families Note: Countries are ranked in decreasing order of total family benefit spending in 2007. Expenditure includes child payments and allowances, parental leave benefits and childcare support (e.g. spending on childcare and preschool services for children under school age). Spending on health and housing support also assists families, but is not included here. For additional details, see data source. *Data source* OECD (2011)

in 2007 in the OECD. Yet, cross-country differences in the total amount transferred to families remain large, with Denmark, France, Iceland and the United Kingdom spending over 3.5 % of GDP for families, compared with just over 0.5 %, for example, in Korea.

The breakdown of spending into broad categories of policy instruments also varies greatly across countries. Overall, cash payments are often the main group of expenditures, representing 1.25 % of GDP on average. Child-related tax breaks are also quite widespread among OECD countries. Only 6 out of 32 OECD countries do not grant any specific tax deductions to families. Tax-related transfers for families include tax allowances on earned income, tax credits or tax deductions for services such as childcare. As Fig. 1 shows, a large majority of OECD countries provide such tax breaks, but their relative weight in overall support to families varies quite widely. They are the main levy to support families in the United States and represent a large share of the overall money transferred to families in France and Germany.

Some OECD countries have favoured developing in-kind benefits over cash transfers and education spending. Nevertheless, at almost 0.9 % of GDP on average in the OECD, in-kind expenditures for pre-school children still represent no more than 1/3 of total expenditures for families. Denmark, France, Iceland, Finland and Sweden are the 'big' service providers with total in-kind expenditures of over 2 % of GDP, i.e. more than twice the OECD average. A detailed description (and illustration) of variations over time and across countries of each of our five family policy variables can be found in Luci and Thévenon (2012).

Note that there are many different types of leave entitlements after childbirth in OECD countries. First, working mothers are entitled to a period of maternity leave (or pregnancy leave) around the time of childbirth which protects the health of the working mother and her children and guarantees that she can return to her job within a limited number of weeks after childbirth. Fathers are also entitled to specific paternal leave at the time of childbirth, but these entitlements cover a much shorter period. Then, parental leave entitlements allow employed parents to benefit from additional weeks of 'parental' and/or 'childcare' leave if they want to continue caring for their child beyond the standard period of maternity or paternity leave. Parental leave payment (all kinds of publicly paid parental leave and birth grants) is a key determinant of parental leave uptake. However, as leave payments (lump-sum benefit or wage substitution[5]) never fully replace the leave-taker's salary, and since women very often earn less than their partners, they are more likely than men to take all or the majority of the leave entitlement. Differences in duration and payment conditions of parental leave lead to substantial variations in the amounts of public transfers per child in terms of parental leave in OECD countries.

Childcare coverage for children below age 3 is increasing in most OECD countries, but differences in coverage and spending are still large. In Denmark, about 2/3 of under-3-year-old children have a place in day care centres, whereas in Austria, care services cover only 12 %. The most noticeable is also the relatively high enrolment rate of children in the US, despite the comparatively low public spending in this country. The development of the private sector explains this figure. This points to the absence of a strict linear relation or implication between the level of government spending and the coverage rate. This is not surprising since public investments depend not only on coverage rates, but also on parameters such as quality of services and the number of care hours available.

To sum up, OECD countries have considerably increased their expenditures to support families over the past decades. All types of support have been expanded to some extent: in-cash transfers towards families with children have been increased in many countries since the early 1980s, but the relative share of GDP per capita invested per child has grown at a slower rate since the mid 1990s or has decreased in some countries. Overall, remarkable differences still exist across countries in the way policy instruments are combined to provide support to families. Differences especially concern the extent and form of support provided to working parents with

[5] Overall, two types of leave schemes can be distinguished. First, countries which were pioneers in introducing parental leave entitlements provide comparatively long periods of leave (up to 3 years) with flat-rate payments, which make a return to the labour market difficult, especially for low-qualified women. Second, countries where leave entitlements were introduced later and/or reformed recently offer shorter periods of leave, often combined with earnings-related payments and special incentives for fathers to take up parental leave (Nordic countries, Germany). This second type of leave scheme promotes a combination of work and family life for both parents and encourages mothers to participate in the labour market before and after childbirth. Overall, a polarization between countries can be observed between the two leave schemes over time. Only Germany has radically changed its leave policy scheme from the first to the second type, resulting in a drastic reduction in the number of paid leave weeks from 2007 on (a period not covered in the present study).

children under age three (Thévenon 2011). In that respect, Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) outdistance the other OECD countries, providing comprehensive support to working parents with very young children (below 3 years of age). English-speaking countries (Australia, Canada, Ireland, United Kingdom New Zealand and the United States) provide much less in-time and in-kind support to working parents with very young children, while financial support is greater but very much targeted on low-income families and on preschool children. Continental and Eastern European countries form a more heterogeneous group with a more intermediate position. Two exceptions are France and Hungary, which provide relatively generous support for working parents compared with other countries of this group.

Figure 2 shows that in parallel to the fertility upturn in several OECD countries, average public expenditures for families in OECD countries increased over the same period.

However, a steep decline in TFR can be observed in Japan, Korea, German-speaking countries and in southern European countries, where fertility still remains low. By contrast, fertility rates have recovered strongly in countries of Continental and Nordic Europe, and in English-speaking countries. In some cases, this rise in public expenditures for families started to accelerate slightly before the fertility rebound.

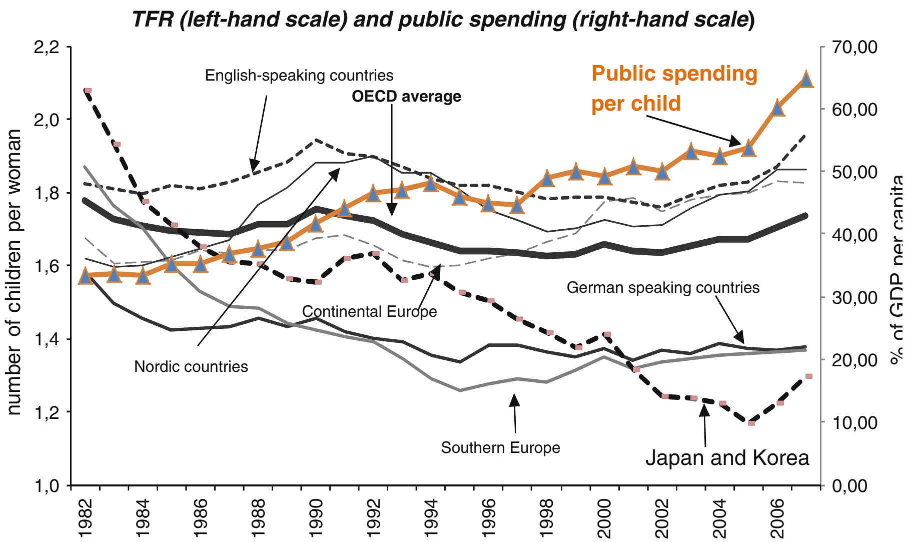

Fig. 2 Total fertility rates and average government spending for families TFR (*left-hand scale*) *and public spending* (*right-hand scale*) Geographical areas are defined as follows: Anglophone (Australia, Canada, New Zealand, United Kingdom, United States); Nordic (Denmark, Finland, Norway, Sweden); Continental (Belgium, France, the Netherlands); German-speaking (Austria, Germany); Southern Europe (Greece, Italy, Spain). Government spending per child includes expenditures on family benefits, childcare services, leave and other payments made around childbirth. The average is calculated for 18 countries for which data are available, including Denmark, Netherlands, Spain, Norway, Sweden, Portugal, France, New Zealand, Belgium, United States, Italy, Japan, Australia, United Kingdom, Ireland, Finland, Germany and Austria

In the following, we empirically assess the influence of these policies on fertility trends in OECD countries. Our empirical analysis aims at answering whether and how far the development of family policies is able to contribute to increases in fertility.

4 Empirical Procedure

We empirically estimate the linear impact of family policy variables on fertility while using information at the country level as well as on the time period level.[6] Several methodological issues are important to deal with in order to obtain accurate estimates of the influence of policy instruments. Potential bias due to the omission of explanatory factors that can be correlated with policies is addressed here notably by using a two-way Fixed Effects estimation model which helps controlling for unobserved fixed country characteristics as well as for time effects. Since these period effects can vary across countries, we also include in our specification country-specific time trends that capture idiosyncratic changes in national contexts. To distinguish between within- and between-country variations, we compare the results of the model with fixed effects with those of a Between Effects model.

Besides the control for potential methodological problems, we also test different specifications in order to control for birth postponement and other side effects that might influence fertility besides family policies, such as women's economic emancipation and a country's labour market characteristics. Last but not least, the influence of policies might vary across countries and more profoundly across Welfare States. These variations will then be scrutinized by measuring the influence of policy instruments conditional to the variations in family policy patterns.

In the following we describe the different steps of our empirical analysis in more detail, starting with the equation summarising the estimated model:

$$f_{\mathrm{it}} = \alpha_{\mathrm{i}} + \beta * p_{\mathrm{it}} + \lambda X_{\mathrm{it}} + T_{\mathrm{t}} + c_{\mathrm{i}} t + \varepsilon_{\mathrm{it}} \tag{1}$$

where f_{it} stands for fertility and p_{it} stands for our policy variables. X_{it} denotes other time-varying factors. T_{t} stands for period-specific fixed effect and $c_i t$ denotes country-specific time trends, α_{i} stands for country fixed effects and $\varepsilon_{\mathrm{it}}$ stands for country and time-specific random shocks.

The introduction of country fixed effects produces the same effect as when performing regressions in deviations from country means, i.e. it eliminates unobserved country-specific variables that are constant over time. The FE estimator

[6] Preliminary checks of data properties were done to verify that regression results are affected by potential non-stationarity or cross section dependence of data series (see Luci and Thévenon 2012 for details). Stationarity tests for individual country time series as well as panel unit root tests were, therefore, carried out. The results show that nonstationarity of fertility and policy variables in levels cannot be ruled out. However, the assumption of stationarity of first difference variables is not rejected in most cases by individual country and panel unit root tests. This suggests that System GMM estimations, which includes first differences as instruments might be an accurate way to control for non-stationarity of data series (Blundell and Bond 1998). Then, a Pesaran (2004) test of cross section dependence provides strong evidence for the presence of cross section correlation within the sample. The two-way fixed effects transformation eliminates cross section dependence in the data if policy parameters and the influence of the unobserved common factor(s) are identical across countries.

thus reduces the risk of OVB and also controls for the fact that fertility can be set at different levels across countries. By cutting out country heterogeneity, the FE estimator disentangles the impact of policy changes over time from country-constant characteristics that affect fertility.

Reverse causality can also create biases in the estimation of the influence of family policies on fertility trends. Measures of public expenditure *per child* are, in principle, not affected by increases in fertility, which limits (but does not eliminate) potential endogeneity problems. To further limit potential biases caused by endogeneity, a Two-Stage Least Squares model using time-lagged exogenous policy variables as instruments has been also carried out, of which results are shown in the Annex. Finally, we apply a System GMM estimator which controls for reverse causality, omitted variable bias, non-stationarity and dynamics of adjustment at the same time.

In the next step, we control the Two-Way FE model for birth postponement by adding mothers' age at first childbirth to the regressors, and by substituting the endogenous variable TFR with tempo-adjusted fertility rates (adjTFR). The tempo-adjusted fertility rate is intended to measure fertility levels within a given period in the absence of postponement (Bongaarts and Feeney 1988; Sobotka 2004). By weighting TFR by changes in women's mean age at childbirth, this adjusted measurement focusses on the quantum component of fertility changes.[7]

We compare the two-way FE model to a between effects and a random effects model (Hausman test, significance, goodness of fit) and find the FE model to be superior.

Next, we introduce a series of control variables among the regressors to our preferred estimation model, the country and time fixed effects estimation with country-specific time, as policy settings and fertility can also be influenced by the economic and institutional context. We control for female employment rates (women aged 25–54) and also add female average working hours to compensate for the fact that women's full-time equivalent employment rates are not available for large parts of our sample. We control for these variables, as the measured impact of family policies on fertility risks will be biased if policies affect female employment and women's working hours, which are correlated with fertility. For the same reason, we add unemployment rates (ages 25–54) and a measure for employment protection, which allows controlling for the labour market context. We also add the share of non-marital births as a proxy for changes and differences in gender and family norms.[8]

[7] However, *adjTFR* only corresponds to a pure quantum measure of fertility on the assumption of uniform postponement of all stages, i.e. an absence of cohort effects (Kohler and Philipov 2001). Consequently, *adjTFR* only controls imperfectly for tempo effects.

[8] The addition of control variables certainly causes multicollinearity problems. A correlation between exogenous variables implies that interpreting the estimated coefficients becomes difficult, as we cannot ascribe the change in the endogenous variable to a certain determinant. However, we are primarily interested in the sign and significance of the estimated coefficient of our five policy variables and not in quantifying the estimated impact of our control variables on fertility. As we consider the economic context, women's emancipation and societal norms as important factors for fertility, we prefer to reduce the risk of an omitted variable bias (OVB) by putting up with multicollinearity. At the same time, we abstain from introducing further control variables (one might think, for example, of access to and costs of housing and health care as other important determinants of fertility) to not further increase the problem of multicollinearity (and endogeneity) as well as to not further reduce the number of observations.

A final issue we look at is whether the effects of policies are the same in all countries, or dependent on their overall 'welfare state' context. In the models estimated so far, the effects are indeed assumed to be the same across countries, which is debatable as it suggests that policy measures have the same effective influence in all countries. It might be the case, however, that the effect of policies varies with the broad context of Welfare States which assign different roles to men and women and to public policies in providing welfare to families (Esping-Adersen 1999; Thévenon 2013). In order to investigate such possible heterogeneity, we run regressions that include interactions with country clusters taken from the categorization of family policy regimes provided by Thévenon (2013). Country dummies are thus replaced by dummies for four different patterns identified from the combination of a large range of key dimensions of family policies (English-speaking, Southern European, Nordic and Continental Welfare States as explained in the previous section), and then interacted with each of the policy variable.[9] The estimation model now takes into account multiplicative interaction between family policy variables and their context of implementation.

Fertility is now modelled as follows:

$$f_{it} = WS_i + \beta_2 p_{it} WS_i + \beta_1 X_{it} + T_t + c_i t + \varepsilon_{it} \qquad (2)$$

where the marginal effect ($\beta_2 WS_i$) of policy variables p_{it} is now assumed to be conditional on countries' Welfare State context (see Brambor et al. 2006 for more information on this type of models).

5 Regression Results

Columns 1 and 2 of Table 2 show the regression results for the OLS and the two-way fixed effects model, both with country-specific (linear) trends.

The OLS regression explains 35 % of the overall variation (without time trends). The FE regression obtains a goodness of fit of 14 % (without time trends and dummies), i.e. 14 % of the variations can be explained by between-country variations.

Even though within-country variations of family policies and fertility are smaller than overall variations, the fixed effects model produces more significant coefficients of policy variables, indicating that variations of policies over time within a country are important to explain the fertility variations in our dataset. The null hypothesis stating no impact of family policy settings on fertility can be rejected for three of our five policy variables: The FE results suggest a positive impact on fertility of income support over childhood, as measured by spending on cash benefits per child. This is also the case for spending per birth around childbirth

[9] Another approach to investigate heterogeneity consists in running estimations for each category of countries separately. However, the small sample size of each category leads to insignificant parameters which prevent us from showing the results. In this context, a more convincing approach is the one described above with dummies for types of welfare states replacing country dummies (and not complementing them in order to avoid over-specifications). Country-specific linear time trends are also dropped to avoid over-specification.

Table 2 The impact of family policies on fertility for 18 OECD countries (1982–2007)

Endogenous variable	Total fertility rate (TFR)			Tempo adj. TFR
Type of regression	Pooled OLS	Time and country fixed effects	Time and country fixed effects	Time and country fixed effects
Regressors				
Spending on cash benefits per child (%GDPpc)	0.0185** (2.72)	0.0424*** (4.70)	0.0421*** (4.62)	0.0843*** (6.83)
Spending per birth around childbirth (%GDPpc)	0.00136 (1.39)	0.00438*** (4.42)	0.00458*** (4.11)	0.000379 (0.32)
No. paid leave weeks	−0.0000603 (−0.22)	−0.0000193 (−0.08)	−0.000107 (−0.42)	−0.000869* (−2.09)
Enrolment young children (0–2) in childcare	0.000868 (0.68)	0.00675*** (3.78)	0.00785*** (4.45)	−0.000620 (−0.45)
Spending on childcare services per child (0–2) (%GDPpc)	−0.000709 (−0.67)	0.00279 (1.54)	0.00250 (1.30)	0.00137 (0.81)
Mean age of mothers at 1st childbirth			−0.0974*** (−3.79)	
Country-specific time trends	Yes	Yes	Yes	Yes
Time dummies	No	Yes	Yes	Yes
Country dummies	No	Yes	Yes	Yes
Constant	1.484*** (27.33)			
N	274	274	215	161
No. of countries*	18[a]	18[a]	16[b]	11[c]
Time period	1982–2007	1982-2007	1982–2007	1982–2007
R^2 (without dummies and time trends)	0.357 (overall)	0.137 (within)	0.388 (within)	0.552 (within)
R^2 adj.	0.345	0.051	0.314	0.505

t statistics in parentheses, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. They are based on the estimation of robust standard errors

[a] Australia, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK, USA

[b] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, New Zealand, Norway, Portugal, Spain, Sweden, UK

[c] Austria, Denmark, Finland, Ireland, Italy, Japan, Norway, Portugal, Spain, Sweden, USA

(leave and birth grants) and childcare enrolment. Expenditure on childcare per child has no significant impact on fertility when both childcare variables are included simultaneously in the regression. Regressions not reported here, which show that the two childcare coefficients do not change in sign or significance when either childcare enrolment or childcare expenditure are included separately.

Due to the higher significance of the estimated coefficients, we consider the fixed effects model as more appropriate for the purpose of our analysis in comparison to the OLS model. Moreover, as the FE model captures only within-country variations, this model is more appropriate than the OLS model for disentangling the 'causal' impact of policy changes over time from country-constant characteristics. Finally, the FE model reduces a potential OVB by eliminating country-specific variables that are constant over time.

We now control the Fixed Effects model for birth postponement. We add the mean age of mothers at first childbirth as control variable (column 3), and we substitute the endogenous variable TFR by tempo-adjusted fertility rates (column 4). Column 3 shows that within-country increases in the mean age of mothers at first childbirth goes hand in hand with decreases in TFR. At the same time, all significant policy variables keep their significance level and their positive sign even when controlling for birth postponement, suggesting that a combination of financial transfers and work–life balance policies is likely to encourage fertility. Similar results are obtained when substituting the mean age of mothers at first childbirth by their average age at childbirth when all their children are considered. The policy variables keep their sign and significance. However, the coefficient of mothers' average age childbirth, all children considered, is insignificant (results available on request). When TFR is substituted with tempo-adjusted fertility rates, childcare enrolment and spending per birth around childbirth lose significance. However, it would be imprudent to conclude that childcare coverage influences the timing of births more than the fertility 'quantum', because the use of tempo-adjusted fertility rates as endogenous variable considerably reduces the number of observations, since for 7 out of 18 OECD countries this variable is not available. As this concerns countries in which the recent fertility rebound has been quite large (such as France, the Netherlands, New Zealand, Belgium or the UK), estimation results based on tempo-adjusted fertility rates have only limited explanatory power.

Results for the Between Effects-, the 2SLS- and the System GMM-model are presented and discussed in the Appendix.

We now add further control variables to our FE specification. These control variables account for important factors of fertility besides family policies (women's emancipation, the labour market context and societal norms[10]). Table 3 presents the regression results.

For all specifications, all significant policy variables turn out to have a positive impact on fertility. Columns 1 and 2 present estimates of the impact on family

[10] We also add the log of GDP per capita (measured at purchasing power parity in constant 2005 US $) and its squared term to the five policy variables. This procedure allows controlling for a convex impact of economic development on fertility, as suggested by Luci and Thévenon (2010). GDP per capita turns out to have a convex but insignificant impact on TFR, as family policies seem to capture most of the fertility variations (results available on request).

Table 3 The impact of family policies on fertility: addition of *control variables*

Endogenous variable	Total fertility rate (TFR)				
Type of regression	Time and country fixed effects				
Regressors					
Spending on cash benefits per child (%GDPpc)	0.0371*** (4.07)	0.0191** (3.04)	0.0252*** (3.89)	0.0194** (2.84)	0.0298*** (3.86)
Spending per birth around childbirth (%GDPpc)	0.00507*** (3.83)	0.00292* (2.29)	0.00231* (2.01)	0.00285* (2.16)	0.00163 (1.18)
No. paid leave weeks	−0.000167 (−0.65)	0.000463* (2.09)	0.000430* (2.08)	0.000514* (2.24)	0.000620* (2.51)
Enrolment young children (0–2) in childcare	0.00473* (2.21)	0.00889*** (4.11)	0.00672** (3.12)	0.00860*** (3.60)	0.00789*** (4.08)
Spending on childcare services per child (0–2) (%GDPpc)	0.00332 (1.87)	0.00259* (2.07)	0.00277* (2.35)	0.00255 (1.89)	0.00178 (1.17)
Female employment rate (25–54)	0.0158** (3.23)	−0.000267 (−0.06)	−0.00586 (−1.47)	−0.000678 (−0.16)	−0.00326 (−0.60)
Women's avr. working hours		−0.000629** (−2.73)	−0.000767*** (−3.65)	−0.000621** (−2.70)	−0.000630* (−2.50)
Unemployment rate (25–54)			−0.0149*** (−3.82)		
Labour market protection				0.0178 (0.73)	
Share of out-of-wedlock births					0.00767 (1.75)
Country-specific linear time trends, country dummies and time dummies	Yes	Yes	Yes	Yes	Yes
N	268	228	228	222	191
No. of countries	16[a]	16[a]	16[a]	16[a]	14[b]
Time period	1982–2007	1982–2007	1982–2007	1982–2007	1982–2007

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, based on the estimation of robust standard errors

[a] Australia, Astria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, New Zealand, Norway, Portugal, Spain, Sweden, UK

[b] Australia, Astria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, New Zealand, Norway, Portugal, Spain, Sweden

policies while controlling for women's labour market participation. These estimates actually give the most important insight into the drivers of fertility presented in this paper. Column 1 shows that employment rates for women (aged 25–54) are positively correlated with TFR, while childcare enrolment is barely significant. Once we add women's average working hours to the control variables (column 2), however, childcare enrolment becomes a lot more significant, and childcare expenditure and the number of paid leave weeks also becomes significant. At the same time, financial transfers lose their importance for fertility. The fact that women's working hours are negatively correlated with fertility reveals that work–life balance policies such as childcare services and parental leave are important for fertility once women enter paid work. Even though financial transfers seem to be less important in comparison to work–life balance policies for women who work and want children at the same time, they are still relevant. This suggests that a mix of different family policies is the most efficient way to support families with children, as the needs of parents and children are very heterogeneous, not only between countries, but also between groups within countries.

Finally, adding further control variables to the exogenous variables does not change our conclusions. A mix of work–life balance policies and financial support is confirmed to be the most effective strategy to enable parents to realise their fertility intentions. Labour market insecurity, as measured by unemployment, has a significantly negative impact on fertility. This suggests that most households require financial security and a predictable future to start a family or to have more children, as underlined by Adsera (2011) and Sobotka et al. (2011).

Labour market protection and the share of non-marital births are both found to be insignificant. Both coefficients become significantly positive after female employment and female working hours are dropped, while the significance of family policy parameters does not change (results available on request).

Finally, Table 4 reports the results of regressions where Welfare State dummies are introduced and interacted with policy variables. We use TFR as endogenous variable, the five policy variables interacting with Welfare State dummies as endogenous variables, and we control for female labour market participation and women's average working hours. Here, coefficients of family policies measure the influence of family policies conditional to each Welfare State context. Variations in the association between policy variables and the TFR reveal the role of idiosyncratic characteristics attached to the different Welfare State contexts which seem to affect the effectiveness of policies.

The effect of coverage of childcare services for children under age three on fertility rates is found to be positive and strong in all welfare states except in the English-speaking countries. Nevertheless, the positive association fades when women's labour force participation is controlled for in Southern Europe, which suggests that an increase in childcare coverage has not been strong enough to boost both fertility and female employment rates at once. By contrast, the coefficient on childcare coverage gains in magnitude and statistical significance for Nordic countries once the variables on female labour market situation are included in the estimation. This suggests that fertility rates are, in these countries, raised by a

Table 4 The impact of family policies on fertility by types of Welfare States

Endogenous variable	Total fertility rate (TFR)	
Regressors		
Spending on cash benefits per child (%GDPpc)		
«Continental» Welfare States	0.008	−0.015
	(0.94)	(−1.51)
«English-speaking» Welfare States	*−0.000*	−0.003
	(−0.01)	(−0.37)
«Southern European» Welfare States	*0.041**	0.034
	(2.06)	(1.60)
«Nordic» Welfare States	*0.119****	0.06***
	(8.02)	(5.23)
Spending per birth around childbirth (%GDPpc)		
«Continental» Welfare States	0.003***	0.004***
	(3.50)	(4.49)
«English-speaking» Welfare States	*0.001*	0.001
	(1.17)	(1.01)
«Southern European» Welfare States	*−0.009*	−0.016***
	(−1.78)	(−4.04)
«Nordic» Welfare States	*−0.002*	−0.000
	(−0.60)	(−0.12)
No. of paid leave weeks		
«Continental» Welfare States	−0.000*	0.000
	(−2.30)	(1.71)
«English-speaking» Welfare States	−0.001	0.003
	(−0.31)	(1.19)
«Southern European» Welfare States	*−0.010****	−0.014
	(−4.19)	*(−1.81)*
«Nordic» Welfare States	*−0.003***	*0.003**
	(−3.14)	*(1.99)*
Enrolment young children (0–2) in childcare		
«Continental» Welfare States	0.007***	0.005*
	(3.66)	(2.44)
«English-speaking» Welfare States	*−0.000*	*0.005*
	(−0.07)	*(−1.56)*
«Southern European» Welfare States	*0.007****	*0.000*
	(4.24)	*(0.21)*
«Nordic» Welfare States	*0.003*	*0.010****
	(1.12)	*(5.85)*
Spending on childcare services per child (0–2) (%GDPpc)		
«Continental» Welfare States	−0.001	0.000
	(−0.68)	*(0.54)*

Table 4 continued

Endogenous variable	Total fertility rate (TFR)	
«English-speaking» Welfare States	*−0.002*	*−0.004*
	(−0.60)	*(−1.04)*
«Southern European» Welfare States	*0.002*	*0.002*
	(1.17)	*(1.03)*
«Nordic» Welfare States	*0.011***	*0.000*
	(2.80)	*(0.00)*
Female employment rate (25–54)	–	0.0008
	–	(0.35)
Women's avr. working hours	–	−0.0004*
	–	*(−2.12)*
N	274	228
No. of countries	18	18
Time period	1982–2007	1982–2007

t statistics in parenthesis, * *p* <0.05, ** *p* <0.01, *** *p* <0.001

All models include time and welfare state dummies, as well as country linear time trends in column 1 but their single effects are not reported. *t* statistics in parentheses from robust standard errors. Categorization of countries as follows: 'English speaking': Australia, Canada, Ireland, New Zealand, United Kingdom, United States; 'Southern European': Italy, Spain, Portugal; 'Nordic countries': Denmark, Finland, Norway, Sweden; 'Continental': Austria, Belgium, France, Germany, the Netherlands. Country-specific linear time trends are dropped to avoid over-specification

greater coverage of childcare services regardless of women's situation in the labour market.

Then, spending on cash benefits appears to be more important for fertility in Nordic than in the other areas where the related coefficient is not statistically significant. This suggests that the provision of support in-cash is especially effective in countries where the living costs are relatively high.[11]

The impact of spending per birth around childbirth on *TFR* appears to be positive in Continental countries, while the association between the two variables is either not statistically significant or negative in South Europe when controlling for female employment. Weeks of paid leave appear to also have a very weak role everywhere, but a negative association with fertility rates seems to hold in Southern countries, where only few weeks of maternity leave are paid even though they can be prolonged with a period of unpaid parental leave (not accounted here). A possible explanation of these findings is that the increases in spending on leave and birth grants, as well as in the duration of paid leave, may reflect the higher opportunity cost that working women have to bear when they have children in these countries where the development of childcare facilities started much later than in most others and where the lack of labour market flexibility makes the returns to work after a childbirth more difficult (Pissarides et al. 2005). By contrast, working women on

[11] Kurkowiak (2012) shows that price levels indexes for household final consumption are comparatively higher in Norway, Denmark, Sweden and Finland than in most other European countries.

leave receive earnings-related payment for a longer period in Nordic countries, where children are also more likely to be covered by childcare facilities upon the expiry of parental leave. Such a context makes it more likely for a lengthening of paid leave to have a positive incidence of fertility rates, as suggested by the positive (but weakly significant) coefficient obtained with the estimation controlling for female labour market situation.

6 Discussion

How do our results corroborate previous findings? In order to answer this question, we compare our findings to those of recent cross-national key studies which provide some assessments of the impact of family policies on fertility trends in economically advanced countries.[12] The findings of these studies differ for reasons such as the use of different fertility indicators and different policy variables, as well as different geographical and period coverages. Since we use a comprehensive range of policy markers, our results help to understand some of the contradictory results obtained by the former studies. The interpretation of our result is limited, however, by the fact that variations in TFR are a consequence of both changes in fertility timing and in the total number of children, and tempo-adjusted fertility rates provide debatable estimates of variations in fertility 'levels'. Comparing our results to those of other studies using other measures gives a clearer picture of the scope and limits of our own results. By doing so, some general conclusions on policy effectiveness can be drawn.

Table 5 summarises the key results of the most recent cross-national studies analysing the effect on fertility patterns of family policies in the areas of financial support, parental leave and childcare.[13]

Three studies—Gauthier and Hatzius (1997), Adsera (2004) and D'Addio and Mira d'Ercole (2005)—are directly comparable to our study as they use the same measure of fertility—TFR. Hilgeman and Butts (2009) use a different fertility measure, the number of children ever born for women aged 18–45. Kalwij (2010) uses retrospective data on fertility history to differentiate the influence of policies on the timing of births and completed family size.

Family policy characteristics are also captured with different indicators. A first difference lies in the way the generosity of financial support for families is measured. D'Addio and Mira d'Ercole (2005) use the difference in net disposable income of a single earner family with two children and average earnings compared to those of a childless household with same earnings to approximate the financial

[12] We review here only studies based on cross-national data, but many micro-level studies for single countries are available. For a more complete review, see Sleebos (2003) or Thévenon and Gauthier (2011).

[13] The list of key contributions could easily be extended if our aim was to survey the literature, which is beyond the scope of the present paper. In general, the evidence suggests that while family benefits do significantly reduce the direct and indirect costs of children, their effect on fertility per se is limited. Furthermore, while family benefits have an effect on the timing of births, their effect on the final fertility choices of individuals is contested (Thévenon and Gauthier 2011).

Table 5 Comparison of results of cross-national studies

		Gauthier and Hatzius (1997)	Adsera (2004)	D'Addio and Mira d'Ercole (2005)	Hilgeman and Butts (2009)	Kalwi (2010)		Present study
Explained variable		Or 3 and more children separately)	Total fertility rates	Total fertility rates	Achieved fertility at age 18–45	Timing of birth	Family size	Total fertility rates
Country and period—methodology		22 OECD countries 1970–1990—Panel data methods	28 OECD countries 1960–1997—Panel data methods	16 OECD countries 1980–1999—Panel data methods	20 OECD countries, 1995–2000 waves of European or World Value Surveys—cross-sectional multilevel approach	16 European countries—Event history analysis Information on individual fertility history from the European Social Survey 2004		OECD countries 1982–2007—Panel data methods
Childcare provisions	Enrolment rates				Positive	Not included		Positive
	Spending per child	–	–	–	–	No effect	Positive	Positive
Leave entitlements	Spending per child (all leave included)	–	–	–	–	Positive	No significant effect	Positive
	Payment rate of maternity leave	Negative but statistically insignificant	–	Positive	Not significant	–		–
	Duration	Positive but statistically insignificant	Positive	Negative	Negative	Not included		Positive
Financial transfer		Positive	–	Positive	–	No effect	No effect	Positive

support received by families. This covers family support provided by tax allowances as well as by cash benefits (although variations across different household types are not accounted for). By contrast, both Gauthier and Hatzius (1997) and Kalwij (2010) only consider family cash benefits. Gauthier and Hatzius (1997) measure the generosity of family benefits as a percentage of average wages, while Kalwij (2010) considers the average amount of public expenditures per child below age 16 for employed women. In our study, we use both approaches and obtain similar results for both measures of financial support.

Besides our study, three other studies consider the duration of paid leave entitlements (Gauthier and Hatzius 1997; D'Addio and Mira d'Ercole 2005; Hilgeman and Butts 2009). Hereby, D'Addio and Mira d'Ercole (2005) as well as Gauthier and Hatzius (1997) consider maternity leave only, whereas our study also takes into account the number of weeks of maternity and parental leave. Leave payment conditions are also assessed differently: replacement rates during maternity leave are taken into account by Gauthier and Hatzius (1997) and D'Addio and Mira d'Ercole (2005). Kalwij (2010) considers only the average leave-related expenditure per child below age one, while in our study we sum the annual expenditures per child for maternity and paternity leave, for parental leave and for birth grants.

Finally, only three studies include information about childcare services. Kalwij (2010) includes childcare expenditures (consistent with his expenditure-based approach), while Hilgeman and Butts (2009) test the impact on fertility of enrolment of children below age 3 in formal childcare. Our study includes both childcare expenditure and enrolment.

The results of the cited studies are quite diverse but some general conclusions can be drawn. The present study, like those of Gauthier and Hatzius (1997) and D'Addio and Mira d'Ercole (2005) but conversely to Kalwij (2010), finds that cash transfers have a positive effect on fertility. We also find that the average amount of cash benefits granted in the period after the year of childbirth has a large positive impact on TFR. This impact is confirmed when adjusted-tempo fertility rates are taken into account to control for changes in the timing of births, suggesting that these cash benefits impact not only the timing of births but also have a quantum effect on fertility.

Results regarding the influence of leave entitlements also vary across studies, which is not unexpected given the potentially ambiguous effect of these entitlements on fertility. On the one hand, these entitlements support household income and labour market participation around the time of childbirth, which has a positive effect on fertility. However, as entitlements are often conditional on employment, they encourage men and women to postpone childbirth (which has a negative effect on overall fertility) until they have established themselves in the labour market. This ambiguity is likely to explain the variable results reported in Table 3. Similar to Adsera (2004), we find that an increase in paid leave duration has a positive impact on fertility rates once we control for female employment and female working hours. Gauthier and Hatzius (1997) find a similar positive but not statistically significant result. Controversially, D'Addio and Mira d'Ercole (2005) find a negative impact, but their model does not control for the development of childcare services for children below 3 years of age. However, leave duration tends to be longer in countries where the provision of childcare services, which parents can substitute for parental care, is less developed. In these circumstances, it is very likely that the identified negative impact of leave duration captures partially the impact of a shortage of childcare services for very young children. In all, we find that the effect of the duration of leave entitlements is small.

The income received for childbirth in the form of payments associated with leave or birth grants also affects fertility behaviour, as pointed out by the different studies. D'Addio and Mira d'Ercole (2005) find a positive impact of maternity leave payments on fertility rates, while Gauthier and Hatzius (1997) find an insignificant impact. Our study, which combines a comprehensive measure of different kinds of payments received for childbirth, finds a small positive effect of leave payments on fertility. This small influence on TFRs (but not on the tempo-adjusted measures) is likely to illustrate a timing effect on childbearing, as suggested by Kalwij (2010) who finds that leave-related expenditures impact the timing of births but not completed fertility levels.

Evidence from cross-country and national studies almost invariably points to a positive effect of formal childcare on fertility patterns. Kalwij (2010) finds that childcare subsidies have no effect on the timing of births, but do have a positive effect on second and higher-order births and completed family size. Hilgeman and Butts (2009) find a significant effect of childcare enrolment on the total number of children ever born for women aged 18–45 in the early 2000s.[14] We also find a strong positive effect of childcare provision on fertility. This highlights the important role of childcare services in avoiding a conflict between childbearing and labour market participation for mothers. We find that not only family policy instruments but also female employment is positively correlated with fertility. The finding of a negative impact of female working hours on fertility suggests that possibilities to combine work and family life play an important role in women's decision to have children once they are actively participating in the labour market.

Moreover, when combining family policies with female employment and women's working hours, we find that all policy instruments (paid leave, childcare services and financial transfers) have a cumulative positive influence on fertility, suggesting that a continuum of support, especially for working parents, during early childhood is likely to facilitate parents' choice to have children. Nordic European countries and France are examples of this mix. Policy levers do not have similar weight, however. We find that in-cash and in-kind benefits covering the 1st year after childbirth have a larger potential influence on fertility than leave entitlements and benefits for childbirth.

Certain unobserved factors influence fertility behaviour by enhancing the effectiveness and coherence of the family policy mix (Thévenon 2013). Our results suggest that the effect of each policy measure on fertility varies with the Welfare State contexts which provide a more or less comprehensive support to households making the decision to have children and/or to combine work and family life. It also suggests that the relative influence of policy variables will vary all together, with for

[14] National studies for Nordic countries corroborate the positive effect of childcare on fertility rates (Rindfuss et al. 2010). They also find that reductions in the cost to parents of affordable good-quality childcare can have a substantial effect on fertility rates, especially when childcare provision is widespread (Mörk et al. 2009).

example, the provision of childcare facilities for children under age three having a larger influence in the continental area where the support in-cash is relatively advanced. Similarly, fertility rates are more sensitive to the duration of paid leave in Nordic countries where female employment rates and the provision of childcare services are higher than in most other countries. Other factors which are not identified may also have a role if they ensure that policy instruments support effectively parents' work–life balance, for example by avoiding a gap in the sequence of support between the expiry of leave entitlements and the provision of childcare services, by providing childcare services that match parents' working hours, or by guaranteeing a stability of policies over time.

Last, the results obtained when controlling for change in the timing of births and with tempo-adjusted rates of fertility suggest that policies can have quantum effects on fertility, i.e. parents do not only change the timing of childbirth, but they actually decide to have *more* children. However, the controls for birth postponement applied in this paper are imperfect. More accurate controls are necessary to be able to identify the pure quantum effect of family policies. Combining macro data with individual observations facilitates these controls. Micro data can reveal when, *in a life cycle perspective*, family policies encourage parents to have (additional) children. How family policies are linked to age-specific fertility is left to future exploration.

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Appendix

Robustness Checks

We compare the Fixed Effects model to a Between Effects (BE) and a Random Effects (RE) model. Results of the Between Effects model are presented in column 1 in Table 6. Results of the Random Effects model are available on request. We use a Hausman (1978) test to invalidate the hypothesis that the unobserved country effects are not correlated with the error term in the RE model. The test suggests that the fixed effect specification is better than a random effects specification for controlling for unobserved country heterogeneity. The BE estimation obtains insignificant coefficients for all policy variables. The insignificance along with the high R^2 and the relatively low adjusted R^2 indicate that unobserved country-specific effects explain most of the fertility variance in the Between Effects model. We, therefore, consider the BE model to be inappropriate for our empirical analysis and conclude that the country and time fixed effects estimation with country-specific time trends (column 2 of Table 2) is best suited to capture the impact of family policies on fertility. This means that variations of policies over time within a country are most important to explain fertility variations in comparison to between-country and overall variations.

Table 6 The impact of family policies on fertility: robustness checks

Endogenous variable	Total fertility rate (TFR)			
Type of regression	Between effects	2SLS[1]	2SLS[2]	System GMM[3]
Regressors				
Spending on cash benefits per child (%GDPpc)	0.0251 (1.74)	0.0364*** (4.98)	0.0341*** (4.16)	0.0139** (3.01)
Spending per birth around childbirth (%GDPpc)	0.00319 (0.57)	0.00583*** (4.99)	0.00529*** (3.64)	−0.00094 (−0.81)
No. of paid leave weeks	−0.00209 (−0.88)	0.000402 (1.69)	−0.000168 (−0.77)	−0.0000974 (−0.23)
Enrolment young children (0–2) in childcare	0.00997 (1.00)	0.00912*** (5.48)	0.0133*** (3.72)	0.00414** (2.66)
Spending on childcare services per child (0–2) (%GDPpc)	−0.00593 (−0.66)	0.00592 (1.95)	0.00661 (1.38)	0.0017 (0.89)
(TFR) $t-1$				0.713** (11.87)
Country-specific time trends	No	Yes	Yes	No
Time dummies	No	Yes	Yes	Yes
Country dummies	No	Yes	Yes	No
Constant	1.383*** (7.19)			0.269** (2.62)
N	274	253	195	59
No. of countries[a]	18	18	18	18
Covered time period	1982–2007 (yearly observations)	1982–2007 (yearly observations)	1982–2007 (yearly observations)	1985, 1990, 1995, 2000, 2005
R^2	0.439 (between)			
R^2 adj.	0.206			
Sargan (p value)				0.035
Sargan-difference (p value)				0. 078

Table 6 continued

Endogenous variable	Total fertility rate (TFR)			
Type of regression	Between effects	2SLS[1]	2SLS[2]	System GMM[3]
Instruments for first differences equation				First lag of all exogenous variables
Instruments for levels equation				First difference of all exogenous variables

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a] Australia, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK, USA

[1] Time and Country fixed effects (with robust SE) with 1-year lags of childcare variables as instruments

[2] Time and Country fixed effects (with robust SE) with 5-year lags of childcare variables as instruments

[3] System GMM on 5-year observations with lagged TFR among exogenous variables

Subsequently, we control our fixed effects model for endogeneity. Therefore, we introduce time-lagged exogenous variables, i.e. we instrument childcare expenditure and childcare coverage with its time-lagged levels, which also takes into account time-lagged adaptations of fertility to changes in a country's childcare context. One-year as well as 5-year lags are applied and results are presented in columns 2 and 3 of Table 6 (a discussion of the methodology is presented in the appendix). The results confirm a significant impact of spending on cash benefits; spending per birth and childcare enrolment when controlling for potential endogeneity. The estimated coefficient of childcare enrolment is higher for the model with 5-year lags than for the model with 1-year lags and the FE model presented in table, suggesting a considerable time-delayed response of fertility to changes in the supply of childcare facilities. This time delay seems to exceed 1 year, which is rather intuitive as fertility changes take at least 9 months to be realised.

The last column in Table 6 presents results of a System GMM estimation, which not only controls for endogeneity (along with OVB and non-stationarity), but also for dynamics of adjustment (by introducing a lagged endogenous variable among the regressors). Accounting for these dynamics is important as the impact of family policies on fertility is likely to depend on the countries' initial fertility level, as assumed, for example, by Gauthier and Hatzius (1997) and D'Addio and Mira d'Ercole (2005). In order to significantly reduce the number of instruments, which is necessary to avoid an over-identification of the model, the GMM estimation is based on data containing observations for every 5 years (1985–2005). The System GMM results confirm a positive impact of spending on cash benefits and childcare enrolment for fertility.

Between Effects Estimation (Column 1)

The between effects estimator is based on time averages of each variable for each country and, therefore, focusses on between-country variation, i.e. the BE estimator allows answering the question if and how far policy differences between countries explain differences in fertility between countries. Estimation with a mean group estimators (MG) also capture the heterogeneous influence of policies on fertility trends across countries (Pesaran and Smith 1995). However, since our panel is relatively short and especially unbalanced, the standard errors obtained with this procedure are quite high and probably overestimated (Coakley et al. 2001). *T* statistics might be affected, while the pooled and fixed effects estimators have an efficiency advantage over the mean group estimator in small *T* samples. For this reason, we do not report the results of MG estimation. They are available on request.

2SLS Estimations (Columns 2 and 3)

The use of lagged exogenous variables lessens the risk of obtaining biased and inconsistent estimators due to reverse causality between the endogenous and the exogenous variables. For example, TFR observed in 2007 cannot impact childcare expenditure in 2006. At the same time, it is likely that variations in fertility resulting from changes in childcare expenditure appear time-lagged. Of course, the use of time-lagged variables represents only a ‘second best’ option for controlling for endogeneity, as this procedure cannot completely rule out a potential estimation bias caused by reverse causality. The best option would be to substitute each family policy variable by a proper instrumental variable that is highly correlated with the family policy variable but not correlated with fertility. As variables which meet these requirements are not available, we put up with lagged observations as instruments for current policy observations. At the same time, the use of lagged exogenous variables allows us to account for possible time delays in fertility responses to policy changes. We, therefore, estimate our models with 1-year lags as well as with 5-year lags to see how far the timing of policy implementation corresponds to the timing of fertility change.

System GMM Estimation (Column 4)

Besides capturing the dynamics of adjustment (lagged TFR as exogenous variable), the System GMM estimation helps to control for endogeneity and omitted variable bias, and limits the risk of spurious regressions due to non-stationarity (Blundell and Bond 1998). To do so, the System GMM estimator combines a set of first-differenced equations with equations in levels as a ‘system’, and uses different instruments for each estimated equation simultaneously. This involves the use of lagged levels of the exogenous variables as instruments for the difference equation, and the use of lagged first differences of the exogenous variables as instruments for the levels equation. The use of lagged exogenous variables is useful to limit inconsistencies raised by possible endogeneity, while difference variables control for omitted (time constant) variables as well as for non-stationarity. Our analysis of time properties of the data (Appendix) suggests that all time series are difference stationary, implying that System GMM controls for non-stationarity by the integration of first-differenced equations. The controls are imperfect; however, as lagged levels are likely to be poor instruments for differences, and differences are likely to be weak instruments for levels. Moreover, the use of so many instruments produces a risk of model over-identification. In order to reduce the number of instruments, we apply the System GMM estimator to reduced data which contain only observations of every 5 years (1985–2005), highlighting long-term variations. Column 4 shows that lagged levels of fertility capture most of the fertility variations, i.e. the control for dynamics of adjustment lessens the informative value of the model intending to capture the impact of family policies on fertility. Moreover, the relatively small p values of the Sargan tests (not significantly higher than 0.05) suggest that our model still risks being over-identified. Hence, we prefer to continue robustness checks (Table 3) with the Fixed Effects specification.

References

Adsera, A. (2004). Changing fertility rates in developed countries: the impact of labor market institutions. *Journal of Population Economics, 17*(1), 17–43.

Adsera, A. (2011). Labor market conditions and fertility in Europe. *European Journal of Population, 27*(1), 1–32.
Ahn, N., & Mira, P. (2002). A note on the relationship between fertility and female employment rates in developed countries. *Journal of Population Economics, 15*(4), 667–682.
Barro, R., & Becker, G. (1989). Fertility choice in a model of economic growth. *Econometrica Econometric Society, 57*(2), 481–501.
Becker, G. (1960). *An economic analysis of fertility*. Demographic and Economic Change in Developed Countries. » NBER Conference Series 11, pp. 209–231.
Blossfeld, H.-P. (Ed.). (1995). *The new role of women: Family formation in modern societies*. Boulder: Westview Press.
Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115–143.
Bongaarts, J., & Feeney, G. (1998). On the quantum and tempo of fertility. *Population and Development Review, 24*(2), 271–291.
Brambor, Th., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. *Political Analysis, 14*, 63–82.
Coakley, J., Fuertes, A. M., & Smith, R. P. (2001). *Small sample properties of panel time-series estimators with I(1) errors*. Working Papers series, WP01-08, Financial Econometrics Research Centre.
D'Addio, A., Mira d'Ercole, M. (2005). *Trends and Determinants of Fertility Rates in OECD Countries: The Role of Policies*. Social, employment and migration working papers, no. 27, OECD, Paris.
Day, C. (2004). The dynamics of fertility and growth: baby boom, bust and bounce-back. *Topics in Macroeconomics, 4*(1), 132.
Doepke, M. (2004). Accounting for fertility decline during the transition to growth. *Journal of Economic Growth, 9*(3), 347–383.
Esping-Adersen, G. (1999). *The social foundations of postindustrial economies*. New York: Oxford University Press.
Galor, O., & Weil, D. N. (1996). The gender gap, fertility and growth. *American Economic Review, 86*, 374–387.
Gauthier, A. (2007). The impact of family policies on fertility in industrialised countries: A review of the literature. *Population Research Policy Review, 26*(3), 323–346.
Gauthier, A., & Hatzius, J. (1997). Family benefits and fertility: An econometric analysis. *Population Studies, 51*(3), 295–306.
Goldstein, J. R., Sobotka, T., & Jasilioniene, A. (2009). The end of lowest-low fertility? *Population and Development Review, 35*(4), 663–699.
Gregory, A., & Miller, S. (2008). Fatherhood regimes and father involvement in France and the UK. *Committee Work and Family, 11*(1), 61–84.
Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*, 1251–1271.
Hilgeman, Ch., & Butts, C. (2009). Women's employment and fertility: A welfare regime paradox. *Social Science Research, 38*, 103–117.
Hotz, V.-J., Kerman, J.-A., & Willis, R.-J. (1997). The economics of fertility in developed countries: A survey. In M. Rosenzweig & O. Stark (Eds.), *Handbook of population economics, vol. 1A* (pp. 275–347). Amsterdam: Elsevier.
Kalwij, A. (2010). The impact of family policy expenditures on fertility in Western Europe. *Demography, 47*(2), 503–519.
Kohler, H. P., & Philipov, D. (2001). Variance effects in the Bongaarts–Feeney formula. *Demography, 38*(1), 1–16.
Kurkowiak, B. (2012). *Major dispersion in consumer prices across Europe*. Comparative price levels in 37 European countries for 2011, Statistics in Focus, 26/2012, Eurostat, Luxembourg.
Luci, A., Thévenon, O. (2010). *Does economic development drive the fertility rebound in OECD countries*? INED working paper n°167.
Luci, A., Thévenon, O. (2012). *The impact of family policy packages on fertility trends in developed countries*? INED working paper n°174.
McDonald, P. (2006). Low fertility and the state: The efficacy of policy. *Population and Development Review, 32*(3), 485–510.
Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy, 70*(5), S50–S79.

Mörk, E., Sjögren, A., Svaleryd, H. (2009). *Cheaper child care, more children.* Document de treball de l'IEB 2009/2.

Myrskylä, M., Kohler, H. P., Billari, F. (2009). Advances in development reverse fertility declines. *Nature*, *460*(6), doi:10.1038/nature08230.

OECD. (2011). *Doing better for families*. Paris: OECD Publishing.

Pesaran, M. H. (2004). *General Diagnostic Tests for Cross Section Dependence in Panels.* IZA Discussion Paper No. 1240.

Pesaran, M. H., & Smith, R. P. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics, 68*(1), 79–113.

Pissarides, C., Garibaldi, P., Olivetti, C., Petrongolo, B., & Wasmer, E. (2005). Women in the labor force: How well is Europe doing? In: Boeri, T. & Del Boca, D., Pissarides, C (Eds.) *Women at work: an economic perspective* (pp. 9–120). Oxford: Oxford University Press. ISBN 0199281882.

Rindfuss, R., Guilkey, D., Morgan, Ph, & Kravdal, O. (2010). Childcare availability and fertility in Norway. *Population and Development Review, 36*(4), 725–748.

Sleebos, J. E. (2003). *Low fertility rates in OECD countries: Facts and policy responses.* OECD Social, employment and migration working papers, No. 15. OECD: Paris.

Sobotka, T. (2004). Is lowest-low fertility in Europe explained by the postponement of childbearing? *Population and Development Review, 30*(2), 195–220.

Sobotka, T., Skirbekk, V., & Philipov, D. (2011). Economic recession and fertility in the developed world. *Population and Development Review, 37*(2), 267–306.

Thévenon, O. (2011). Family policies in OECD countries: A comparative analysis. *Population and Development Review, 37*(1), 57–87.

Thévenon, O. (2013). Institutional settings of having children: A comparison of family policy development across Europe. In J. Klobas, A. Liefbroer, & D. Philipov (Eds.), *Reproductive decision-making in a micro-macro context*. Unpublished manuscript.

Thévenon, O., & Gauthier, A. (2011). Family policies in developed countries: A fertility booster with side-effects. *Community Work and Family, 14*(2), 197–216.

Willis, R. (1973). A new approach to the economic theory of fertility behaviour. *Journal of Political Economy, 81*, S14–S64.

O. Thévenon, A. Luci (Greulich) (2012): "Reconciling work, family and child outcomes: What implications for family support policies?" *Population Research and Policy Review*, (2012) 31: 855. *(*cnrs cat. 4).

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Reconciling Work, Family and Child Outcomes: What Implications for Family Support Policies?

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Abstract This paper discusses the potential of family policies to reconcile the multiple objectives that they are expected to serve, over and above their role in offsetting the economic cost of children. We start by emphasizing the need to consider the multiple challenges that family policies in European Union—and/or OECD—countries have to address through a broadening of the standard economic approach to the cost of children. Policies indeed aim to reduce the "direct" monetary cost of raising children, but they also aim to minimise the indirect cost arising from the incidence of children on the parents' work-life balance and on the aggregate level of employment. Moreover, motives for policy intervention such as concerns about child development, gender equity or aggregate fertility levels are not fully captured by cost measurements. We thus analyse how, and to what extent, family policies can successfully reconcile these multidimensional objectives. We offer a holistic approach, pointing out that a coherent family policy mix supporting working parents with preschool children is the only way to reconcile or limit the conflicts between work, family and child outcomes. Three main dichotomies are identified to explain cross-country differences in family policy packages: the emphasis on poverty alleviation; the supposed antagonism between fertility and female employment; and the potential conflict between this latter and child development. Ways to reconcile these objectives and to improve the effectiveness and efficiency of family policies are further discussed.

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The "modernisation" of policies supporting parenthood and families has become an increasing concern raised by several international bodies such as the OECD and the European Commission: policies should be more effective in creating conditions conducive to child-raising, in supporting women's participation in the labor force and gender equality, and in improving the social integration of families and the well-being of children (OECD 2009a, 2011). Family support policies are expected to play a crucial role, not only in enabling people to have the number of children they want, thereby contributing to demographic renewal, but also in combating child poverty. Moreover, the modernisation of policies supporting parenthood is key to promoting equal opportunities for women and men, for parents and non-parents and for children from different backgrounds, and, ultimately, for the success of the European "Lisbon strategy",[1] which depends, to a significant extent, on increasing the labor force participation of women.

The purpose of this paper is to discuss the challenge of adapting family policies to their multifaceted objectives in EU and OECD countries. In this perspective, we provide an overview of the existing knowledge about how and to what extent family policies succeed in offsetting the "cost" of parenthood and in supporting the well-being of families. We point out that a comprehensive assessment of family policies calls for a broader approach, over and above the standard measurements of the economic cost of raising children. Family policy is multifaceted and involves a range of objectives. These include combating child and family poverty and promoting child development and well-being by helping households to bear the costs associated with children. They also include mobilising female labor supply and promoting gender equality by making it easier for parents to combine work and family responsibilities. This, in turn, is expected to help households to have the number of children they desire at the time of their choice. The role of family policies is to create a context where these different primary objectives are compatible, although relative priorities may vary across countries (Thévenon 2011; OECD 2011). The way in which objectives are framed, and the policy instruments used to achieve them also differ widely from country to country.

In this context, a proper assessment of the economic "private cost" of children, measuring their specific impact on households' standard of living and expenditures, is needed. However, focussing on these direct "consumption" costs is not sufficient to encompass the many concerns that family policies have to address. Indirect costs that arise from labor market interruptions or part-time working after childbirth also need to be considered (this concerns the wage loss in particular).

[1] Action and development plan for the economy of the European Union between 2000 and 2010, set out by the European Council in Lisbon in March 2000. One explicit objective of this plan is to raise female employment rates to min. 60 % in all European countries, and to develop formal childcare services accordingly.

By revealing the multidimensionality of child costs, this article shows how family policies should be designed to offset these costs in a coherent and comprehensive way. Our article adopts a novel holistic approach by assessing the multiple objectives of family policies, such as poverty alleviation, gender equality and child development. Most existing studies, many of which are discussed in this article, limit their focus of analysis to only one of these three main objectives. We point out possible conflicts as well as possible synergy effects among different family policy objectives and measures, and determine their joint impact on the economic, social and demographic progress of different countries. Our main question is to determine how different family policy instruments can succeed in reconciling work, family and child outcomes. We identify two pillars for a coherent, efficient and equitable family policy mix by showing that a combination of universal and targeted assistance is necessary to guarantee complementarity as well as continuity of support for children and parents. A key point is also that policies which help women to remain in employment and which promote a gender equitable division of paid employment and childcare seem to go hand in hand with better income and child outcomes.

In the first section, we see how the costs of children borne by households are determined under the standard economic approach, and point up the limits of this approach for the design of family policies. In the next step, we present evidence on employment, family and child outcomes in Western countries and identify the differences in policy mix that are central to explaining these outcomes. We cover EU and OECD countries by using the OECD Family Data Base as well as the Eurostat ESSPROS data base as main sources. We then discuss the general policy orientations that may produce the most effective balance in work, family and child outcomes. Relevant questions for policy makers are identified, and policy responses emerging from the literature review are explored from an internationally comparative perspective.

Broadening the Assessment of the "Costs" of Children: A Challenge for Policy

Most analyses of the economic cost of children and its impact on work and family behaviour have their roots in the fertility decision model pioneered by Becker (1960), where demand for children is a function of their costs and of individuals' (or couples') "preferences" for (choice of/taste for) a given level of income. The model is based on the idea that children are a special type of goods, i.e. a long-lived asset that produces a flow of "welfare" (satisfaction/well-being) entering into the parents' utility function. Within this framework, the "costs of children" can be reduced by cash benefits and tax credits to families with children, and by childcare subsidies. Such family policies help parents to make ends meet and ensure that parents are not substantially worse off in comparison to families without children. They may thus help parents to realise their fertility intentions (Thévenon and Gauthier 2011).

Analysing and recording the costs of children is of crucial importance for determining a government's contribution to reducing these costs for parents.

Identifying what parents pay directly to raise their children is not sufficient, however.

Besides current consumer spending, expenditures not directly linked to consumption, such as housing costs, which vary widely with the presence and the number of children, must also be included. In addition, the opportunity costs of children caused by a reduction or cessation of paid work must also be taken into account: having children implies "indirect" costs for parents in the form of short- or long-term earning losses. These indirect costs are not gender neutral as it is generally women who leave paid work to raise children (Misra et al. 2011).

The "Direct" Costs of Children (Consumption Expenditure)

The direct budgetary costs correspond to the additional consumption expenditure (i.e. for food, clothing, care, education, housing, …) of households with children compared to those without children. Conventionally, these costs are estimated in terms of "loss" of living standard caused by the presence of children, while taking into account scale effects related to family size. The available income is divided by the number of "equivalent-adults", a factor representing the number of people in the household, before examining the budget allocations. Due to economies of scale, the relative cost of an additional person in the household is assumed to decrease with the household size. Moreover, a child costs less to the household budget than an adult, and its cost decreases with birth order: the second or third child thus costs less than the first. The cost of each additional adult and of the children is defined in relation to the first adult, which makes it possible to define scales of equivalence ("equivalent-adults"). Hence, living standard comparisons between households are based on equivalence scales that set the available income in relation to the household size. To estimate the costs of children, comparisons are made between households with the same income characteristics but with different numbers of children. The direct costs are estimated based on the consumption changes associated with the presence of children. These changes not only reflect the children's consumption, but also that of parents who change their own consumption after the birth of a child.

Assessing properly how the presence of children affects household standards of living is crucial for keeping families out of poverty and for limiting the inequalities that can arise between families and childless households. There are several limits to this approach, however. A first limit lies in the constraints surrounding the definition of individual "welfare" (wellbeing/happiness created by the presence of children). First, preferences/tastes for income and consumption are stated as similar for households with or without children, so any change in these preferences due to the birth of a child is ignored. This may be a serious limitation since the arrival of a child certainly creates additional costs, but also represents a positive component for the parental "welfare" function in the case of parental altruism. Hence, the presence of children is itself a source of "welfare", counterbalancing the direct cost of raising children. Thus, a more complete approach should include this positive impact of children on household "welfare" or "well-being", even though the additional welfare created by the presence of children is certainly difficult to quantify and differs between households.

Another hypothesis is that levels of consumption of adult-specific goods are related to standard of living, which implies that there is no substitution between goods due to the presence of children. In this case, household welfare can be written as the sum of separable functions of parental consumption, child-specific consumption and household socio-demographic characteristics. There are situations where this property of separability is not verified, however (Nelson 1993).

An additional limit is that the estimation presented above considers the household as a unitary decision-making entity, and consequently ignores the question of the differential incidence of child costs on adult members of the household. However, consumption decisions are more likely to result from a collective rational decision-making process. In this case, the share of the household budget spent on children and the associated cost depends on the rule of income sharing, and on the bargaining power of household members (Apps and Rees 2002; Browning et al. 2006). The literature on intra-family allocation shows that expenditures on child-specific goods are higher when the female partner has greater control over the household budget (Lundberg et al. 1997). Recent developments in welfare comparison of households have been extended to account for equivalence scales under the collective approach to household decision making (Browning et al. 2006). Child-related equivalence scales have not yet been clearly identified in this context, however, given the complexity of deriving testable restrictions.

Last but not least, the budgetary cost considered up to now does not take into account the “time-costs” due to the time invested by parents in raising their children (i.e. the loss of individual leisure time). These “time costs” can be relatively high, however, particularly in the child’s early years (Craig and Bittman 2008; Bradbury 2008; Fig. 1). The inclusion of time costs in the estimation of direct costs of children is not straightforward since they depend on the negotiations that take place within households and on the “price” that serves as a reference to place a value on this time. However, their inclusion can double the estimated value of the full costs of children (Apps and Rees 2002). In this context, the use of informal or formal services to care for children saves parental time and consequently helps to reduce the time cost of children. The decision to purchase childcare services results here from a trade-off between the direct costs of these services and the value of the time saved by each parent. The lack of available informal and formal support limits the opportunities for such a trade-off, however.

The choice between formal and informal childcare is also limited by relatively rigid gender-specific social norms whereby mothers are expected to play a greater role in childcare than fathers. Gender norms exist in all countries, but are stronger in some countries (Southern Europe, Germany…) than others (France, Nordic countries…). In Germany, for example, women who have children and work full time are still seen as bad mothers (“Rabenmütter” in German), whereas in France working mothers are the norm and it is rather the stay-at-home mums who get stigmatised as “mother hens” (“mère poule” in French) (Salles et al. 2010). The evolution of gender norms seems to be closely related to variations in the institutional context of support to working parents (Anxo et al. 2007), i.e. countries

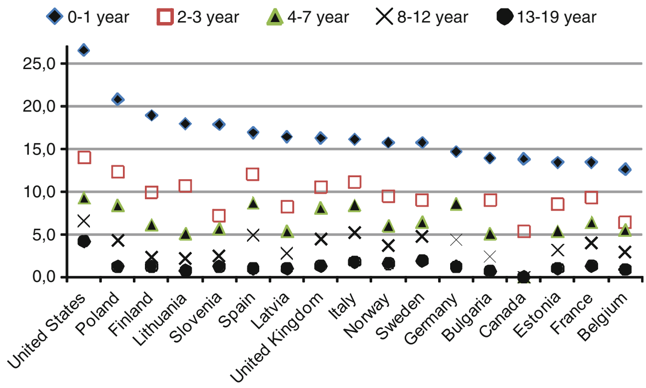

Fig. 1 Proportion of time spent by mothers on care work by age of the youngest child. Countries are ranked by decreasing time spent by mothers with children under age 1. Care work refers here to the provision of personal care but also the supervision and the education of a child, including reading and talking with children, as well as transporting children. Going together to the cinema, watching television with a child, etc. are considered as primary leisure activities, with childcare seems as a secondary activity. *Source* OECD Family Database (2011)

with higher childcare coverage, for example, tend to have higher maternal labor force participation rates and less rigid gender roles. In these countries, men spend more time in unpaid work, but in all countries, women still do more unpaid work than men each week, independently of their labor market involvement (Miranda 2011).

In addition, the presence of children also generates indirect costs due to their impact on parents' employment patterns and the accompanying long-term consequences. Hence, the costs of children can be much higher when their "indirect" components are taken into account.

The Indirect Costs of Children

The "indirect" costs of children represent basically the income loss of households due to an interruption of paid labor or a reduction in working hours due to the presence of children.[2] In contrast to the direct costs of children that are shared more or less equally among household members, mothers are the primary bearers of these costs, as reflected by the time they invest in childcare compared with men (Gauthier et al. 2004; Miranda 2011). Nevertheless, other household members can also be affected to the extent that income is pooled in the household (and that the tax bill depends on pooled income).

The main (measurable) element of these indirect costs is the immediate earnings loss due to the interruption of labor market participation (lower earnings in the medium and long run, which are caused by lower career prospects associated with

[2] The analysis of indirect costs is limited to measurable, indirect economic costs. Non-economic indirect costs or economic indirect costs that appear only in the medium and long term are not taken into account by most statistics (as for example the loss of networks and social contacts or the loss of skills which can reduce future income options…).

the raising of children, are much more difficult to estimate). Because women have to allocate time between work and care, they often leave their job after the birth of a child. Consequently, mothers stop accumulating human capital during the period of interruption. The loss of "human capital" (competences, knowledge, skills) can only partially be restored after returning to work.

In the long run, the acquisition of human capital and the wage progression of parents (mothers mostly) will be lower than if they had not stopped working, even if they later return to work. Moreover, the pension losses of mothers caused by their interruption of paid labor and their decelerated wage progression must also be considered when estimating the indirect costs of children.

Moreover, anticipating such an interruption, women may be inclined to "self-select" into jobs where the loss of "human capital" in case of career interruption is limited. The expectation of discrimination in the labor market can also be an important factor reinforcing such a self-selection process. In most OECD countries, women with children are, for example, overrepresented in service-sector jobs that provide flexible working hours but do not pay much and offer few career perspectives (hotel and catering, sales, education, health…). This selection into certain sectors (horizontal segregation) and into lower hierarchical levels (vertical segregation) contributes to the fact that women tend to have fewer earnings and weaker social security protection than men (Luci 2011).

Caring responsibilities are also one of the main reasons for women's overrepresentation in part-time work (OECD 2010, 2011). For many women, the choice of part-time work is constrained by lack of access to affordable high quality childcare, and short and/or irregular school hours. A regulatory framework has been developed by many western countries in the past decade to ensure equal treatment of part-time and full-time workers. However, there is a penalty to part-time work as, on average, it is characterised by lower hourly earnings, less training, fewer promotion opportunities, less job security and less access to unemployment insurance. This situation can lead to long-term costs in terms of earnings and social protection since the return to full-time work is postponed and generally not very frequent (Misra et al. 2011; Thévenon 2009).

The literature provides some estimation of these costs and investigates the determinants of the "family earnings gap", i.e. of the foregone earnings which can be attributed to the incidence of children. These investigations are useful to explain differences in earnings between mothers and childless women, and between men and women. Comparative analyses of the differences across European/OECD countries are also available (Harkness and Waldfogel 2003; Davies and Pierre 2005; Sigle-Rushton and Waldfogel 2007). All these studies agree that, among European countries, the UK and (West) Germany have similar family earning gaps, with higher indirect costs of children than in France or Sweden, for example. Davies and Pierre (2005) present estimates of the pay penalty associated with motherhood for 11 European countries using the European Community Household Panel Survey. They find that significant penalties in pay also exist in Denmark, Ireland, Spain and Portugal.

Sigle-Rushton and Waldfogel (2007) estimate that a working mother with two independent children (ages 25 and 27) in Germany and the Netherlands has, on average, only 42–46 % of the cumulative earnings of otherwise similar female employees. The proportion is 58 % in the United Kingdom, but the "family gap" is much smaller in Finland, Norway, Sweden or the United States where mothers earn 80–89 % of non-mothers' earnings. Income losses incurred by mothers in the first 2 years after childbirth are also substantial in Canada (Zhang 2010). However, Canadian mothers returning to work seem to regain the lost earnings within about 7 years following childbirth, and this effect is strongest for mothers returning to work for their original employer. By contrast, Davies and Pierre's (2005) findings for Germany (using the German Socio-Economic Panel) and the UK (using the British Household Panel Survey) also reveal that career breaks contribute to lower earnings growth. While periods of family formation are associated with lower earnings growth in Germany, in the UK completed spells of family formation are associated with a recovery in earnings growth.

Finally, there are other indirect costs of children caused by women's career interruptions after childbirth, which must be taken into account at a collective level. These collective costs only appear in the medium and long run and are "macroeconomic" costs in terms of GDP (aggregate income on the country level). It is acknowledged by the scientific community today that women's education, employment and income are fruitful for all of society, as female economic participation increases a nation's "talent pool" (quantity and quality of the work force) and raises investments in children (education and health in particular) (Klasen 2002; OECD 2012). Consequently, mothers' lower levels of education, labor market participation and income prevent countries from fully realising their "growth potential". This clearly suggests that the lack of work-life balance policies generates high social costs by making it difficult for parents to combine work and family life. Policies enabling parents (and especially mothers) to achieve a work-life balance are thus are key to limiting the "cost" of raising children—not only for parents but for the society as a whole. The fact that a large share of the population is affected by these costs is one argument that can be used by governments to justify investing in these kinds of public policies. The benefits that can be derived from these policies are a crucial factor in establishing their legitimacy. Some of these benefits have already been identified thanks to the standard "cost of children" approach. However, it is clear that a holistic approach must consider children's "costs" and "benefits" not only on an individual basis (parents, children) but on an aggregate one (labor markets, social security…).

Can Policies Reconcile Work, Family and Child Outcomes?

The literature on the economic cost of children reviewed above points out two reasons for implementing policies that support families' well-being. First, children impact the household standard of living, and transfers in-cash or in-kind may partially, if not completely, offset this impact. Second, assistance with childcare can help parents to save time and combine work and care responsibilities. The design of effective policies to reconcile work and family outcomes depends on several factors, however. One parameter is the extent to which these outcomes are conflicting or, conversely, mutually beneficial. Potential conflicts between parental labor market participation and child outcomes are of essential concern, and priorities may vary across countries. These differences are rooted in countries' histories, their attitudes towards families, gender roles, the role of government and collective ideas of what should be done to ensure positive child development. Yet while trade-offs between policy orientations are not always explicit, they are nonetheless central in policy design.

Family Policy Objectives

Family policies have to address several objectives which are defined at individual, household or country levels. They concern mothers, fathers and children. Some of these can be conflicting, but there are also positive associations that leave room for policies to reconcile these objectives. Three broad categories of family policy objectives can be defined. The first objective is to assist parents with the direct costs of children in order to reduce differences in the standard of living between households with and without children. The second objective is to help parents to combine work and family life This can be achieved by investments in all-day childcare facilities and/or entitlement to short parental leave schemes that encourage parents to work before and to minimize time away from work after a birth. These "work-life balance" policies not only encourage mothers' labor market participation and gender equality in a larger sense but also have social and educational aims, which represent the third category of objectives. Thus, the third objective is to support children's cognitive and social development (Kamerman 2006; Esping-Andersen 2008), particularly by promoting equal opportunities for children and by compensating for any disadvantages they may experience from an early age. Fertility objectives are rarely mentioned explicitly by governments. By pursuing these three stated objectives, family policies generally intend to create conditions whereby adults are able to have the number of children they desire at the time of their choice.

Policies can be designed to achieve these objectives in different ways, but differences in policy packages mainly reflect differing priorities. Policy making involves trade-offs within and between these objectives. They are not all made explicitly but depend on national histories, attitudes towards the family, gender norms, private life and the role of government. We identify three main dichotomies in policy approaches. The first relates to the intensity of income support to the poorest families and its potential conflict with policies designed to offset the cost of children. The second relates to potential conflict between the decision to pursue a career or to have children. The last derives from possible trade-offs between children and parental labor market outcomes.

Offsetting the Cost of Children or Supporting Poor Families?

As discussed above, the basic concern of family policies is to supplement family income in order to limit the effect of children on the standard of living of households. However, such policies are confronted with competing redistributive concepts that must be brought into equilibrium. Indeed, one objective may be to limit the differences in standard of living associated with family size and to help parents bear the financial burden of raising children. One might thus claim that the tax and benefit systems should seek to reduce these differences by virtue of the principle of "horizontal equity". However, if the relative cost of a child increases with the household income, a policy that strictly offsets these costs would have an anti-redistributive effect as richer households would receive more transfers than poor ones if there was no limit to the "principle". It thus conflicts with the central principle of "vertical equity" in tax and benefit transfers which aims at reducing income inequalities. If financial assistance focuses on helping poor families, transfers to rich households can be limited by defining a maximum transfer.

The French quotient familial illustrates the equilibrium between those two redistributive concepts. It provides for an income tax allowance that increases with the household income (up to a certain maximum), based on the number of children. This tax allowance also increases with the number of children and is much higher from the third child on. This mechanism represents "horizontal equity" by taxing families according to their financial capacity and by taking into account the number of children. In other words, by giving priority to compensating the costs of children, the quotient offers a tax break that increases with the household income, even though the costs are not fully offset. At the same time, these horizontal transfers are limited by a ceiling on the amounts that can be transferred to richer households, in accordance with the vertical equity principle.

The combination of these two guiding principles is not straightforward, and depends basically on the conventionally adopted definition of the costs of children taken as a reference to determine the amounts that should be transferred to families with children. This involves an arbitrary selection between different normative criteria. For example, Le Minez and Roth (2007) suggest basing the costs of children on a household's "average social conditions" which are calculated for different family types as the average cost of an additional child for households with median income. Many countries do not have such a sophisticated measure and use means testing to target income support towards poor families. Moreover, in most countries, benefits decrease as income increases, and the primary purpose of transfers is to support poor families, with large cross-country differences, however (see next section). Overall, transfers are an efficient means to reduce poverty. For example, it is estimated that child poverty fell from 16.3 % without transfers to 9.2 % after transfers in the mid-2000s (Witheford and Adema 2007).

Poverty reduction is also one aim of policies aiming to bring parents of young children into work because parents' employment is a major protection against poverty. OECD (2011) points out that child poverty falls on average in the OECD from 49 % in households with two jobless partners to less than 4 % when the two partners are working. Similarly, 61 % of children with a sole parent live in a poor household when this parent is not working, while the proportion falls to 21 % when the parent is working. In this context, the provision of in-work benefit can guarantee that parents gain more from work than from the assistance they receive when out of work.

Supporting Female Labor Market Participation or Fertility?

The decision to allocate time to the labor market can conflict with fertility decisions, as suggested by Becker (1960) who stresses that having children competes with other time-consuming activities. Furthermore, the rise in female educational attainment has led to a large increase in the "opportunity cost of children that has been seen as a key driver of the fertility decline in developed countries since the early 1970s" (Hotz et al. 1997). At the same time, countries have developed policies to help parents combine work and care responsibilities. These changes in the contexts of household decisions are seen as one key reason for the change in the relationship between female employment and fertility rates over the past decades (OECD 2011). In 1980, most of the countries with higher female employment rates had low fertility levels. By contrast, in the mid-2000s, a much clearer divide appears between countries which combine low female employment and fertility rates (for example, Italy, Spain, Greece, Korea) and those which combine high rates (Nordic and English-speaking countries). These two groups of countries provide quite generous support to working parents with children, though patterns differ. A continuum of publicly provided support for the work-life balance is available in Nordic countries, while the English-speaking countries combine higher development of part-time work with means-tested childcare support and in-work benefits, as favoured by the low cost of domestic services in the United States (Thévenon 2011). As a result, in these countries the choice between employment and motherhood is less absolute, even though there is often still a trade-off at the individual level between having children and participating in the labor force (Kögel 2004).

Recent contributions have confirmed the contribution of "core" family policy tools in fertility trends. In particular, they point out that aids concentrated at childbirth, in the form of leave entitlements or birth grants, seem to influence the timing of an expected birth, but do not necessarily affect the final number of children. Financial assistance that comes later is quantitatively greater and seems to have an incidence of greater amplitude, to the extent that it contributes more significantly to offsetting child costs. Moreover, the provision of childcare services for young infants that enables parents, particularly women, to balance work and family life, is also a key factor that seems to enhance fertility (OECD 2011; Luci and Thévenon 2011). In all, it has been shown that policies which facilitate mothers' return to work after childbirth have positive feedbacks on fertility trends (Thévenon and Gauthier 2011).

Child Development and Parents' Working Career: Can These Objectives be Reconciled?

The third dichotomy in family policies derives from the potential conflict between parental employment and child well-being and development. However, the evidence on conflicting relationships is far less conclusive than is suggested by attitudes and norms towards childcare. From the child's perspective, one central question concerns the policy framework that best promotes child development: should policy enable parents to care for their infants on their own or should it offer childcare services to substitute for parental care and accelerate mothers' return to work? These two alternatives are of course theoretical, and families' behaviours are more mixed. To answer this question, many studies examine in a first step the impact of maternal employment after childbirth on subsequent child development. Actually, the decision to return to work after childbirth represents a dilemma for parents, in particular for those with low incomes. On the one hand, parents' employment protects children against poverty, but on the other, less parental time devoted to childcare can have a negative effect on children's well-being, health and development. Even though this detrimental effect is sometimes observed, the available evidence suggests that this is far from being a general case and that there may also be a positive association between maternal employment and child outcomes. A very recent analysis by Huerta et al. (2011) based on panel data following children in five countries (Australia, Canada, Denmark, United Kingdom, and the United States) highlights four key points—which are also confirmed by different literature reviews (Kamerman 2006; OECD 2009a, 2011):

- Children's cognitive outcomes may be affected by mothers' return to work within 6 months of childbirth, especially if they work full-time, but the association is small and not universally observed—in fact, a negative relation may appear in the United Kingdom or the United States,[3] while the associations are more likely to be positive in Denmark, Canada and Australia.
- The small negative associations of early maternal employment with child outcomes are not observed in families with lower education and income. On average, low-educated parents are less likely to engage in stimulating parenting activities and the smaller negative relationship between maternal return to work and children's outcomes is more likely to be counterbalanced by the positive association of maternal income and formal childcare participation.
- Formal childcare and pre-school participation is generally positively associated with cognitive development of children, but some negative effects on behavioural outcomes may be observed if children are in poor-quality care or in care for long hours (Ruhm 2004a; Belsky et al. 2007; Datta-Gupta and Simonsen 2010; Esping-Andersen et al. 2012).[4] Moreover, the earlier access to preschool at age 2 rather than 3 does not seem to significantly impact child

[3] Most research in the United States emphasises that maternal employment can have negative consequences for the cognitive development and health of children during their early years (Han et al. 2001; Brooks-Gunn et al. 2002; Baum 2003; Ruhm 2004a, b; Baker et al. 2005). However, another series of studies find a mitigated effect of parents' employment and even a negative effect on child development of childcare provided permanently and exclusively by mothers (Gregg et al. 2005; Waldfogel et al. 2002).

[4] Most of the available evidence on preschool experiments shows positive effects on pupil and student outcomes (Currie 2001; OECD 2011; Huerta et al. 2011). However, some studies point out negative impacts of early enrolment in day care centres or kindergarten on behavorial outcomes or test scores (Lefebvre et al. 2011; Smith 2011). Overlong hours spent in childcare centers are potential factors for explaining why the low-fee childcare policy did not have the expected positive influence on child outcomes in Quebec (Lefebvre et al. 2011). This hypothesis is accredited by Datta-Gupta and Simonsen (2010) who found for Denmark that increasing hours in family daycare from 30–40 to 40–50 h per week and hours in pre-school from 20–30 h per week to 30–40 h leads to significantly lower child non-cognitive outcomes.

educational outcomes while it helps women to accelerate their return to work (see for, example, Goux and Maurin 2010 for France).

In all, this set of evidence suggests that a conflict between mothers' employment and child development occurs in specific circumstances only. Only a very early return to work after childbirth (within 6 month to a year) can be negatively associated with child outcomes. Child well-being depends on two parameters, namely the quality of formal care that substitutes for parental care, and the balance achieved between time spent in parental care and in formal care. Nevertheless, the identified effects of parental employment on children are generally small enough to be counterbalanced by the indirect effects on child outcomes of higher standards of living due to parental work. This is particularly relevant for low income families, since long-term exposure of children to poverty and material deprivation has proved to be detrimental to their development and (long-term) school achievement (Esping-Andersen 2008).

In this context, it would be useful to determine the age at which children could benefit from alternating care between parents and external care facilities. Determining that age would be important for establishing the optimal length of parental leave and its conditions of remuneration, which differ widely across countries. Existing studies do not allow us to precisely determine this key age for children, but suggest that child development is not a valid argument for legitimising entitlements to long periods of parental leave.

Do Policies Succeed in Reconciling Outcomes?

How do policies succeed in reconciling these issues? In order to answer this question, we adopt a holistic approach embracing a large set of family, work and child outcomes instead of analysing them one by one. Table 1 presents some key family indicators with different colours that indicate the relative position of a given country by comparison with the OECD average. A light grey square indicates that the country's performance is better than the OECD average, a white square indicates that its performance is average and a dark grey square that it is below the average. There are considerable cross-national differences in family outcomes, but no country significantly outperforms or underperforms the others in all outcome areas. However, Nordic countries generally have significantly better family outcomes than the OECD average, while Australia, Belgium, France, the Netherlands and New Zealand, also record relatively good outcomes. Greece, Italy, Korea, Poland, the Slovak Republic, and Spain still face challenges in a range of areas.

This evidence on the relative performance of different OECD countries regarding family, work and child outcomes suggests that the different objectives of family policies mentioned above can be reconciled. It also suggests that differences in outcomes relate broadly to variations in the way policies are defined, and in the way policy instruments are combined to provide support to families. As stated in an earlier study, these differences in policy frameworks especially concern the support provided to working parents with children under age 3 (Thévenon 2011). In that respect, Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) outdistance the other

Table 1 Countries' performance relative to OECD average

	Total fertility rate 2009*	Employment to population ratio Women 15–64. 2009**	Employment rates of sole parents 2008	Gender pay gap[a] 2008***	Child poverty[b] mid–late 2000s****	Childcare enrolment[c] (aged <6) 2008*****	PISA reading scores[d] 2009	Public spending on family benefits[e,f] % GDP, 2007
OECD average (intervals)	**1.74 (+/– 0.183**	**59.6 (+/– 5.52)**	**73 (+/– 6.5)**	**16 (+/– 4.1)**	**12.7 (+/– 3.06)**	**54.7 (+/– 7.38)**	**494 (+/– 11.4)**	**2.2 (+/– 0.46)**
Nordic Europe								
Denmark	1.84	73.1	83.5	12	3.7	78.6	495	3.7
Finland	1.86	67.9	80	21	4.2	51	536	2.7
Iceland	2.22	77.2		13	8.3	74.9	500	3.5
Norway	1.98	74.4	72.5	9	5.5	72.8	503	2.9
Sweden	1.94	70.2	84.2	15	7	68.4	497	3.1
Continental Europe								
Austria	1.39	66.4	73.9	21	6.2	44.3	–	3.1
Belgium	1.83	56	54.7	10	10	73.6	506	3.1
France	1.99	60	77.8	12	8	70.8	496	3.7
Germany	1.36	65.2	56.9	25	8.3	60.2	497	2.8
Luxembourg	1.59	57	90.5	–	12.4	62.4	472	3
Netherlands	1.79	70.6	76.2	17	9.6	61.3	508	2.9
Anglophone countries								
Australia	1.9	66.2	47.9	12	11.8	39.6	515	2.7
Canada	1.66	69.1	79.8	20	14.8	40.4	524	1.4
Ireland	2.07	57.8	54.7	16	16.3	40.1	496	2.6
New Zealand	2.14	67.4	64.9	8	12.2	65	521	2.3
Switzerland	1.5	73.8	85.7	20	9.4	–	501	1.4
United Kingdom	1.94	65.6	47.7	21	10.1	64.4	494	3.6
United States	2.01	63.4	80.1	20	21.6	45.2	500	1.2
Eastern Europe								
Czech Republic	1.49	56.7	64.4	21	10.3	40.4	478	2.4
Hungary	1.33	49.9	69.5	2	7.2	48	494	3.3
Poland	1.4	52.8	63.5	14	21.5	26	500	1.5
Slovak Republic	1.41	52.8	–	–	10.9	37.3	477	2.2
South Europe and Asia			–					
Greece	1.53	48.9	86.5	10	13.2	30.2	483	1.3
Italy	1.41	46.4	86.5	1	15.3	63.6	486	1.4
Portugal	1.32	61.6	88.7	16	16.6	63.4	489	1.3
Spain	1.4	53.5	81.8	12	17.3	66.9	481	1.6
Japan	1.37	59.8	86	31	14.2	59.4	520	1.3
Korea	1.15	52.2	69	39	10.3	59.3	539	0.6

Above the OECD average | Around the OECD average (or no data) | Below the OECD average

The OECD average is calculated as the unweighted average for OECD countries for which data is available. Countries are categorised in "above" or "below" groups if they are at least half a standard deviation above or below the OECD average

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law

[a] The gender wage gap is unadjusted and is calculated as the difference between median earnings of men and women relative to median earnings of men. Estimates of earnings used in the calculations refer to gross earnings of full-time wage and salary workers, but may vary slightly across countries. For Italy the gender wage gap is based on gross hourly earnings of full-time employees

[b] Child poverty is calculated as the proportion of children living in households with less than half the median equivalised income of all households

[c] Estimates refer to enrolment in *formal* childcare only, including public and private providers: group care in childcare centres, registered childminders based in their own homes looking after one or more children and, care provided by a carer at the home of the child. For the 3 to 5 year olds, children covered are those enrolled in formal pre-school services, and in some countries 4 and 5 year olds in primary schools

[d] PISA literacy is scored based on a weighted OECD average of 500 and standard deviation of 100: the unweighted OECD average for all countries including the new (2010) member countries is 494

[e] Public support accounted here only concerns public support that is exclusively for families (e.g. child payments and allowances, parental leave benefits, childcare support, and, income support for sole parents). Spending in other social policy areas such as health and housing support also assists families, but not exclusively, and is not included here. Data on tax breaks towards families are not available for Chile, Estonia, Greece, Hungary, Israel and Slovenia

Table 1 continued

[f] Coverage of spending on family may be limited as such services are often provided, and/or co-financed, by local governments. This leads to large gaps in measurement of spending in Canada, the Netherlands and Switzerland. Local governments also play a key role in financing childcare. This can make it difficult to get an accurate view of public support for childcare across a country, especially but not exclusively, in federal countries

* 2007 for Canada; *** 2005 for the Netherlands; 2007 for Belgium and France, **** 2008 for Germany, Italy, Korea, Netherlands, New Zealand, Norway, Sweden and the United States; 2007 for Canada, Denmark and Hungary; 2006 for Japan, Ireland, Switzerland and the United Kingdom; 2004 for Australia, Austria, Belgium, Czech Republic, Finland, Greece, Iceland, Luxembourg, Poland, Portugal, the Slovak Republic, Spain and Turkey; and, ***** refers to estimates for 2008 based on childcare enrolment rate for children aged <3 in 2007 and children aged 3–5 in 2008; 2005 for Australia and the US; 2006 for Canada

Source OECD Family database (2011) (www.oecd.org/els/social/family/database)

OECD countries, providing comprehensive support to working parents with very young children (under 3 years of age). Parental leave policies vary in these countries, but they all provide broad coverage of childcare services from age 1. English-speaking countries (Australia, Canada, Ireland, United Kingdom New Zealand, and the United States) provide much less in-time and in-kind support to working parents with very young children, while financial support is greater but targeted on low-income families and preschool children. As mentioned above, part-time work is also used more widely by mothers to balance work and family, as is also the case in Germany and the Netherlands. Continental and Eastern European countries form a more heterogeneous group with a more intermediate position regarding total spending for families and forms of support. Two outliers of these groups are France and Hungary, which provide relatively generous support for working parents compared with other countries of their respective group. By contrast, the countries in Asia and in southern and Eastern Europe with the lowest outcomes are all characterised by very limited public assistance to families.

These differences in family policy packages suggest that countries with comprehensive policies for working parents with children from preschool age onwards achieve better aggregate performance regarding female employment, poverty and fertility. The existence of a continuum of support throughout early childhood would seem to be a key characteristic of countries where the aim is to achieve higher fertility, greater female labor market participation and higher employment rates for lone parents, while reducing the risk of poverty. Moreover, enabling mothers to return to work some months after childbirth seems to positively influence fertility trends and, in turn, to ensure the material conditions needed for child development. The outcomes of "vulnerable" families seem particularly sensitive to such support, employment being the most certain protection against poverty which benefits all family members, including children.

Towards more Effective Support to Families?

When evaluating the effectiveness of family policies, one key aspect to be considered is the actual balance between the different types of outcomes achieved by these policies. We suggested above that different equilibria can be achieved, and countries set different priorities to achieve one equilibrium or another. These differences in policy orientations lead to a range of situations in which the choice of policy instruments (financial assistance, childcare facilities, parental leave schemes etc.) and the conditions of eligibility may vary. It is especially important to consider policy packages (how policy instruments are combined) when seeking to assess whether policies are effective in achieving a combination of better work, family and child outcomes. We argue here that a better balance of outcomes is likely to be achieved with support that starts in early childhood, combines in-cash and in-kind support, and which identifies gender equity as a central concern.

The multiple facets of these policies also multiply the number of economic and social reasons for promoting public policies to support families. State intervention is first justified by economic theory because of the collective benefits derived from "mutualising" the costs of children, in terms of both efficiency and equity.

Sharing the costs of children is also justified in standard economic theory by the fact that better outcomes for families with children (and especially long-term outcomes) involve positive externalities for society as a whole, including for childless citizens. Children should consequently be considered as a "public good" rather than a strictly private concern (Browning 1992). These expected benefits are fourfold, from a short to a longer term perspective:

– First, policies facilitating a combination of employment and parental responsibilities are expected, in the relatively short term, to foster maternal employment and reduce their career interruptions, and to subsequently help parents to accumulate human capital which might raise labor productivity and growth.
– A related benefit might be that a larger share of the active population in work can raise fiscal resources in the short term, and may strengthen the financial sustainability of the pension and welfare state system in the long run.
– Third, positive cognitive outcomes for children can be expected to foster their human capital formation, with long-term incidence on economic growth patterns.
– Finally, positive incidence on children's "social capital" (soft skills, capacity to integrate and build networks and connections, civic engagements…) can also be generated as a by-product of policies, and thus contribute to preventing risky or deviant behaviour that would incur a cost to all individuals—although these costs cannot be strictly quantified.

In this context, recent research advocates that family policies should be seen as social investment generating important rewards and not only costs, similar to investments in "human capital" (Heckman and Masterov 2007). The idea of "investment" is used to stress that outputs are cumulative and will ultimately be higher than the initial policy expenditure.[5] By contrast, the rewards of investments

[5] Basically, Heckman and Masterov (2007) argue that investments during early childhood provide a means to benefit from the complementarities that exist when young children acquire cognitive and social capacities, as the acquisition of these capacities at an early age favours self-production of human capital. Higher investment at very young ages would reduce the investments required at later stages, so that early spending can in fact lower later expenditures.

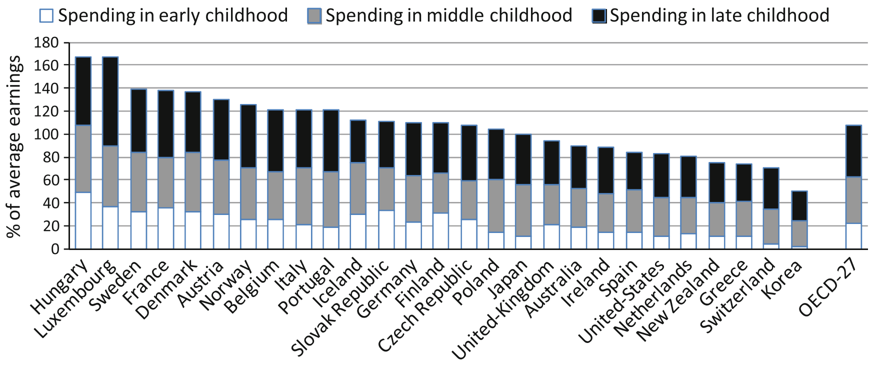

Fig. 2 Total public spending per child (from 0 to 17 years old), 2003 (in % of average earnings). Public spending includes child payments and allowances, parental leave benefits and childcare support. Spending on education is also included and represent the largest item of expenditures for middle and late childhood. Early childhood refers to children aged 0–5; middle childhood refers to ages 6–11; late childhood covers children aged 12–17. Estimates include public expenditures on family-related benefits and tax rebates, public (or subsidised) childcare and education and other in-kind expenditures. See OECD (2009a, Chap. 3) for more information. *Source* OECD (2009a), Doing Better for Children, Chap. 2, Paris

decline if their flow is interrupted. Investing early is also promoted for equity reasons, since support during early childhood is more likely to reduce inequalities between children with different economic and social backgrounds.

Investing Early to get Better Outcomes

These arguments speak in favour of high public investments aimed at small children in order to encourage their cognitive development and to protect them from poverty and deviant behaviour. However, the age-profile of spending on children shows that expenditure for children under school age is far lower than the average amounts spent per children above this age (Fig. 2). Cross-country differences are quite large, however, with Scandinavian countries, Hungary, France or Luxembourg spending rather high amounts for early childhood compared with English-speaking countries, especially.

Public expenditures for older children (including lump-sum benefits, tax allowances and financial assistance reducing the costs of childcare) also vary widely across countries, but they generally do not increase with the age of children—and even decrease from age 15–18 onwards (OECD 2011). Yet this pattern may be poorly adapted to the actual structure of child costs since, as reported above, children's share in household expenditure appears to increase from adolescence onwards.

Combining Support In-cash and In-kind to Raise Policy Effectiveness

Effectiveness and efficiency are two sides of the same coin representing how policies can influence behaviour. Policy effectiveness captures the extent to which

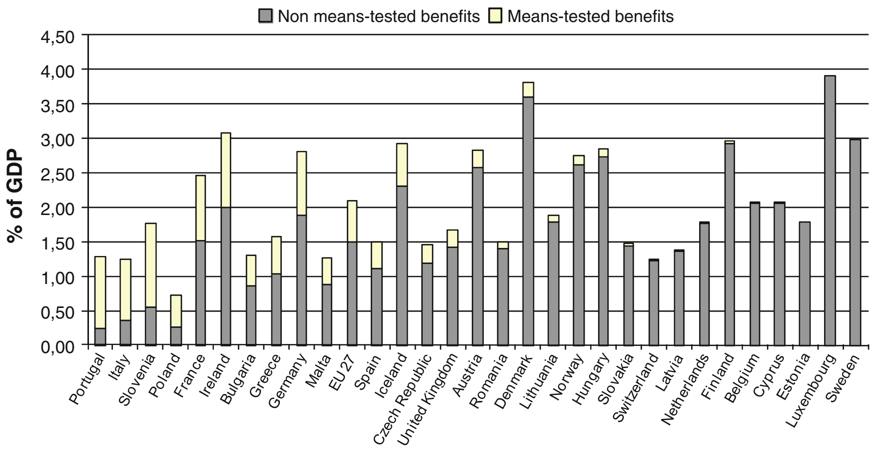

Fig. 3 Variable budget shares of means-tested family benefits (in % of GDP, 2008). Family-related cash benefits include income maintenance benefit in the event of childbirth, birth grants, parental leave benefits, family or child allowances, and some other cash benefits. Countries are ranked by decreasing proportion of mean-tested benefits in total family benefits. *Source* Eurostat ESSPROS database. Data on social protection: May 2011

potential recipients of a benefit actually claim their rights. Some workers might, for example, be eligible for parental leave or childcare subsidies, but do not claim them for various reasons. The assessment of policy effectiveness thus tries to capture the extent to which households make use of their rights (e.g. meet their needs), disregarding the influence that these entitlements might have on their subsequent behaviour. In contrast, policy efficiency considers whether this behaviour complies with the expected outcome, for a given cost of support.

One way to limit the "cost" of policy support, it is argued, is to target benefits on families with the greatest needs. For that reason, means-testing is often used, but its relative importance in overall expenditure for families varies considerably across countries (Fig. 3). For example, more than two-thirds of total spending on family benefits is means-tested in Portugal, Italy and Slovenia, while there is no means testing at all in Estonia, Luxembourg and Sweden.

However, targeting benefits by means testing raises both effectiveness and efficiency problems. First, means tests are used to limit the number of benefit recipients. Yet means testing can fail to reach the population with greatest needs for basically two reasons. First, specific targeting can produce a stigmatisation of benefit recipients that dissuades some of the eligible population from taking up their benefits. Stigmatisation can in this case be assimilated to a psychological "cost" deterring vulnerable populations from claiming their rights (Moffitt 1983).

Second, the implementation of targeted programmes involves administrative work that has a cost and can produce inefficiencies in programme management. Checks must be made to ensure that claimants are entitled to the benefit and recipients must be closely followed over time. This requires action on the part of both the administration and the recipients, with associated “transaction costs” that can be high and to which the poorest households are the most sensitive (Currie and Ghavari 2008). These “transaction” costs might thus make it even more difficult to reach the potential recipients with the highest needs, unless they are paid by the administration. However, management costs can be so high that the relative advantage of targeted over universal programmes disappears (Smolensky et al. 1995). By contrast, universal programmes can avoid this skimming problem if the rules for attribution are simple enough to be followed by the most vulnerable population.

Third, means testing for benefit allocation is not necessarily more efficient for reducing poverty, because there is basically no strict relationship between the existence of means tests and the intensity of support to poor families (OECD 2011). Conversely, the generosity of universal benefits explain why universal programmes can be more efficient for reducing poverty (Korpi and Palme 1998). This generosity is possible because the legitimacy of universal programmes is based on a broad consensus whereby everyone contributes but also receives benefits. For this reason, universal benefits are also more resistant in the case of budgetary restrictions (Nelson 2007).

The provision of in-kind support or childcare subsidies can also help to avoid the unwanted effects of cash-based programmes. Currie and Ghavari (2008) argue for example, that in-kind benefits provided on a universal basis can overcome the inefficiencies associated with targeted cash benefits. In particular, the provision of services for families with specific needs does not require very restrictive formal eligibility criteria. Management costs might thus be limited while ensuring that families' needs are met. Direct provision of in-kind childcare benefits also provides a better guarantee of the quality of services used by parents. Differences by socioeconomic status in the quality of services used are also likely to be more limited by direct provision of standardised services (Currie and Ghavari 2008).

Last but not least, many countries combine childcare subsidies with cash-for-care allowances received by parents (mostly mothers) who personally care for their child. However, this combination often has the effect of maintaining if not increasing social and gender social inequalities in labor market outcomes. Childcare subsidies primarily benefit women who are able to remain employed and can afford high quality childcare services, while cash-for-care allowances are taken up mainly by women with low income and/or in low quality jobs. Although cash payments make it easier for governments to respond to social demand for more childcare choices, they in turn have a long-lasting detrimental impact on women‘s progression in the labor market.

Despite the advantages associated with the provision of services, investments in services for families vary in scale across Europe. On average, the 27 EU Member States devoted 0.7 % of GDP to benefits in kind or services to families and children in 2006, ranging from 1.4 % or more in Nordic countries to 0.2 % or less in the Czech Republic, Latvia, Romania, Switzerland, Estonia, Malta, and Slovakia, as shown in Fig. 4.

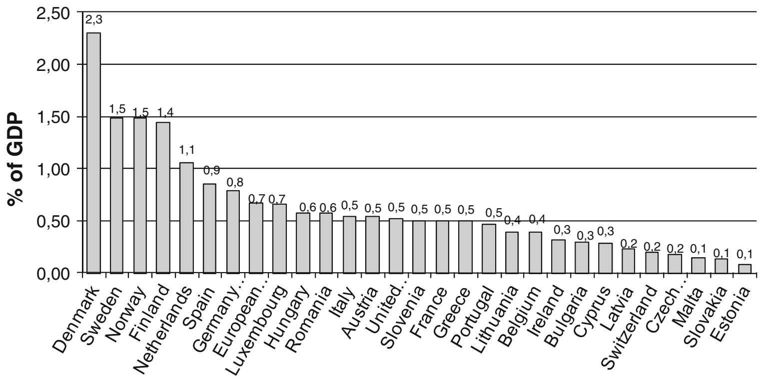

Fig. 4 Family/child benefits in kind as % of GDP, 2008. The benefits in kind included here are those related to child daycare, accommodation for children, expenditures on home help, and other benefits in kind. Other benefits on housing, health, or nutrition can be family-related but are not included. Services supporting parenting skills are also excluded. *Source* ESSPROS database—Eurostat

Fostering Gender Equality

Parental leave entitlements are an important component of childcare policies because they free up time for working parents to care for children during the months (or years in some cases) after childbirth. Nevertheless, leave entitlements vary widely across countries (Fig. 5) since they lie at the crossing point between the above-mentioned objectives, with large cultural differences in the way parental employment and children outcomes are balanced. However, it has been shown that long periods out of work negatively impact career prospects, in the short but also potentially in the long run.[6]

At the same time, as reported above, gender differences in the time allocated to childcare and unpaid work remain quite large, though they are smaller on average in countries with higher female employment rates. This suggests that a more equal gender balance in the time spent on unpaid activities might be necessary to raise female employment rates up to that of men. It would also provide a way to share the risk of career penalties induced by childbirth more equally between the sexes. Some evidence also suggests that a greater involvement of fathers in childcare can also be good for children. Dex and Ward (2007) suggest, for example, that children in the UK are more likely to have developmental problems if their parents do not share the

[6] Prolonged periods out of work affect career development and are key determinants of the so-called "family pay gap" that measures the lifetime differential in earnings between mothers and childless women. In Sweden, for example, taking 16 months of parental leave negatively affects career profiles (Eversston and Duvander 2010). Available evidence for France and Germany suggests that extending paid leave increases the likelihood of precarious employment conditions after the return to work and reduces the wage growth of those who take prolonged leave by 5–20 % (Meurs et al. 2010; Ondrich et al. 2002); while differences decrease over time they are still observable long after the return to work. Nevertheless, some evidence for Canada suggests that despite substantial income losses incurred by mothers in the first 2 years after childbirth, mothers returning to work seem to regain the lost earnings within about 7 years, and this recovery is quicker for mothers who go back to work with their original employer.

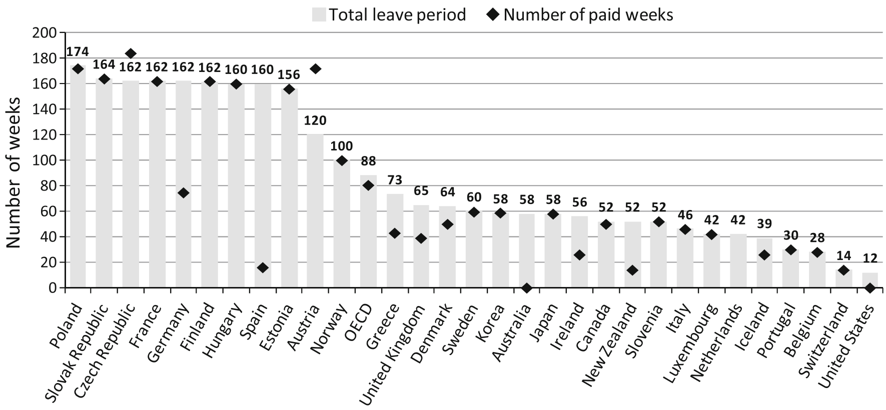

Fig. 5 Length in weeks of childbirth-related leave available for mothers, 2008. Total length of parental leave is added to weeks of basic maternity leave entitlements. The numbers above the bars refer to the total length of employment-protected maternity/parental leave in 2008. Information refers to parental leave and subsequent prolonged periods of paid and unpaid leave women can take after maternity leave to care for young children (sometimes under a different name, such as for example, "childcare leave" or "home-care leave", or the "complément de libre choix d'activité" in France). In many countries, the overall period of leave is not fully covered by leave payments, and thus the length of paid leave is lower than the overall period of available "job-protected" leave. In Austria and Czech Republic, payment can be obtained for a longer period than the number of weeks for which the job-protection stipulation applies. More details in OECD (2011). *Source* OECD Family Data Base (2011)

caring tasks. More recently, Baxter and Smart (2011) identified clearcut effects of fathering on the socio-emotional and learning outcomes of Australian children.

Keeping these benefits in mind, parental leave entitlements can be designed to encourage more fathers to take leave and to participate more in childcare activities. The enforcement of individual (and non-transferable) leave entitlements for each parent, combined with earnings-related payments can be efficient tools to raise fathers' participation (OECD 2011). Father-specific rights to leave exist in about half of OECD countries, but the period covered is still often very short (5–15 days in most countries, see Fig. 6) in comparison to the total number of weeks of leave that either parent can take under law, but which in practice is taken by women. Nonetheless, a few countries have recently increased the number of paid weeks reserved for fathers only, with a significant change in men's behaviour. For example, in 2001 Iceland introduced three months of parental leave for each parent plus three additional months which can be shared, the overall period being paid at 80 % of parents' earnings. This reform led to an increase in the proportion of parental leave days taken by fathers from 3 % to around 35 % today. Similarly, recent reforms in Germany provide for a bonus of 2 months earnings-related paid parental leave if taken by the father. While about 8.8 % of the fathers of children born in 2007 took parental leave, the percentage doubled to over 17 % in 2008. Parental leave was also reformed in Portugal in 2009, with a quota reserved for the father and a higher payment rate if both parents share the leave. Before 2009, only 0.08 % of fathers took parental leave, but their proportion is now estimated at 17 %.

These numbers show that parental leave reforms have been effective in raising fathers' leave uptake, even though the time allocated to childcare by men and

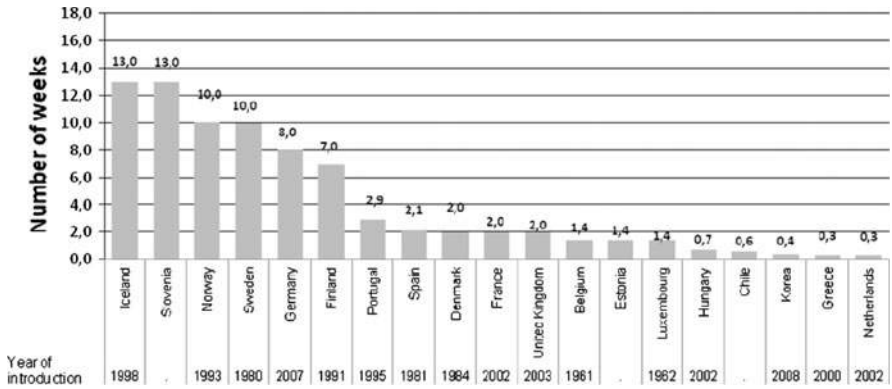

Fig. 6 Length in weeks of father-specific leave entitlements, 2008. Estimates of the weeks of entitlement include paternity leave and father-specific "quotas" in parental leave entitlements. *Source* OECD Family Data Base (2011)

women is still strongly unequal. Moreover, changes in leave-taking among men are unlikely to generate change in the gender division of paid and unpaid work that persists once leave entitlements have expired. In this context, flexibility in working time patterns are a necessary complement to combine work and care commitments.

Flexible working time includes various practices: part-time work, flexible starting and finishing times, teleworking, etc., which can all improve the work/life balance (OECD 2011). Regular part-time work is the most commonly used form of working-time flexibility that helps many parents to balance work and family life on a long-term basis and to fit their schedule around school hours. The use of part-time work is highly gendered, however. Across the OECD, one in ten men and one in four women work part-time (OECD 2010). For many parents, the decision to work part-time is constrained by lack of access to affordable childcare. However, there is often a penalty for part-time work as, on average, it is characterised by lower hourly earnings, fewer training and promotion opportunities, and less job security (OECD 2010). At the same time, there is also a premium to part-time work in terms of control over working time, stress and health, and the advantages appear to outweigh the disadvantages for the vast majority of part-timers. However, part-time working does not seem to help maintain the link with the labor market, and is often not sufficient to protect families from poverty (OECD 2009b, 2010): on average, the poverty risk for part-timers is double that observed for full-timers. This suggests that actual opportunities for part-timers to move to full-time work should be increased, since transitions in this direction are quite rare: on average, about 15 % of part-timers take up or return to full-time employment each year.

Reconciliation Policies: A Cost-Effective Strategy?

The synthesis proposed here emphasises the multidimensionality of child costs and of the policies designed to offset these costs. Family support policies have various dimensions and influence these costs directly or indirectly. These dimensions are: the maintenance of families' living standards, the reduction of economic and social inequalities, the cognitive and emotional development of children, the work-life balance of parents, gender equality and fertility. It is crucial to take this multiplicity into account when evaluating family policies, as it affects the way these policies are conceived as well as their appointed characteristics. The most important challenge of family policies is to create a coherent institutional context which corresponds to families' various needs and which reconciles different and sometimes conflicting objectives. We argued in particular that two broad categories of trade-offs are at stake. The first concerns the balance which has to be achieved between strict coverage of the cost of children and the contribution of family policies to social assistance and the reduction of income inequalities. The second focuses on the work/family balance and aims to reconcile the two perspectives of child development, on the one hand, and of labor market outcomes and household division of labor, on the other.

In this context, family policies must be evaluated on the basis of a holistic approach by taking into account all mentioned outcomes jointly in relation to family policy packages in which in-time, in-cash and in-kind services complement each other (Thévenon 2011; OECD 2011). The challenge here is to identify possible conflicts as well as possible synergy effects among the various family policy measures and to determine their joint impact on the economic, social and demographic progress of different countries.

Moreover, it is particularly important to consider the actual mix of dimensions existing in each country in order to define what dimensions must be developed further. The coherence of this set of family policies is particularly important for its effectiveness, but so are other factors such as the targeting and the complementarity of financial assistance to families, of childcare services and of parental leave schemes. Different equity criteria can influence the way family policy targets are defined.

We emphasised that policies encouraging parents (living alone or with partners) to be in work significantly reduce poverty risk, while raising the standard of living of families with children and promoting greater gender equality in the labor market. This might also be a cost-effective strategy since higher employment rates and more continuous working lives might also generate higher taxable income. However, this virtuous circle can be achieved only if the support provided is sufficient to meet the needs of families and to help both parents to combine work and family formation, and to share care tasks.

Besides, several arguments speak in favour of investing in early childhood. First, the earlier such investments are made, the more effectively they support child development. Second, specific financial assistance to the poorest and most vulnerable families promotes greater equity.

In this perspective, a system based on two pillars is helpful to reconcile efficiency and equity aspects while guaranteeing, beyond that, a whole set of further support options corresponding to the specific needs of certain populations:

- A first pillar guarantees a minimum of equality for all families with children and thus avoids pernicious effects of targeting mechanisms. Moreover, universal financial assistance for all families is perceived as a highly legitimate policy instrument by the majority of the population and is thus relatively stable. In particular, universal childcare facilities ensure that underprivileged and privileged children benefit from identical minimum standards of childcare quality. Universal support systems ensure that all children are covered and that none are stigmatised, but they are expensive.

- A second pillar consists of targeting financial or in-kind assistance to families with the greatest or specific needs. The combination of the two pillars is likely to create confidence in the sustainability and durability of the system of family support policies. This confidence is certainly needed to ensure that people use the existing support, and that policy delivery is effective. Confidence also partially explains the success of family support policies in countries like the Nordic states or France with a long tradition of government intervention.

The dynamics of early family support on child development suggest, that, for efficiency and equity reasons, these two pillars would best be organized sequentially. A cascade approach that provides universal services at early ages with more intensive delivery to targeted populations will often be more efficient (OECD 2009a, 2011). For example, a universal system of health visits for families with infants could be supplemented with more intensive service delivery for needy families, as identified though the universal visits. This cascading approach of expenditure could also encompass the support given on housing, health and leisure services, as well as policies to supporting parenting skills, or supplement nutrition.

Moreover, it becomes clear that offsetting the costs of children cannot be the sole objective of family policies. Such assistance is certainly consistent with horizontal equity (between households with the same income but with a different number of children) but not with vertical equity (between households with the same number of children but with different incomes). To guarantee vertical equity, financial assistance to families with children must be lower for households with high income.

Another important conclusion is that financial assistance to families generally does not compensate for the indirect costs of children caused by career interruptions. Family policies promoting the combination of work and family life aim at reducing these indirect costs borne primarily by mothers. These policies not only promote mothers' employment but succeed in reconciling several objectives of family policies, such as reducing family poverty and increasing fertility. This is also valid for policies encouraging a more equal division of labor and care responsibilities between men and women. Gender equity is therefore an additional component of overall systemic coherence that is beneficial to both the parental labor market and child outcomes. The way in which mothers' and fathers' investments in childcare complement each other and their association with high quality substitutes to parental time are crucial to achieving such a balance. Conclusions were also drawn on the design of policies which might be required to combine these objectives. Complementarity between support in-time, in-cash and in-kind was first pointed up as key for ensuring that policies are used effectively by families and produce the desired outcomes. Continuity of support for children and working parents over the child's life course were also stressed as an important requirement for achieving lifelong positive returns. Parental leave entitlements reserved for each parent, favouring earnings-related payment rather than long-term absence from the labor market, are seen as best practices to promote a more gender-equal division of childcare between parents, beneficial to both maternal employment and child outcomes. Efficient outcomes can only be achieved, however, if families have access to high quality childcare services once leave entitlements have expired, which would require massive investment in childcare provision for children under three in many countries. The development of out-of-school care services and of flexible working practices can give parents the freedom to choose between part-time and full-time work. A continuous flow of cash benefits over childhood might also be necessary to help parents bear the cost of raising children. Investments made in early childhood might help to save on spending required later, however.

Finally, across-the-board provision of family-related benefits to workers in all economic sectors is also key to minimizising employment-related inequalities and to avoiding the pernicious effects of restricting family-related entitlements to specific categories of employees (Mandel and Semyonov 2006). As an illustration of these effects, Datta et al. (2008) argue, for example, that the combination of generous family-friendly schemes in the Nordic countries may have led to a societal system in which women select into certain sectors with low pay and limited career opportunities. Employers' response to the provision of family-related entitlements might also limit the benefits of policies facilitating a combination of employment and parental responsibilities if not all workers with access to these policies use them. Fernandez-Kranz and Rodriguez-Planas (2011) point out that the right to work part-time in countries with highly a segmented labor market, such as Spain, has led to increased gender differences in access to permanent labor contracts. Thévenon and Gauthier (2011) also suggest that family policies can unintentionally contribute to accentuating differences in behaviour between socioeconomic groups and to reinforcing the polarisation of decisions about working and/or having children because the different childcare options are not equally accessible across social groups. Thus, the development of family-friendly policies does not automatically benefit all parents but profoundly influences the way in which work and family outcomes are stratified across social groups. These outcomes crucially depend on families' attitudes, gender norms and employers' responses to policies which affect the selection of parents into employment and/or into specific jobs. The future assessment of policies to reconcile family, work, and child outcomes would benefit from a better understanding of this non-gender-neutral selection process.

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References

Anxo, D., Flood, L., Mencarini, L., Pailhé, A., Solaz, A., & Tanturri, M. L. (2007). Time allocation between work and family over the life-cycle: A comparative gender analysis of Italy, France, Sweden and the United States. IZA discussion paper no. 3193, Bonn.

Apps, P., & Rees, R. (2002). Household consumption, full consumption and the costs of children. *Labour Economics, 8*, 621–648.
Baker, M., Gruber, J., & Milligan, K. (2005). *Universal child care, maternal labour supply and family well-being*. Toronto: University of Toronto, Department of Economics.
Baum, Ch. (2003). Does early maternal employment harm child development? An analysis of the potential benefits of leave taking. *Journal of Labor Economics, 21*(2), 409–448.
Baxter, J., & Smart, D. (2011). Fathering in Australia among couple families with young children. Occasional paper 37. Department of Families, Housing, Community Services and Indigenous Affairs, Australian Government.
Becker, G. (1960). *An economic analysis of fertility. Demographic and economic change in developed countries*. Princeton/Cambridge: Princeton University Press/NJ and NBER.
Belsky, J., Vandell, D., Burchinal, M., Clarke-Stewart, K. A., McCartney, K., Owen, M., et al. (2007). Are there long-term effects of early child care? *Child Development, 78*(2), 681–701.
Bradbury, B. (2008). Time and the cost of children. *Review of Income and Wealth, 54*(3), 305–323.
Brooks-Gunn, J., Han, W., & Waldfogel, J. (2002). Maternal employment and child cognitive outcomes in the first three years of life: The NICHD study of early child care. *Child Development, 73*(4), 1052–1072.
Browning, M. (1992). Children and household economic behavior. *Journal of Economic Literature, 30*(3), 1434–1475.
Browning M., Chiappori P. A., & Lewbel A. (2006). Estimating consumption economies of scale, adult equivalence scales, and household bargaining power. Working paper 289, Department of Economics, University of Oxford.
Craig, L., & Bittman, M. (2008). The incremental time costs of children: An analysis of children's impact on adult time use in Australia. *Feminist Economics, 14*(2), 59–88.
Currie, J. (2001). Early childhood education programs. *Journal of Economic Perspectives, 15*(2), 213–238.
Currie, J., & Ghavari, F. (2008). Tansfers in-cash and in-kind: Theory meets data. *Journal of Economic Literature, 46*(2), 333–383.
Datta-Gupta, N., Smith, N., & Verner, M. (2008). The impact of Nordic countries' family friendly policies on employment, wages and children. *Review of the Economics of Households, 6*, 65–89.
Datta-Gupta, N., & Simonsen, M. (2010). Non cognitive children outcomes and universal high quality child care. *Journal of Public Economics, 94*(1–2), 30–43.
Davies, R., & Pierre, G. (2005). The family gap in pay in Europe: A cross-country study. *Labour Economics, 12*(4), 469–486.
DeCicca Ph., & Smith J. (2011). The long-run impacts of early childhood education evidence from a failed policy experiment. National Bureau of Economic Research (NBER), working paper 17085.
Dex, S., & Ward, K. (2007). *Parental care and employment in early childhood: Analysis of the Millennium Cohort Study (MCS) Sweeps 1 and 2. Research series*. Manchester: Equal Opportunities Commission.
Esping-Andersen, G. (2008). *Trois leçons sur l'Etat Providence, Seuil, coll*. Paris: La république des Idées.
Esping-Andersen, G., Garfinkel, I., Han, W.-J., Magnuson, K., Wagner, S., & Waldfogel, J. (2012). Child care and school performance in Denmark and the United States. *Children and Youth Services Review, 34*(3), 576–589.
Eversston, M., & Duvander, A. Z. (2010). Parental leave—possibility or trap? Does family leave length effect Swedish women's labour market opportunities? *European Sociological Review*. doi:10.1093/esr/jcq018.
Fernandez-Kranz, D., & Rodriguez-Planas, N. (2011). Unintended effects of a family-friendly law in a segmented labour market. IZA (Institue for the Study of Labor) discussion paper 5709.
Gauthier, A., Smeeding, T. M., & Furstenberg, F. F. Jr. (2004). Are parents investing less time in children? Trends in selected industrialized countries. *Population and Development Review, 30*(4), 647–671.
Goux, D., & Maurin, E. (2010). Public school availability for two-year olds and mothers' labour supply. *Labour Economics, 17*(6), 951–962.
Gregg, P., Washbrook, E., Propper, C., & Burgess, S. (2005). The effects of a mother's return to work decision on child development in the UK. *Economic Journal, 115*(501), F48–F80.
Han, W., Waldfogel, J., & Brooks-Gunn, J. (2001). The effects of maternal employment on later cognitive and behavioral outcomes. *Journal of Marriage and the Family, 63*, 336–354.

Harkness, S., & Waldfogel, J. (2003). The family gap in pay: Evidence from seven industrialized countries. *Research in Labor Economics, 22*, 369–414.
Heckman, J., & Masterov, D. (2007). The productivity argument for investing in children. NBER working paper 13016.
Hotz, V. J., Klerman, J. A., & Willis, R. (1997). The economics of fertility in developed countries. In M. Rosenzweig & O. Stark (Eds.), *Handbook of population and family economics* (Vol. 1A, pp. 276–347). Amsterdam: Elsevier.
Huerta, M., Adema, W., Baxter, J., Corak, M., Deding, M., Gray, M. C., Han, W. J., & Waldfogel, J. (2011). Early maternal employment and child development in five OECD countries. Social, employment and migration working papers. OECD, Paris.
Kamerman, S. (2006). Parental leave policies: The impact on child well-being. In P. Moss & M. O'Brien (Eds.), *International Review of Leave Policies and Related Research 2006.* DTI Employment Relations Research Series 57.
Klasen, S. (2002). Low schooling for girls, slower growth for all? *World Bank Economic Review, 16*, 345–373.
Kögel, T. (2004). Did the association between fertility and female employment within OECD countries really change its sign? *Journal of Population Economics, 17*, 45–65.
Korpi, W., & Palme, J. (1998). The paradox of redistribution and strategies of equality: Welfare state institutions, inequality, and poverty in western countries. *American Sociological Review, 63*(5), 661–687.
Le Minez, S., & Roth, N. (2007). Transferts monétaires et compensation du coût de l'Etat. *Informations Sociales, 137*, 68–79.
Lefebvre P., Merrigan Ph., & Roy-Desrosiers F. (2011). Quebec's childcare universal low fees policy 10 years after: Effects, costs and benefits. Working paper 11-01. Centre Interuniversitaire sur le Risque, les Politiques Economiques et l'Emploi (CIRPEE), Montréal.
Letablier, M.-Th., Luci, A., Math, A., & Thévenon, O. (2009). The costs of raising children and the effectiveness of policies to support parenthood in European countries: A literature review. Report for the European Commission. http://ec.europa.eu/social/families/docs/EU_Report_Cost_of_children_Final_11-05-2009.pdf.
Luci, A. (2011). Frauen auf dem Arbeitsmarkt in Deutschland und Frankreich—Warum es Französinnen besser gelingt, Familie und Beruf zu vereinbaren. (Reconciliation possibilities in France and Germany) Research report for the Friedrich Ebert Foundation.
Luci A., & Thévenon O. (2011). The impact of family policy packages on fertility trends in developed countries. INED working paper no 174. Annual Conference of the Population Association of America, Washington.
Lundberg, S., Pollak, R., & Wales, T. (1997). Do husbands and wives pool their resources? Evidence from the united kingdom child benefit. *Journal of Human Resources, 32*(3), 463–480.
Mandel, H., & Semyonov, M. (2006). A welfare state paradox: State interventions and women's employment opportunities in 22 countries. *American Journal of Sociology, 111*(6), 1910–1949.
Meurs, D., Pailhé, A., & Ponthieux, S. (2010). Child-related career interruptions and the gender wage gap in France. *Annales d'Economie et de Statistique,* (99–100), 15–46.
Miranda, V. (2011). Cooking, cleaning and volunteering: Unpaid work around the world. Social, employment and migration working papers. OECD, Paris.
Misra, J., Budig, M., & Boeckmann, I. (2011). Cross-national patterns in individual and household employment and work hours by gender and parenthood. *Research in the Sociology of Work, 22*, 169–208.
Moffitt, R. (1983). An economic model of welfare stigma. *American Economic Review, 73*(5), 1023–1035.
Nelson, J. (1993). Household equivalence scales: Theory versus policy? *Journal of Labor Economics, 11*(3), 471–473.
Nelson, V. (2007). L'universalisme ou le ciblage: la vulnérabilité de l'assurance sociale et de la protection du revenu minimum sous condition de ressources dans 18 pays, 1990–2002. Revue Internationale de Sécurité Sociale (p. 37).
OECD. (2009a). *Doing better for children*. Paris: OECD Publishing.
OECD. (2009b). Is work the best antidote to poverty? In *Employment Outlook* (Chap. 3, pp. 165–210). OECD Publishing, Paris.
OECD. (2010). How good is part-time work? In *Employment Outlook* (Chap. 4, pp. 211–266). OECD Publishing, Paris.

OECD. (2011). *Doing better for families*. Paris: OECD Publishing.

OECD. (2012). Gender Equality in education, employment and entrepreneurship. Final report to the meeting council of ministers, Paris. http://www.oecd.org/dataoecd/20/5/50423364.pdf. Accessed May.

Ondrich, J., Spiess, K., & Yang, Q. (2002). *The effect of maternity leave on women's pay in Germany 1984–1994*. Berlin: DIW, German Institute for Economic Research.

Ruhm, C. (2004a). How well do parents with young children combine work and family life. NBER working paper no. 10247. National Bureau of Economic Research, Cambridge, MA.

Ruhm, C. (2004b). Parental employment and child cognitive development. *Journal of Human Resources, 39*(1), 155–192.

Salles, A., Rossier, C., & Brachet, S. (2010). Understanding the long term effects of family policies on fertility: The diffusion of different family models in France and Germany. *Demographic Research, 22*(34), 1057–1096.

Sigle-Rushton, W., & Waldfogel, J. (2007). Motherhood and women‘s earnings in Anglo-American, continental European, and Nordic countries. *Feminist Economics, 13*(2), 55–91.

Smolensky, E., Reilly, S., & Evenhouse, E. (1995). Should public assistance be targeted? *Journal of Post Keynesian Economics, 18*, 3–28.

Thévenon, O. (2009). Increased women's labour force participation in Europe: Progress in the work-life balance or polarization of behaviours? *Population, 64*(2), 235–272 (english edition).

Thévenon, O. (2011). Family policies in OECD countries: A comparative analysis. *Population and Development Review, 37*(2), 57–87.

Thévenon, O., & Gauthier, A. (2011). Family policies in developed countries: A 'fertility-booster' with side-effects. *Community, Work and Family, 14*(2), 197–216.

Waldfogel, J., Wen-Jui, H., & Brooks-Gunn, J. (2002). The effects of early maternal employment on child cognitive development. *Demography, 39*(2), 369–392.

Witheford P., & Adema W. (2007). What works best in reducing child poverty: A benefit or work strategy? OECD Social, employment and migration working papers 51. OECD, Paris.

Zhang, X. (2010). Can motherhood earnings losses be ever regained? Evidence from Canada. *Journal of Family Issues, 31*(12), 1671–1688.

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DÉMOGRAPHIE

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FINANCE

« Rebond de la fécondité » dans les pays développés, automatisme ou apanage de quelques rares privilégiés ?

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Dans la plupart des pays développés, une chute rapide de la fécondité en dessous du taux de remplacement a été observée au cours des dernières décennies, tandis que les niveaux moyens de revenus ont continué d'augmenter. Toutefois, ces dernières années, la fécondité est repartie à la hausse dans plusieurs pays très développés, simultanément à un développement économique continu. Dans le même temps, la fécondité stagne à des niveaux très bas dans bon nombre d'autres pays ayant des niveaux de revenus similairement élevés.

L'inversion de la tendance de la fécondité, également appelée « rebond de la fécondité », qui accompagne le processus de développement économique dans certains pays développés, mais pas dans tous, montre que l'incidence du développement économique sur la fécondité est ambiguë. Le caractère positif ou négatif de cette incidence dépend de nombreux facteurs, en plus de la dimension économique. Dans la mesure où la fécondité affecte la croissance démographique et la pyramide des âges, les évolutions de la fécondité dans le futur immédiat ont des conséquences très importantes sur le développement économique, la croissance de la productivité et certains aspects des systèmes de protection sociale. Par conséquent, le fait de savoir si de nouveaux progrès économiques sont susceptibles de provoquer un rebond de la fécondité dans les pays très développés revêt un intérêt politique, social et économique majeur.

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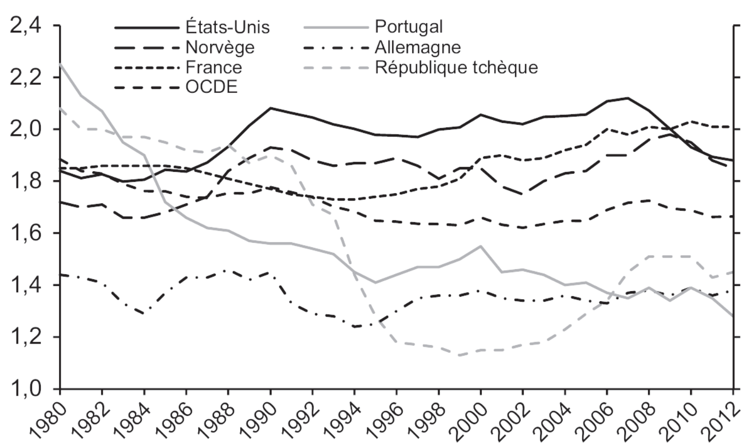
Cet article apporte un éclairage sur les moteurs potentiels de la fécondité dans les pays très développés. En dressant un état de l'art de la littérature empirique sur le sujet, l'article répond à la question suivante : le phénomène du « rebond de la fécondité » est-il susceptible, et dans quelles conditions, de devenir un fait stylisé dans les pays développés dans un avenir proche ?

LE PHÉNOMÈNE DU REBOND DE LA FÉCONDITÉ

Le graphique 1 illustre l'évolution des taux de fécondité totale dans certains pays sélectionnés ainsi que la moyenne de l'Organisation de coopération et de développement économiques (OCDE). En moyenne, dans les pays de l'OCDE, les taux de fécondité totale ont chuté en dessous du niveau de remplacement (2,1 enfants par femme) au cours des cinquante dernières années. Dans la plupart des pays, ce déclin ininterrompu s'est poursuivi jusqu'au milieu des années 1990. Depuis, plusieurs pays développés ont connu une inversion de la tendance avec une hausse des taux de fécondité. Le « rebond » a été particulièrement élevé en France, aux États-Unis, au Danemark, en Suède, en Finlande et en Norvège. Dans le même temps, dans les pays germanophones et dans la plupart des pays de l'Est et du Sud méditerranéens, la fécondité stagne depuis la fin des années 1990 à des niveaux inférieurs à 1,5 enfant par femme. Depuis la récente crise économique, la fécondité a de nouveau chuté dans de nombreux pays développés, à l'instar des États-Unis, de la Norvège et de la Suède, ainsi que du Portugal et de l'Espagne. Dans la plupart des autres pays développés, la fécondité stagne depuis 2008.

Graphique 1
Taux de fécondité totale dans les pays développés



Source : Indicateurs de développement, Banque mondiale (2016).

Il n'est pas possible de dégager une tendance nette de la fécondité à long terme pour les pays développés. Certains pays connaissent un rebond, mais rien ne prouve que les niveaux de fécondité convergent naturellement vers le niveau de remplacement une fois atteint un certain niveau minimal : certains pays semblent enrayés dans un scénario de faible fécondité, tandis que dans d'autres pays, la fécondité a récemment recommencé à décroître après une période de reprise.

Ce tableau donne l'impression que les décisions en matière de fécondité émergent dans le cadre d'une interaction complexe entre institutions et circonstances macroéconomiques. Ces facteurs influencent non seulement le *quantum* (autrement dit, le nombre d'enfants qu'une femme a à la fin de sa vie reproductive), mais également le calendrier des naissances (le *tempo*). En tant que mesures périodiques, les taux de fécondité totale sont sensibles aux évolutions du calendrier des naissances. L'ajournement des naissances conduit à une baisse des taux de fécondité totale. Parallèlement, la fin de cet ajournement contribue au rebond des taux de fécondité totale (Goldstein *et al.*, 2009 ; Bongaarts et Sobotka, 2012), même si la taille finale moyenne de la famille (descendance finale) demeure inchangée par cet ajournement et ce processus de rattrapage. Ainsi, le *tempo* des naissances n'agit pas forcément sur le *quantum*. Par conséquent, il est théoriquement possible que les différences entre pays au niveau des taux de fécondité totale sont uniquement liées aux différences dans le calendrier des naissances. Néanmoins, le fait que le rebond de la fécondité soit si important dans certains pays, alors que dans d'autres, la fécondité stagne à des niveaux très bas pendant des décennies, suggère que les différences en termes de fécondité entre pays développés ne résultent pas seulement des différences dans le calendrier des naissances, mais reflètent également les disparités entre les décisions des parents quant au nombre d'enfants qu'ils auront au final.

Mais quels sont les principaux déterminants des décisions parentales en termes de fécondité ? Dans ce qui suit, l'article présente des données empiriques relatives aux déterminants potentiels de la fécondité, au-delà du développement économique.

DANS QUELLE MESURE LES DÉCISIONS EN MATIÈRE DE FÉCONDITÉ SONT-ELLES DÉTERMINÉES PAR LE CONTEXTE MACROÉCONOMIQUE DES PAYS ?

Quelques récentes études ont analysé l'évolution des relations entre croissance économique et fécondité. Par exemple, Myrskylä *et al.* (2009) ont observé, pour un échantillon de plus de cent pays, une corrélation strictement négative entre l'indice de développement humain (qui associe l'espérance de vie, le niveau d'études et le PIB – produit intérieur brut – par habitant) et les taux de fécondité totale pour 1975. En revanche, pour 2005, le tableau est moins uniforme : on constate que les pays ayant de faibles niveaux de développement ont des niveaux de fécondité très élevés, que les pays ayant des niveaux de développement moyens ont des niveaux de fécondité très bas et que dans les pays ayant des niveaux de développement les plus élevés, la fécondité se situe à un niveau quelque peu supérieur. Ces observations portant sur plusieurs pays suggèrent un virage du négatif au positif dans la relation entre développement et fécondité. Mais quel est le seuil de développement qui marque l'inversion de la tendance de la fécondité ? Et quel est le moteur derrière le développement qui conduit au rebond ?

LE DÉVELOPPEMENT ÉCONOMIQUE : UNE CONDITION NÉCESSAIRE, MAIS PAS SUFFISANTE AU REBOND DE LA FÉCONDITÉ

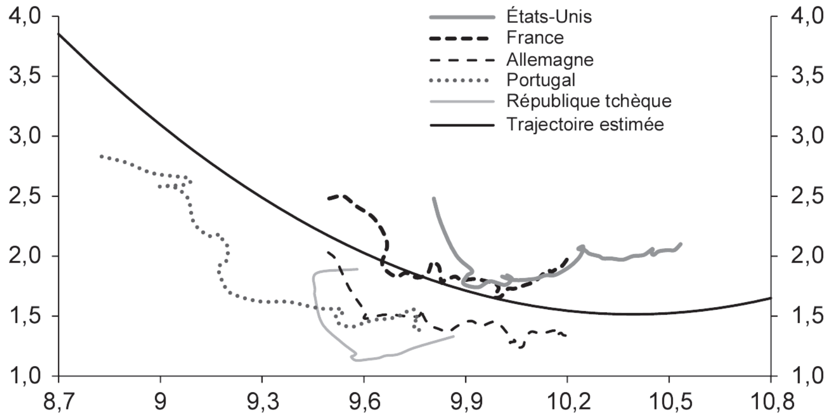
Afin de traiter ces questions, Luci-Greulich et Thévenon (2014) évaluent l'impact du PIB par habitant sur la fécondité en utilisant des données agrégées pour trente pays de l'OCDE sur une période couvrant plus de quarante années (1960-2007). En appliquant un modèle d'estimation mettant l'accent sur les variations à l'intérieur des pays (estimation à effets fixes), ils constatent que la corrélation entre le PIB par habitant et la fécondité passe de négative à positive à partir d'un niveau de PIB par habitant de 32 600 dollars (log du PIB par habitant de 10,3). Le niveau minimal correspondant des taux de fécondité totale se situe à 1,5 enfant par femme.

Le graphique 2 (ci-contre) illustre la trajectoire estimée et la compare aux tendances réelles observées dans quelques pays sélectionnés.

À l'image de la trajectoire estimée, toutes les tendances des pays présentent un profil en J inversé. La différence avec la trajectoire estimée s'observe au niveau de fécondité auquel les tendances des pays se situent. Dans la plupart des pays nordiques et anglophones ainsi qu'en France, la tendance se situe à un niveau de fécondité supérieur au niveau estimé. En outre, en France et aux États-Unis, la reprise de la fécondité est plus importante que celle prévue par la trajectoire estimée. Dans les pays de faible fécondité tels que l'Allemagne, le Portugal et la République tchèque, la tendance se situe à un niveau de fécondité plus faible et la reprise est moins importante que prévue.

L'Allemagne et la France enregistrent des tendances quasiment parallèles, mais le niveau de fécondité est globalement plus élevé et le rebond beaucoup plus important en France. Compte tenu des niveaux de développement économique relativement similaires des deux pays, les résultats montrent que le développement économique ne suffit pas à expliquer la raison pour laquelle un rebond de la fécondité survient dans certains pays et pas dans d'autres.

Graphique 2
Tendance estimée en matière de fécondité et tendances observées en matière de fécondité dans quelques pays tout au long du processus de développement économique (1960-2007)
(en abscisse, log du PIB par habitant, prix constants de 2005, PPA ; en ordonnée, taux de fécondité totale)



PPA : parité de pouvoir d'achat.

Source : Luci-Greulich et Thévenon (2014).

L'EMPLOI DES FEMMES FAIT TOUTE LA DIFFÉRENCE

Afin de déterminer quels facteurs – outre les progrès économiques – sont à l'origine du rebond de la fécondité, Luci-Greulich et Thévenon (2014) décomposent le PIB par habitant selon ses composantes, à savoir la productivité du travail, les heures de travail et l'emploi des hommes et des femmes. La variable la plus corrélée à la reprise de la fécondité est l'emploi des femmes. L'évolution de l'incidence du développement économique sur la fécondité, qui de négative devient positive, émerge dans les pays dans lesquels la hausse du PIB s'accompagne d'une hausse de la participation des femmes au marché du travail.

Le rebond de la fécondité dans les pays très développés s'accompagne ainsi d'une évolution de la corrélation entre fécondité et emploi des femmes. Tandis que les taux de fécondité les plus élevés étaient clairement observés dans les pays ayant les taux les plus faibles d'emploi des femmes au début des années 1980, c'est aujourd'hui le contraire qui est constaté, avec des taux de fécondité plus élevés dans les pays où les taux d'emploi sont également plus élevés (OCDE, 2011). À ce jour, des taux élevés d'emploi des femmes ainsi que des taux élevés de fécondité s'observent notamment dans les pays nordiques, alors qu'en Europe du Sud et de l'Est, non seulement la fécondité mais également les taux d'emploi des femmes sont relativement faibles. En Allemagne, une faible fécondité apparaît de concert avec un faible taux d'emploi à temps plein des mères de jeunes enfants, tandis que ces deux mesures sont beaucoup plus élevées en France.

Comment le passage d'un lien négatif à un lien positif entre fécondité et emploi des femmes s'explique-t-il ? À des stades de développement économique relativement peu avancés, la croissance du PIB ouvre aux femmes l'accès à l'éducation et à l'emploi. Ce phénomène accroît les « coûts d'opportunité liés au fait d'avoir des enfants », dans la mesure où le temps passé à la maison représente une perte de salaire implicite (coût indirect des enfants). Par conséquent, dans un contexte où la possibilité de faire garder des enfants est limitée, de nombreuses femmes favorisent le travail au détriment de la maternité (Mincer, 1958). Néanmoins, la poursuite du développement économique peut inverser le lien entre taux d'emploi des femmes et taux de fécondité, qui de négatif devient positif, de deux façons. En premier lieu, l'emploi des femmes apporte un revenu supplémentaire qui renforce la situation économique des ménages. Cela rend plus abordable le fait d'avoir davantage d'enfants (Becker, 1960). En second lieu, les pays peuvent se permettre d'investir de plus en plus dans des politiques qui aident les parents à supporter le coût indirect des enfants en leur permettant de concilier plus facilement travail et vie de famille.

IMPORTANCE DE LA RÉCONCILIATION ENTRE VIE PROFESSIONNELLE ET VIE FAMILIALE

Compte tenu de ces arguments, la compatibilité entre maternité et emploi des femmes apparaît comme un paramètre clé de la reprise de la fécondité dans les pays très développés. Les parents qui semblent réussir à combiner vie professionnelle et vie familiale vivent principalement dans les pays développés qui fournissent une aide institutionnelle importante aux parents actifs de jeunes enfants.

Par conséquent, les politiques familiales contribuent potentiellement à la reprise de la fécondité : elles permettent de réduire les coûts monétaires directs liés aux enfants (logement, éducation) grâce au soutien de transferts financiers et permettent de réduire les coûts indirects (opportunités de revenus manquées) en facilitant l'emploi des parents.

Afin de déterminer quelles institutions publiques sont les plus efficaces, Luci-Greulich et Thévenon (2013) évaluent l'impact des évolutions dans les politiques familiales sur les tendances de la fécondité dans les pays développés. Des données agrégées de panel provenant de dix-huit pays de l'OCDE et portant sur la période 1982-2007 sont utilisées. Plusieurs instruments de politique familiale sont pris en compte : différents types d'allocations, durée du congé parental rémunéré ainsi que couverture des besoins en garde d'enfants et dépenses liées à la garde des enfants. Ces auteurs constatent que même si tous les instruments ont un effet positif sur la fécondité, tous les leviers politiques n'ont pas le même poids : les prestations en espèces couvrant l'enfance au-delà de l'année de naissance et le taux de couverture des services de garde d'enfants pour les enfants âgés de moins de trois ans ont une influence potentielle plus importante sur la fécondité que le droit au congé et les prestations allouées au moment de la naissance. En parallèle, Thévenon (2015) constate que les politiques investissant dans des structures formelles de garde d'enfants accroissent plus efficacement l'emploi des femmes que les autres politiques familiales.

En effet, les pays développés ayant les taux de fécondité et d'emploi des femmes les plus élevés sont également ceux qui ont un taux de couverture élevé des services de garde d'enfants, à l'instar des pays nordiques ou de la France. En revanche, les pays caractérisés par des niveaux faibles de fécondité et d'emploi des femmes ont tendance à fournir un soutien relativement faible en faveur de la réconciliation du travail et de la vie de famille. Dans les pays où l'accès à la garde d'enfants formelle est limité, les femmes sont contraintes de choisir entre emploi et enfants, ce qui réduit à la fois le taux de fécondité et le taux d'emploi des femmes. C'est le cas, par exemple, dans les pays du Sud de l'Europe où de nombreuses mères sont inactives. En Allemagne, beaucoup de mères doivent limiter leurs activités professionnelles à de petits emplois précaires à temps partiel, tandis que les femmes qui poursuivent une carrière à temps plein ont tendance à ne pas avoir d'enfants ou à n'en avoir qu'un seul (Greulich, 2015).

La reprise de la fécondité se produit donc dans les pays développés qui investissent afin de permettre aux parents de concilier vie professionnelle et vie familiale. D'autres études à l'échelle macroéconomique complètent cette conclusion en montrant que le rebond de la fécondité est plus important dans les pays développés qui ont le plus œuvré vers une évolution des relations entre les sexes en faveur d'une meilleure égalité, tel que cela est mesuré, par exemple, par des attitudes favorables à l'égalité entre les sexes en faveur de l'emploi des femmes, par un nombre croissant de naissances hors mariage qui reflètent les normes de la famille moderne ou par l'implication croissante des hommes dans la vie du foyer (Balbo *et al.*, 2013 ; Goldscheider *et al.*, 2013 ; Neyer *et al.*, 2013 ; Arpino et Esping-Andersen, 2015 ; Baizan *et al.*, 2015).

La concordance des études macroéconomiques suggère que le lien positif qui existe entre autonomisation économique des femmes et fécondité est plutôt solide. Mais dans quelle mesure ce lien reflète-t-il les comportements individuels ? Est-ce vraiment les femmes qui sont actives économiquement qui ont le plus d'enfants ?

LES FEMMES AYANT SUIVI DES ÉTUDES ET AYANT UN EMPLOI ONT-ELLES PLUS D'ENFANTS ?

Quelques études spécifiques par pays ont analysé le lien entre éducation des femmes et maternité. Kravdal et Rindfuss (2008), par exemple, constatent qu'en Norvège, le lien négatif qui existe entre éducation des femmes et naissances de rang supérieur à 1 disparaît entre les cohortes nées au début des années 1940 et celles nées au début des années 1960, tandis que ce lien devient positif pour les cohortes plus jeunes. Klesment *et al.* (2014) confirment un lien positif entre éducation des femmes et naissance d'un deuxième enfant dans le nord et l'ouest de l'Europe, mais pas dans les pays germanophones, ni dans le sud et l'est de l'Europe. Testa (2012) observe une corrélation positive entre éducation et intentions en matière de fécondité en utilisant les données du sondage Eurobaromètre (2006 et 2011) pour vingt-sept pays de l'Union européenne. Baizan *et al.* (2015) constatent que dans les pays européens, la couverture des besoins en garde d'enfants est positivement liée à la descendance finale au niveau individuel pour l'ensemble des groupes de niveaux d'éducation, même si cette corrélation est plus marquée pour les femmes ayant un haut niveau d'éducation. D'Albis *et al.* (2016) observent un impact significativement positif de l'éducation des femmes sur la propension à avoir un deuxième enfant dans les pays européens fournissant un niveau élevé de taux de couverture des services de garde d'enfants.

Peu d'études portent sur le lien entre statut d'emploi des femmes et fécondité. Les données disponibles suggèrent que l'entrée des femmes sur le marché du travail va de pair avec la naissance d'un premier enfant dans les pays où le cadre institutionnel est suffisamment complet pour faciliter la conciliation du travail et de la vie de famille (Schmitt, 2012 ; Rendall *et al.*, 2014 ; Wood *et al.*, 2015). En se basant sur une approche axée sur une cohorte synthétique, d'Albis *et al.* (2015) établissent que dans les pays européens, les femmes qui s'investissent dans l'éducation supérieure et le développement de leur carrière ont leur premier enfant plus tard que les femmes ayant un niveau d'études inférieur et celles n'ayant pas réussi à s'intégrer sur le marché du travail, mais qu'elles sont également moins susceptibles de ne pas avoir d'enfants. Adsera (2011) montre, en s'appuyant sur des données provenant de treize pays européens, que l'incidence du statut d'emploi sur les transitions vers les naissances de rang supérieur à 1 varie de manière significative entre secteur public et secteur privé et selon la durée du contrat. Sur la base de modèles de risque pour la transition vers le premier et le deuxième enfant, Matysiak et Vignoli (2013) constatent que l'emploi des femmes fait obstacle à la maternité en Italie, tandis qu'en Pologne, les femmes ont tendance à concilier les deux activités.

Greulich *et al.* (2016) analysent si la participation des femmes au marché du travail a une incidence sur la propension à avoir un deuxième enfant, en mobilisant des données longitudinales provenant de l'Enquête européenne sur le revenu et les conditions de vie (EU-SILC), couvrant trente pays européens et la période 2003-2011. Ils se concentrent sur la deuxième naissance dans la mesure où ils constatent que près de la moitié de l'écart dans la descendance finale entre pays à forte fécondité et pays à faible fécondité en Europe est due au moindre nombre d'enfants de rang de naissance 2, tandis que les autres rangs de naissance sont moins déterminants. Dans un contexte de préférences plutôt homogènes pour une famille avec deux enfants dans les pays européens (Testa, 2012 ; Sobotka et Beaujouan, 2014), cette conclusion laisse entendre que les parents dans les pays à faible fécondité sont confrontés à des obstacles, en particulier en ce qui concerne le deuxième enfant.

Greulich *et al.* (2016) constatent qu'en moyenne, dans les pays européens, les femmes ayant un emploi stable ont une probabilité significativement plus importante d'avoir un deuxième enfant que les femmes inactives ou au chômage. L'ampleur de l'incidence varie toutefois selon les personnes et entre les groupes de pays. L'impact positif est renforcé pour les femmes ayant un partenaire qui a lui-même un emploi stable, ce qui montre qu'une double activité favorise l'agrandissement de la famille, davantage que les schémas d'emploi hétérogènes entre partenaires. Le fait d'avoir un emploi stable est un déterminant essentiel dans la décision d'avoir un deuxième enfant pour les femmes ayant un niveau d'études élevé, mais ne facilite pas nécessairement cette décision pour les femmes ayant un niveau d'études inférieur. En outre, l'impact positif de l'emploi est important dans les pays à forte fécondité et moindre dans les pays à faible fécondité, indiquant un équilibre entre travail et vie de famille plus conflictuel dans les pays à faible fécondité, en particulier pour les femmes ayant un niveau d'études inférieur.

Afin d'aborder cette question institutionnelle, des modèles multiniveaux sont exécutés, lesquels permettent d'intégrer à l'équation d'estimation des variables agrégées telles que le taux de couverture des services de garde d'enfants (enfants âgés de zéro à deux ans), la durée du congé parental et les transferts monétaires aux familles. On observe que le développement de structures formelles de garde d'enfants augmente la probabilité pour les femmes d'avoir un deuxième enfant, en particulier en ce qui concerne les femmes ayant un emploi, tandis que les autres types de soutien institutionnel n'ont pas un effet positif aussi marqué. Par ailleurs, on constate que les systèmes de garde d'enfants renforcent l'impact positif de l'emploi sur la probabilité d'avoir un deuxième enfant.

Les politiques en matière de garde d'enfants qui facilitent l'emploi des parents apparaissent donc comme les plus susceptibles d'encourager les couples à agrandir leurs familles. Dans les pays européens à faible fécondité, la faible probabilité pour les femmes d'avoir un deuxième enfant est souvent liée aux obstacles institutionnels à l'agrandissement de la famille. L'insuffisance des structures formelles et subventionnées de garde d'enfants décourage en particulier les femmes ayant un niveau d'études inférieurs et actives sur le marché du travail d'avoir un deuxième enfant. Dans la plupart des pays à faible fécondité (notamment en Slovénie, en Slovaquie, en Lituanie et en Lettonie), la grande majorité des femmes travaillent à temps plein après la naissance d'un premier enfant. Ces femmes, et en particulier celles ayant un niveau d'études inférieur et qui vivent souvent dans un ménage à faibles revenus, sont susceptibles de s'abstenir d'avoir un deuxième enfant. Elles redoutent de devoir cesser ou réduire leurs activités professionnelles, ce que le ménage ne peut se permettre. Dans d'autres pays à faible fécondité comme la Pologne, la Hongrie, la République tchèque, la Bulgarie, le Portugal, l'Autriche ou l'Allemagne, de nombreuses femmes sont inactives après la naissance de leur premier enfant ou n'exercent qu'un petit emploi à temps partiel. Là encore, ce sont surtout les ménages à faibles revenus qui doivent s'abstenir d'agrandir leurs familles, en raison de contraintes financières. Dans les pays à forte fécondité, tels que la France et les pays nordiques, l'accès à des structures formelles de garde d'enfants permet aux mères de travailler soit à temps plein, soit à temps partiel étendu (quatre jours sur cinq, par exemple). Ainsi, on constate que la continuité des activités professionnelles des deux parents est favorable à l'agrandissement de la famille pour toutes les catégories de niveau d'études dans ces pays.

PANORAMA : LE REBOND DE LA FÉCONDITÉ EN PÉRIODE DE CRISE ÉCONOMIQUE

La littérature relative au rebond de la fécondité suggère que pour bon nombre de parents, la possibilité de générer et de maintenir un revenu familial constitue une condition fondamentale pour fonder et agrandir une famille. Les pays qui investissent dans des politiques régissant l'équilibre entre travail et vie de famille, telles que celles favorisant les structures formelles de garde d'enfants, sont ceux qui enregistrent les taux de fécondité et d'emploi des femmes les plus élevés. Toutefois, afin de garantir la sécurité financière aux familles, les politiques familiales, d'une part, mais aussi les institutions du marché du travail, d'autre part, jouent un rôle essentiel. Cela semble particulièrement important au regard de la récente crise économique. Au cours des dernières années, les taux de fécondité totale ont stagné ou diminué de nouveau dans beaucoup de pays développés, en particulier dans ceux qui sont les plus touchés par la crise. Le rebond de la fécondité est par conséquent tout sauf un automatisme fiable. De nombreux parents ajournent la naissance d'un enfant en raison de l'incertitude économique actuelle. Si les pays ne parviennent pas à fournir des conditions d'emploi stable, les parents risquent non seulement d'ajourner les naissances, mais aussi ils pourraient y renoncer, en particulier en ce qui concerne les enfants de rang supérieur.

BIBLIOGRAPHIE

ADSERA A. (2011), « Labor Market Conditions and Fertility in Europe », *European Journal of Population*, vol. 27, n° 1, pp. 1-32.

ARPINO B. et ESPING-ANDERSEN G. (2015), « How do Changes in Gender Role Attitudes towards Female Employment Influence Fertility. A Macro-Level Analysis », *European Sociological Review.*

BAIZAN P., ARPINO B. et DELCLOS C. E. (2015), « The Effect of Gender Policies on Fertility: the Moderating Role of Education and Normative Context », *European Journal of Population,* pp. 1-30.

BALBO N., BILLARI F. C. et MILLS M. (2013), « Fertility in Advanced Societies: a Review of Research », *European Journal of Population*, vol. 29, n° 1, février, pp. 1-38.

BECKER G. S. (1960), « An Economic Analysis of Fertility », in *Demographic and Economic Change in Developed Countries*, Universities-National Bureau Committee for Economic Research, Princeton University Press.

BONGAARTS J. et SOBOTKA T. (2012), « A Demographic Explanation for the Recent Rise in European Fertility », *Population and Development Review*, vol. 38, n° 1, mars, pp. 83-120.

D'ALBIS H., GOBBI P. et GREULICH A. (2016), « Having a Second Child and Access to Childcare: Evidence from European Countries », Centre d'économie de la Sorbonne, *document de travail*, n° 2016-17.

D'ALBIS H., GREULICH A. et PONTHIERE G. (2015), *Avoir un enfant plus tard. Enjeux sociodémographiques du report des naissances*, CEPREMAP, opuscule n° 39, Éditions Rue d'Ulm.

GOLDSCHEIDER F., BERNHARDT E. et BRANDÉN M. (2013), « Domestic Gender Equality and Childbearing in Sweden », *Demographic Research*, vol. 29, art. 40, pp. 1097-1126.

GOLDSTEIN J. R., SOBOTKA T. et JASILIONIENE A. (2009), « The End of "Lowest-Low Fertility?" », *Population and Development Review*, vol. 35, n° 4, pp. 663-699.

GREULICH A. (2015), « Sharing Patterns among Couples in European Countries », *Work in Progress*.

GREULICH A., THÉVENON O. et GUERGOAT-LARIVIÈRE M. (2016), « Securing Women's Employment: a Fertility Booster in European Countries? » Centre d'économie de la Sorbonne, *document de travail*, n° 2016-24.

KLESMENT M., PUUR A., RAHNU L. et SAKKEUS L. (2014), « Varying Association between Education and Second Births in Europe: Comparative Analysis Based on the EU-SILC Data », *Demographic Research*, vol. 31, pp. 813-860.

KRAVDAL Ø. et RINDFUSS R. R. (2008), « Changing Relationships between Education and Fertility: a Study of Women and Men Born 1940 to 1964 », *American Sociological Review*, vol. 73, n° 5, octobre, pp. 854-873.

LUCI-GREULICH A. et THÉVENON O. (2013), « The Impact of Family Policy Packages on Fertility Trends in Developed Countries », *European Journal of Population,* vol. 29, n° 4, pp. 387-416.

LUCI-GREULICH A. et THÉVENON O. (2014), « Does Economic Development "Cause" a Re-Increase in Fertility? An Empirical Analysis for OECD Countries (1960-2007) », *European Journal of Population*, vol. 30, pp. 187-221.

MATYSIAK A. et VIGNOLI D. (2013), « Diverse Effects of Women's Employment on Fertility: Insights from Italy and Poland », *European Journal of Population*, n° 29, pp. 273-302.

MINCER J. (1958), « Investment in Human Capital and Personal Income Distribution », *Journal of Political Economy*, n° 66, août, pp. 281-302.

MYRSKYLÄ M., KOHLER H. P. et BILLARI F. (2009), « Advances in Development Reverse Fertility Declines », *Nature*, vol. 460, n° 6, pp. 741-743.

NEYER G., LAPPEGARD T. et VIGNOLI D. (2013), « Gender Equality and Fertility: Which Equality Matters? », *European Journal of Population*, n° 29, pp. 245-272.

OCDE (2011), *Doing Better for Families*.

RENDALL M., DEROSE A., EVANS A., GRAY E., HANAPPI D., KREUTER F., LAPPEGARD T., REEDER L., RØNSEN M. et TOULEMON L. (2014), « Employment Impacts on Partnership and Parenthood Entry in Different Family-Policy Regimes », European Population Conference.

SCHMITT C. (2012), « Labour Market Integration, Occupational Uncertainties and Fertility Choices in Germany and the UK », *Demographic Research*, vol. 26, art. 12, pp. 253-292.

SOBOTKA T. et BEAUJOUAN E. (2014), « Two Is Best? The Persistence of a Two-Child Family Ideal in Europe », *Population and Development Review*, vol. 40, n° 3, pp. 391-419.

TESTA M. R. (2012), « Family Sizes in Europe: Evidence from the 2011 Eurobarometer Survey », Vienna Institute of Demography of the Austrian Academy of Sciences, *European Demographic Research Papers*, n° 2.

THÉVENON O. (2015), « Do "Institutional Complementarities" Foster Female Labour Force Participation? », *Journal of Institutional Economics*.

WOOD J., VERGAUWEN J. et NEELS K. (2015), « Economic Conditions and Variation in First Birth Hazards in 22 European Countries between 1970 and 2005 », *Work in Progress*.

H. D'Albis, P. Gobbi, A. Greulich (2017): "Having a Second Child and Access to Childcare: Evidence from European Countries." *Journal of Demographic Economics*, à paraître (revue pas encore classée car fondée en 2015, ancienne revue *Louvain Economic Review*, CNRS cat. 3)

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Dear Dr. Greulich:

Thank you for submitting the final version of your manuscript entitled "Having a Second Child and Access to Childcare: Evidence from European Countries.", which is acceptable for publication in the Journal of Demographic Economics in its current form.

We will now initiate the Production process and you will receive the proofs in due course.

Sincerely,

Sebastien Schillings
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HAVING A SECOND CHILD AND ACCESS TO CHILDCARE: EVIDENCE FROM EUROPEAN COUNTRIES

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Abstract This paper shows that differences in fertility across European countries mainly emerge due to fewer women having two children in low-fertility countries. It further suggests that childcare services are an important determinant for the transition to a second child to occur. The theoretical framework we propose suggests that (i) in countries where childcare coverage is low, there is a U-shaped relationship between a couple's probability of having a second child and the woman's potential wage, whereas (ii) in countries with easy access to childcare, this probability is positively related with the woman's potential wage. Data from the European Union Statistics on Income and Living Conditions (EU-SILC) confirm these implications when estimating a woman's probability of having a second child as a function of education. This implies that middle-income women are the most affected ones by the lack of access to formal and subsidized childcare.

Keywords: childcare, education, fertility, female employment

JEL Classification Numbers: J11, J13, J16, 011

1. INTRODUCTION

Birth rates across European countries have been falling since the 1960s. Although total fertility rates (TFR) stagnate at very low levels in some European countries, they have started to pick-up in other European countries [Myrskyla et al. (2009); Luci-Greulich and Thévenon (2014); Hazan and Zoabi (2015)]. Figure 1 illustrates

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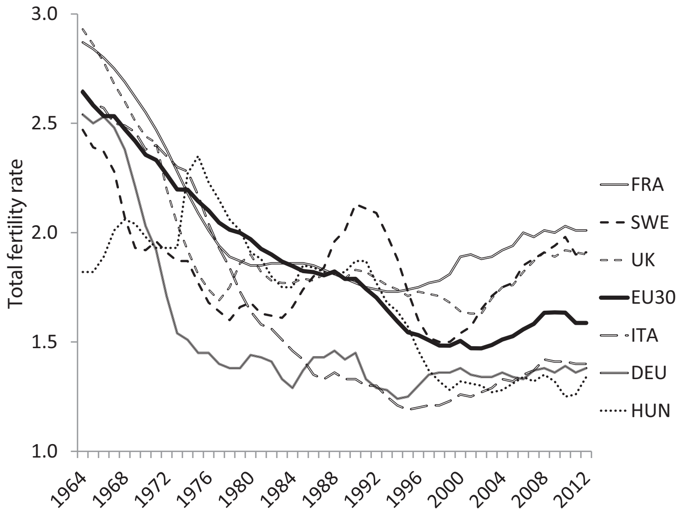

FIGURE 1. Evolution of total fertility rates from 1964 to 2012 in selected European countries.

that in some countries, TFR have shown signs of an upsurge, back to replacement levels since the mid-1990s (notably in France, Sweden, Norway, Denmark, the United Kingdom, and Belgium), whereas in others, fertility has continued to drop below the European average, stagnating under 1.5 children per woman (as in Italy, the Czech Republic, Germany, Hungary, and Poland). This paper contributes to a better understanding of the factors that have made it possible for fertility rates to recover in some countries but not in others.

This reversal of fertility trends in some countries is caused in part by the end of the postponement of childbearing among younger generations [Goldstein et al. (2009); Bongaarts and Sobotka (2012)]. Fertility levels fall initially because women delay the age at which they have their first child, leading to a temporary depression of overall fertility rates. As time elapses, however, the total number of births recovers due to a catch up effect. Differences in the timing of births thus may contribute to differences in fertility rates among European countries.

However, recent research suggests that fertility differentials across European countries cannot be fully explained by differences in birth postponement only. Structural and cultural changes that come with economic development are also likely to affect fertility decisions, not only in terms of timing, but also in terms of quantum [Billari and Kohler (2004); Frejka (2008); Goldstein et al. (2009); Lesthaeghe (2010)]. Luci-Greulich and Thévenon (2013), for example, show that the rise in fertility rates back to replacement levels occurs only in those highly developed countries where female employment comes hand in hand with economic development, highlighting the importance of structural improvements that allow more and more parents, and particularly mothers, to combine work and family life.

Although it has been argued that a below-replacement level fertility may reflect a general preference for low fertility among women and couples, most recent survey data for European countries suggest that there exist in fact barriers hindering parents from realizing their desired fertility levels, and these barriers seem more important in low-fertility countries. The surveys actually indicate stable preferences around a two-child family model for both women and men in all European countries, independent of national fertility level. Sobotka (2013) shows that the variation between countries in desired family size is generally low, centering around the two-child ideal in all European countries. Sobotka and Beaujouan (2014) show that the variance across cohorts of adults' responses to the question of "ideal family size" within European countries gets smaller over generations. Even low-fertility countries (as measured by completed fertility rates of women aged 45+) such as Poland, the Czech Republic, Slovakia, Bulgaria, Spain, Portugal, Germany, and Italy affirm an average desired fertility of two children [(Eurobarometer 2006; 2011)]. The important and persisting gap that exists between intended and realized completed fertility in countries with fertility levels below replacement level suggests that there are institutional barriers that push couples towards a lower fertility regime.

This paper sheds light on these barriers. In Section 2, we first develop a theoretical framework in order to present the mechanism under which childcare availability positively affects fertility. This relationship is empirically documented. The theory assumes a unitary household decision problem in which couples choose their fertility levels, their labor supply, and the type of childcare they desire. Men and women can supply childcare out of their own labor time or purchase childcare services from the market at a given price. The mechanism put forward with this setup is that an easier access to childcare allows parents to purchase these services instead of providing them themselves. The generated income that can be maintained after child birth facilitates the couple's decision in favor of family enlargement.

In Section 3, we first use the cross-sectional wave of the European Union Statistics on Income and Living Conditions (EU-SILC) to show that differences in fertility levels between low- and high-fertility countries mainly emerge due to fewer women having two children in low-fertility countries, suggesting a barrier for the second child birth in low-fertility countries. The theory is then extended to better understand the transition from a first to a second child. Two implications derive from the theory. The first says that the probability of having a second child in low-fertility countries, which are characterized by difficult access to childcare, follows a U-shaped relationship with women's potential wage. The decreasing part of the U is driven by the behavior of couples who cannot afford to purchase childcare activities in the private market. For these couples, it is often the woman who performs childcare activities for the first child and the general trend of increasing female average wages naturally increases the opportunity cost of this personal childcare, and therefore decreases the probability of having a second child. This (substitution) effect, however, subsides after a certain level of income. Once couples are able to outsource childcare, a higher female wage level allows the couple to buy more time from the market and encourages having a second child (increasing part of the U-shaped relationship). The second prediction is that in high-fertility countries, where childcare availability is generalized, only the positive relationship between female wage and fertility is observed. This stems from an income effect that can be seen in high-fertility developed countries, where childcare services are more accessible, leading to a probability of having a second child that is increasing with women's wage.

These theoretical implications are empirically corroborated in Section 3.3 for European countries. We estimate how the impact of women's education (used as a proxy for potential wage) on the couple's probability of having a second child differs with the access to formal childcare. We therefore use the longitudinal module of the European Union Statistics on Income and Living Conditions (waves 2003–2011) in combination with the OECD Family Database. We find that in countries where childcare coverage is low, there is a U-shaped pattern between women's education level and her probability of having a second child, whereas this relationship is continuously positive in countries with easier access to childcare. We control hereby for various side effects such as partner characteristics.

Our findings are in line with recent studies that have looked at the link between measures of female employment, education, and fertility interacting with childcare. This paper relates mostly to Hazan and Zoabi (2015), who find that higher wage inequalities in the United States lead highly educated women to outsource childcare more, driving a U-shaped relationship between women's education and fertility.[1] We differ from them by looking at European countries and focusing on second child birth, as missing children of birth order two contribute most to the fertility gap between low- and high-fertility countries. The large country coverage allows applying multilevel models, which take into account the institutional context in terms of access to childcare.

Relating the cost of childcare to female labor force participation, Blau and Robins (1988) show that the price for outsourcing childcare services in the United States is negatively correlated to women's decision to both enter the labor market and to purchase childcare services. Attanasio et al. (2008) suggest that a decrease in childcare costs could explain the increase in the labor force participation of mothers of young children from the observed 0.47 rate for the cohort born in the 1940s to 0.68 for the cohort born in the 1950s in the United States. Schoonbroodt (2016) provides estimates for childcare costs paid by parents in the United States. She shows in particular that during traditional working hours, women spend three times more of their time in childcare than men.

A series of studies confirm the positive relationship between female labor force participation and access to childcare that has been found in the United States for other countries. In Quebec, Baker et al. (2008) show that an increase in female labor force participation followed the introduction of universal childcare. Similarly, using data on Swedish households, Gustafsson and Stafford (1992) show that public childcare led to higher female labor market participation and that a lower cost of childcare services positively affects the use of of these services if seats for children in these facilities are not rationed. For Germany, Bick (2016) shows that a large fraction of part-time working mothers would work full-time if they had better access to subsidized childcare and Wrohlich (2011) shows that increasing the availability of childcare has a greater effect on maternal employment than reducing the fees of these services.

Finally, some studies have looked at the relationship between childcare and fertility. In a cross-country analysis for countries, Borck (2014) shows that cultural differences with regard to perceived quality of external childcare can help explaining cross-country differences in levels of female labor force participation, childcare provision, and fertility. Baizán et al. (2015) find that in European countries, childcare coverage is positively related to individual-level completed fertility for all educational groups, while this association is strongest for highly educated women. In Western Germany, Hank and Kreyenfeld (2003) show that access to informal care arrangements increase the probability of having a first birth. Aassve et al. (2016) highlight that differences with regard to trusting someone outside the household to care for the children might also explain cross-country differences in fertility trends in developed countries.

This paper provides new elements to the literature. By using survey data covering a high number of countries, we show that socioeconomic differences in fertility behaviour are not universal in Europe but depend on the institutional context. More precisely, we first provide empirical evidence that having a second child is the key difference in fertility behaviour between low- and high-fertility countries in Europe. High-fertility countries also have a higher childcare coverage for children aged 0–2. Second, we provide a theoretical framework that accounts for the facts and outlines the mechanisms. Two implications derive from the theory, and are robust in the data. First, in countries where childcare coverage is low, the probability to have a second child is U-shaped with respect to female education. And second, in countries where childcare coverage is high, female education increases the probability of having a second child.

2. A GENERAL FRAMEWORK

In this section, we develop a microeconomic model that allows us discussing the mechanisms relating female wages, access to childcare, and fertility.[2] We treat fertility first as a continuous decision variable to derive the general mechanisms, and then more specifically, in Section 3.2, as a discrete variable in order to show the model's implications for the probability of having a second child.

2.1. The Model

The economy is populated by couples composed of a man and a woman, respectively, denoted by $i = m, f$. Each parent is endowed with one unit of time that is divided between childcare and work. A child needs $\phi > \bar{\phi}$ units of childcare, that can be supplied by either of the parents or outsourced, and a fixed time cost

$\bar{\phi} \geq 0$ that can only be supplied by the mother.[3] Parents differ in their wages, w_i. Consumption goods and children are public goods in the household. Couples, therefore, cooperatively choose consumption, c, the amount of childcare time supplied by each individual, t_i, the amount of childcare time that is outsourced, t_n, and the number of children to have, n.

The expected cost of outsourcing childcare is denoted by p and writes as

$$p = \epsilon p_s + (1 - \epsilon) p_m, \tag{1}$$

where ϵ is the probability of having access to childcare services at a subsidized price p_s and $(1 - \epsilon)$ is the converse probability of not having access to those childcare services, which implies having to orient towards services a higher market price, $p_m > p_s$. At the aggregate level, the probability of having access to subsidized childcare corresponds to the coverage rate of subsidized formal childcare. This allows the model to account for an excess demand of childcare services due to the limited access to subsidized childcare – which is often the case for European countries, especially those with low-fertility rates [Thévenon (2015)]. The expected childcare cost will enter the budget constraint of the representative couple and we will perform comparative statics with respect to p. A increase in p should be understood as a decrease in childcare coverage. One may check that equation (1) implies that $\partial p / \partial \epsilon < 0$.

Denoting $\beta \in (0, 1)$ as the parental preference for children relative to consumption, the maximization problem of a couple is the following[4]:

$$\max_{c, t_f, t_m, t_n, n} \ln c + \beta \ln n, \tag{2}$$

subject to (1),

$$c = \left[1 - (t_f + \bar{\phi})n\right] w_f + (1 - t_m n) w_m - p t_n n, \tag{3}$$

$$\phi = t_f + t_m + t_n, \tag{4}$$

$$1 - (t_f + \bar{\phi})n \geq 0, \tag{5}$$

$$1 - t_m n \geq 0, \tag{6}$$

and $t_f \geq 0$, $t_m \geq 0$, $t_n \geq 0$.

The Lagrangian of this problem is as follows:

$$L = \ln c + \beta \ln n + \lambda t_f + \mu t_m + \nu t_n + \varphi \left[1 - (t_f + \bar{\phi})n\right] + \gamma \left[1 - t_m n\right], \tag{7}$$

where (λ, μ, ν) are the Kuhn–Tucker multipliers associated to the nonnegativity constraints imposed on $\left(t_f, t_m, t_n\right)$, while (φ, γ) are those imposed on conditions

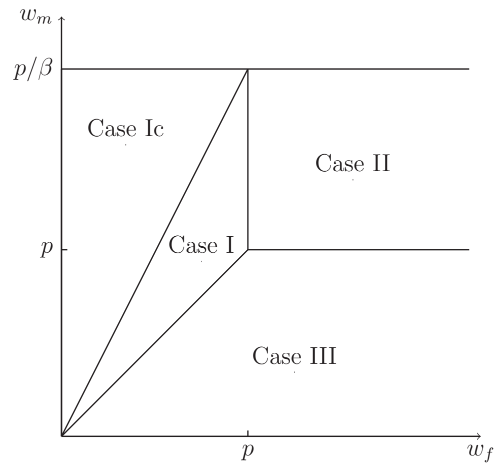

FIGURE 2. Possible cases with respect to w_f, p, and $w_m \in [0, p/\beta]$. Moreover, $\bar{\phi} > \phi\beta/(1+\beta)$.

(5) and (6). The first-order conditions with respect to (t_f, t_m, n) are as follows:

$$-\frac{n\left(w_f - p\right)}{c} + \lambda - \nu - n\varphi = 0, \tag{8}$$

$$-\frac{n\left(w_m - p\right)}{c} + \mu - \nu - n\gamma = 0, \tag{9}$$

$$-\frac{(t_f + \bar{\phi})w_f + t_m w_m + p\left(\phi - t_f - t_m\right)}{c} + \frac{\beta}{n} - \varphi(t_f + \bar{\phi}) - \gamma t_m = 0. \tag{10}$$

Moreover, the optimal solution satisfies

$$\lambda t_f = \mu t_m = \nu t_n = \varphi\left[1 - (t_f + \bar{\phi})n\right] = \gamma\left[1 - t_m n\right] = 0, \tag{11}$$

as well as equations (3) and (4).

Depending on the values of (w_m, w_f, p), the optimal solution can belong to one of the three main cases described below. Figure 2 illustrates when each of these cases arise, with respect to w_f, w_m, and p.

Case I. The woman supplies all the childcare: $t_f = \phi$ and $t_m = t_n = 0$. In this case, condition (11) implies $\lambda = \gamma = 0$ and $n \leq 1/\left(\phi + \bar{\phi}\right)$. The latter inequality means that either the woman is not working and reaches the maximal fertility level given by her time constraint or she is working part-time and chooses a lower fertility level. Using conditions (8), (9), and (10), we obtain

$$n = \frac{1}{(\phi + \bar{\phi})} \qquad \text{if} \qquad w_f \leq \beta w_m \leq p. \tag{12}$$

Conversely, fertility can have an interior solution that is equal to

$$n = \frac{\beta \left(w_f + w_m\right)}{(1+\beta)(\phi + \bar{\phi}) w_f} \qquad \text{if} \qquad \beta w_m \leq w_f \leq \min\{p, w_m\}. \tag{13}$$

In Case I, the wage of the woman is lower than both the wage of the man and the expected cost of outsourcing childcare. The woman reaches the maximal fertility level when her wage is lower than βw_m, whereas she chooses a lower level of fertility when it is above. Both the constrained and unconstrained cases (denoted Case Ic and Case I, respectively) are represented in Figure 2.

When the optimal fertility is interior, we notice that an increase in the wage of the man positively affects the couple's fertility ($\partial n / \partial w_m > 0$), while an increase in the woman's wage affects it negatively ($\partial n / \partial w_f < 0$).

Case II. All the childcare is outsourced: $t_n = \phi$ and $t_m = t_f = 0$. In this case, condition (11) implies $\nu = \gamma = 0$ and $n \leq 1/\bar{\phi}$. We notice that due to outsourcing possibilities, the maximal fertility level is higher than in Case I. Using conditions (8), (9), and (10), we obtain,

$$n = \frac{1}{\bar{\phi}} \qquad \text{if} \qquad p \leq \frac{\beta w_m - w_f}{(1+\beta)\frac{\phi}{\bar{\phi}}}. \tag{14}$$

Conversely, fertility can have an interior solution that is equal to

$$n = \frac{\beta \left(w_f + w_m\right)}{(1+\beta)\left(\bar{\phi} w_f + \phi p\right)} \qquad \text{if} \qquad \frac{\beta w_m - w_f}{(1+\beta)\frac{\phi}{\bar{\phi}}} \leq p \leq \min\left\{w_f, w_m\right\}. \tag{15}$$

A couple will outsource childcare when the expected cost of buying the service is not too high (below the wage of each spouse). If the cost is low, the maximal fertility level is then reached and when it increases, the fertility is more likely to be interior. In Figure 2, where it is assumed that $w_m \leq p/\beta$, only the unconstrained case is represented.

When the optimal fertility is interior, we notice that the wage of the man still has an income effect on fertility, $\partial n / \partial w_m > 0$. However, an increase in the wage of the woman has both income and substitution effects, due to the childbearing time, $\bar{\phi}$. We obtain

$$\frac{\partial n}{\partial w_f} \geq 0 \Leftrightarrow \phi p - \bar{\phi} w_m \geq 0. \tag{16}$$

If $\bar{\phi}$ is relatively low compared to the time that is outsourced, then the income effect dominates the substitution effect and, then, $\partial n / \partial w_f > 0$. Note that a marginal increase in the male's wage increases fertility more than a marginal increase in the female's wage, $\partial n/\partial w_m > \partial n/\partial w_f$. This is due to the fixed cost in terms of childcare $\bar{\phi}$ supported by the woman.

Case III. The man supplies all the childcare: $t_m = \phi$ and $t_n = t_f = 0$. In this case, conditions (11) and $\phi > \bar{\phi}$ imply $\mu = \varphi = 0$ and $n \leq 1/\phi$. Conditions (8), (9), and (10) can be used to obtain

$$n = \frac{1}{\phi} \qquad \text{if} \qquad w_m \leq \left[\beta - (1+\beta)\frac{\bar{\phi}}{\phi}\right] w_f \leq p, \tag{17}$$

and,

$$n = \frac{\beta\left(w_f + w_m\right)}{(1+\beta)\left(\bar{\phi} w_f + \phi w_m\right)} \qquad \text{if}$$
$$\times \left[\beta - (1+\beta)\frac{\bar{\phi}}{\phi}\right] w_f \leq w_m \leq \min\left\{w_f, p\right\}. \tag{18}$$

Case III is exactly symmetric to Case I for $\bar{\phi} = 0$. By adding the fixed cost specific to women, we see that the constrained case is less likely.

In Case III, an increase in the wages of both the woman and the man entails income and substitution effects. If the childbearing time is larger than the childrearing time, then an increase in the man's wage has a positive effect on fertility, whereas an increase in the woman's wage has a negative effect. The opposite case is seen when childbearing time is less than childrearing time.

The next subsection looks at the implications of the theory and compares them to cross-country evidence on how fertility relates to childcare coverage.

2.2. Theoretical Predictions and Discussion

The right-hand side of Figure 3 shows the relationship between fertility and female wage when $w_m = w_m^\star \in (p, p/\beta)$ (dashed line in the left-hand side). We see that fertility is first flat with respect to female wage, as the couple is in Case Ic, then fertility decreases with female wage (Case I), and once the couple is rich enough to buy childcare services, fertility increases with respect to the wage of the woman. This implies an overall U-shaped relationship between fertility and female wage.

Figure 4 illustrates the effect of increasing the childcare coverage rate ϵ, which as implied by equation (1) leads to lowering the average price of childcare, p, on the appearance of each case (left) and on fertility (right). A lower price increases the region in which Case II appears, where all childcare is outsourced, because couples can more easily purchase childcare.

Figure 4 shows the effect of decreasing p to$p\prime$ on the relationship between fertility and the wage of the woman. We see initially that fertility does not change with the wage of the woman, corresponding to the constrained fertility of Case I. But a lower expected price for childcare services (i.e., a larger share of individuals who have access to the subsidized price p_s) has, on average, a positive effect on fertility. This is particularly true for middle-income women, for whom the

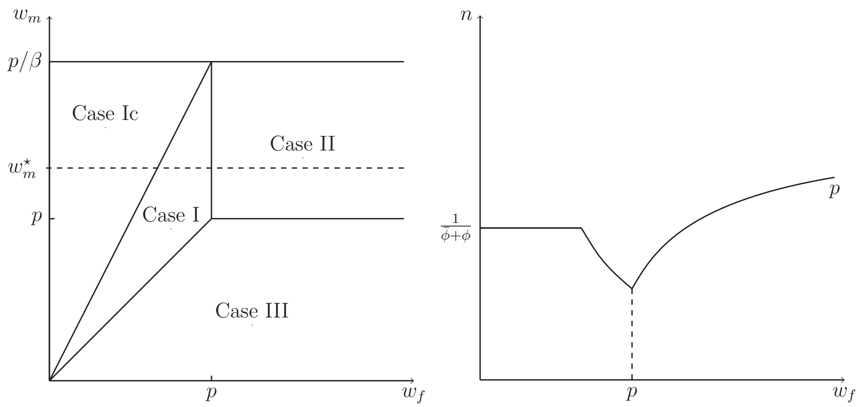

FIGURE 3. Left: Possible cases with respect to w_f, p, and $w_m \in [0, p/\beta]$. Moreover, $w_m^\star \in (p, p/\beta)$ and $\bar{\phi} > \phi\beta/(1+\beta)$. Right: Relationship between n and w_f for $w_m = w_m^\star$.

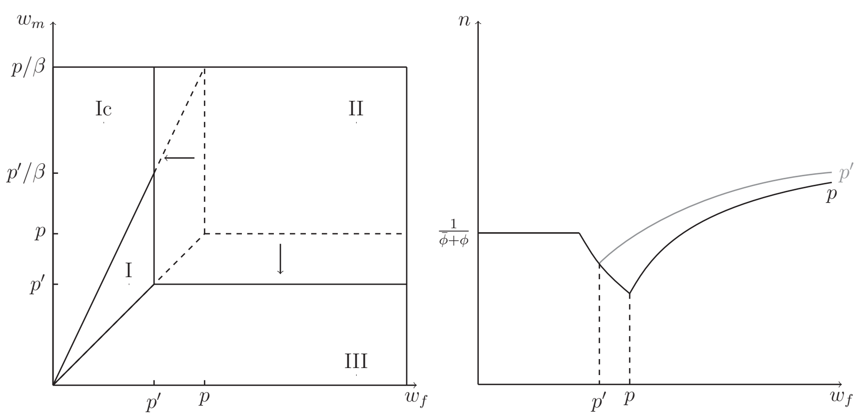

FIGURE 4. Left: Possible cases with respect to w_f, p, and $w_m \in [0, p/\beta]$. Moreover, $\bar{\phi} > \phi\beta/(1+\beta)$. Right: Relationship between n and w_f for $w_m \in (p, p'/\beta)$ and $p > p'$.

opportunity cost to raise children is large. For high female wages, the difference in fertility when the price equals p compared to when the price equals p' gets smaller as wages increase and fertility eventually converges to $\beta/(1+\beta)\bar{\phi}$. The U-shaped relationship is therefore less pronounced with a lower childcare price.

The theoretical prediction in Figure 4 is consistent with cross-country evidence using data from the Family Database (FDB). Indeed, coverage of – and therewith access to – childcare is larger in high-fertility countries.[5] Several studies suggest that childcare coverage figures are a determinant rather than a consequence of TFR,[6] as countries with low childcare coverage tend to have an excess demand for childcare.[7] This is why we consider childcare coverage as a proxy for access

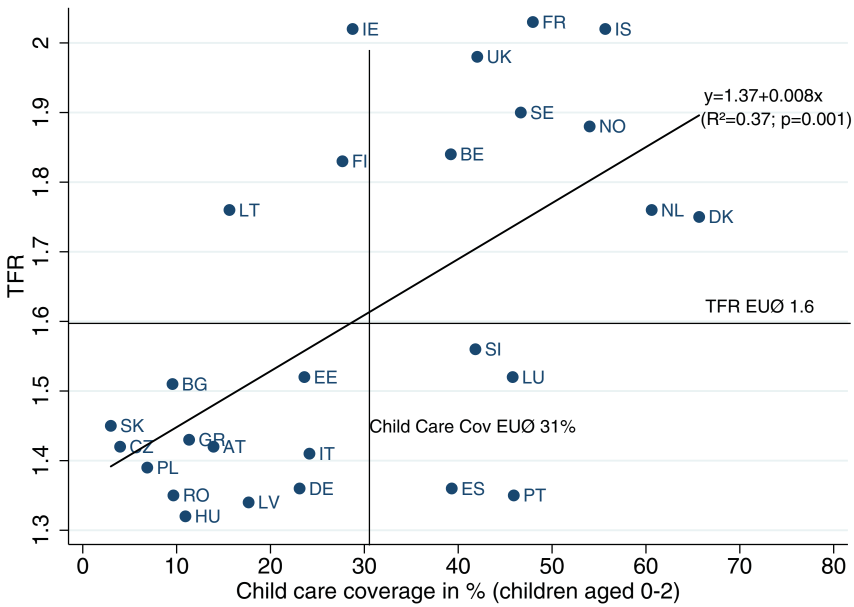

FIGURE 5. (Colour online) Total fertility rates with respect to childcare coverage (children aged 0–2).

to childcare for parents. The higher the coverage, the easier is generally the access for parents to childcare.

Figure 5 plots the TFR in each European country against the average enrollment rate of children under three years of age in formal childcare. We see that the correlation is significantly positive. Low-fertility countries with a TFR below the European average of 1.6 also tend to have a childcare coverage below the European average of 31%, whereas high-fertility countries tend to have a coverage rate above the average.

3. EXPLAINING DIFFERENCES IN FERTILITY ACROSS EUROPEAN COUNTRIESCheck LIST

We first show that, among European countries, the difference in fertility rates between low- and high-fertility countries is mostly due to fewer women having a second child in low-fertility countries. Then, we extend the theoretical analysis of Section 2 to study the decision to have a second child, for women with different wages and facing different possibilities of accessing childcare. To do so, we treat fertility as a discrete variable. Finally, we provide empirical support to some implications from the theory: The probability of having a second child is U-shaped related to female education (as a proxy of women's potential wage) in countries where childcare coverage is low, whereas the probability of having a second child increases with female education in countries where childcare coverage is high.

3.1. The Birth Order that Matters

We use the 2011 cross-sectional wave of the EU-SILC to understand whether fertility differences across 26 European countries are due to differences in starting a family or to enlarging the family size.[8]

We base our calculations on the fertility rate for women aged 38 to 44 years old (i.e., the cohorts of 1967–1973). Women at younger ages are excluded in order to focus on completed fertility. Women at older ages are also excluded because the EU-SILC reports a decreasing number of children per woman for older ages, as these children move out of their parents' homes and can no longer be observed. Due to this partial capture of children that live in the household only, as reported in the EU-SILC, these calculated "approximate" completed fertility rates (ACFR) are somewhat downward biased. Despite this bias, this approximate measure provides a country ranking that is similar to the unbiased completed fertility measured by the Human Fertility Data Base (wave 2012, cohort 1970).[9] The EU-SILC is thus used for our fertility analysis because it provides a large country coverage, an international comparability of socioeconomic measures, and a follow-up of individuals (used later in Section 3.3).[10]

The data shows a weighted average ACFR of 1.61 children per woman across the 26 European countries covered by the 2011 cross-sectional wave of EU-SILC. The 12 countries with rates below this average are Germany, Spain, Italy, Switzerland, Bulgaria, Portugal, Luxembourg, Belgium, Latvia, Greece, Austria, and Estonia. The 14 countries above this average rate are the United Kingdom, the Netherlands, Lithuania, Denmark, France, Norway, the Czech Republic, Finland, Poland, Slovenia, Slovakia, Sweden, Hungary, and Iceland. The weighted average ACFR in high-fertility countries equals 1.73, whereas it is 1.46 in low-fertility countries; the absolute fertility difference between the two groups is thus 0.27 children.

Table B.1 in Appendix B shows that in both low- and high-fertility countries, having two children is the most frequent situation for women aged 38 to 44 years old (40% in low-fertility against 42% in high-fertility countries). Childlessness is higher in low-fertility countries, and the proportion of women having three and four children is higher in high-fertility countries. The absolute differences in the proportions give, however, no direct information about the birth order that is most responsible for fertility being low in the first group of countries. The proportion of women having three and four children might be higher in high-fertility countries, but at the same time, in both country groups, only a relatively small fraction of women is concerned. This lets us suggest that the weight of children of birth order three and four for explaining differences in fertility between the two groups is smaller than the absolute difference in the proportions lets expect. The same logic applies for childless women: The difference in the proportion of childless women

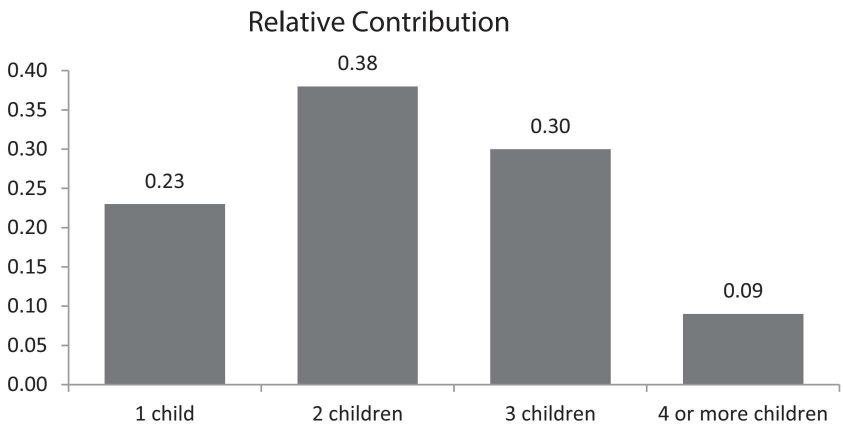

FIGURE 6. Relative contribution of fewer children of birth order i to the fertility gap between high- and low-fertility countries in the EU(26).

between high- and low-fertility countries is considerable, but the proportions itself are relatively small in comparison to the proportion of women having one and two children. At the same time, the proportion of women having two children is important in the two country groups. Consequently, even if the difference between the two groups for this proportion is small, it can lead to high differences in fertility levels.

A decomposition of ACFR is thus needed to determine the contribution of each birth order to the difference in fertility levels between the two groups of countries. As detailed in Appendix 4, we first calculate for each group of countries the proportion of women having at least i children (fertility rate of birth order i). The sum of these cumulative frequencies actually yields the ACFR of each country group. Then, we calculate the differences in each fertility rate of birth order i between low- and high-fertility countries. These differences sum up to the absolute difference in ACFR between the two country groups.

According to these calculations, the absolute difference of 0.27 children per women between high- and low-fertility countries is composed as follows: 0.06 children are due to fewer children of birth order one in low-fertility countries, 0.10 children are due to fewer children of birth order two in low-fertility countries, 0.08 children are due to fewer children of birth order three in low-fertility countries, and 0.02 children are due to fewer children of birth order four in low-fertility countries. Therewith, the fertility gap is mainly explained by fewer children of birth order two. Figure 6 illustrates the relative contribution of each birth order to the fertility gap. Fewer children of birth order one account for 23% of the gap in ACFR between high- and low-fertility countries, fewer children of birth order two for 38%, fewer children of birth order three for 30%, and fewer children of birth order four for 9%.

Our calculations show that fertility differences between European countries mainly emerge due to fewer children of birth order two, suggesting that in low-fertility countries, most women have a first child, but fewer decide in favor of a second one. Following the same calculation method, Breton and Prioux (2005) find a somewhat higher contribution of children of birth order three in comparison to children of birth order two to fertility differences between European countries. This is due to the fact that they do not include Eastern European countries in their sample and focus on a generation that is 10 years older. At the same time, their study and ours consistently find that fewer children of birth order one (i.e., higher childlessness) are not the main explanation for low-fertility levels.[11]

Additional evidence that fertility differences between European countries mainly result from differences in second child birth can be obtained when including younger cohorts in our analysis. We therefore look at the transition probabilities of women aged 15 to 44 years old. To observe the probabilities of child birth by birth order, we use the longitudinal database of the EU-SILC (waves 2003 to 2011). The rotational panel with a follow-up of individuals for a maximum period of four years allows identifying child births that occur during the observed period.

We observe that among women aged 15–44 years who are childless in the beginning of the observed period, 5% have a first child during the observed period. Among women having one child, 10% have a second child and among women having two children, 5% have a third child during the observed period.

Figure 7 plots each country's average probability of observed birth of a child of birth order one, two, and three for women aged 15–44 years old against the country's TFR. The probability to observe a child's birth is higher in high-fertility countries for all birth orders. Figure 7 reveals a separation of European countries in two clearly distinguishable fertility regimes, low versus high ones, with low versus high probabilities of a child's birth. The difference between the two regimes is most striking for a second child birth (middle panel of Figure 7), which is not only due to a level effect. In low-fertility countries, the probability of a second child birth is 66% lower than in high-fertility countries, against 40% for the probability of first and third child birth. Our finding that countries with low and high TFR differ most in the transition to a second child underlines the importance of children of birth order two that was revealed by the previous ACFR analysis focusing on older cohorts only which already have completed their family size.

The following subsection depicts the mechanisms behind a couple's decision of having a second child.

3.2. The Decision of Having a Second Child in Theory

To focus on the transition from the first to the second child, we modify the general model as structured above by considering that n is discrete rather than continuous. As the utility function is increasing and concave with respect to n, a couple will have two or more children if the indirect utility when $n = 2$ is higher than the indirect utility when $n = 1$.

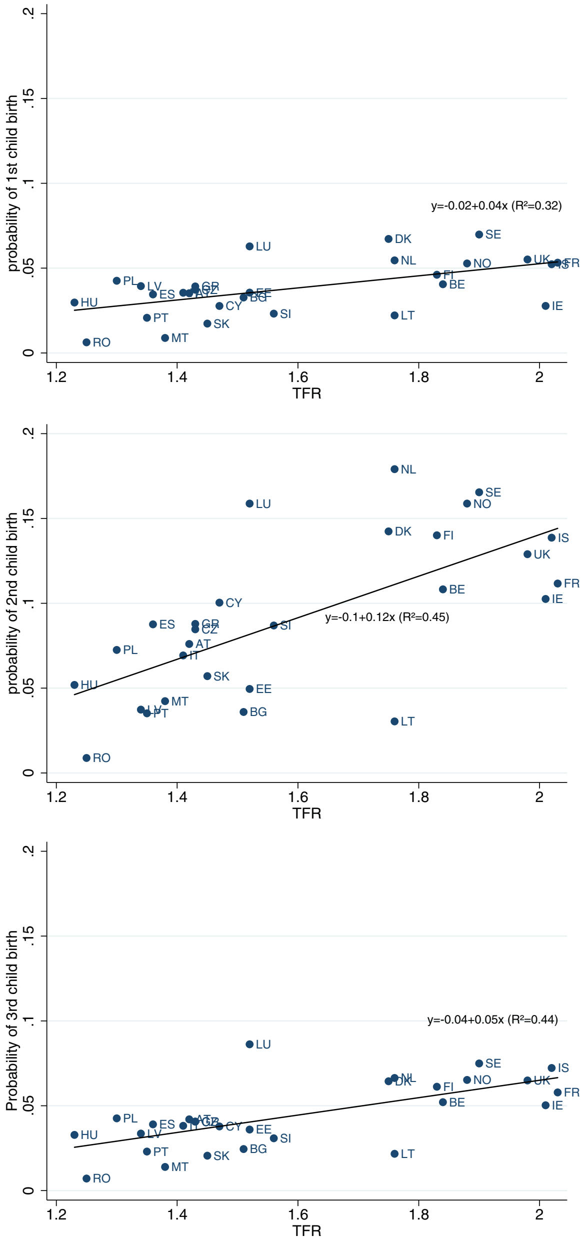

FIGURE 7. (Colour online) Probability of child birth of birth order 1 (top), 2 (middle), and 3 (bottom) vs. TFR.

Let us assume that the parameter restrictions are such that we are either in Case I, where the woman supplies all the childcare, or in Case II where all the childcare is outsourced ($w_m > p$ and $w_f > p$), and that the fertility is interior ($w_f > \beta w_m$). Let $\bar{u}_n^\kappa$ denote the indirect utility of having n children and being in Case $\kappa = \mathrm{I}$ or $\kappa = \mathrm{II}$. For $w_f = p$, we can check that $\bar{u}_n^{\mathrm{I}} = \bar{u}_n^{\mathrm{II}}$.

Moreover, let us define W^{I} and W^{II} the female wage thresholds such that $\bar{u}_1^{\mathrm{I}} = \bar{u}_2^{\mathrm{I}}$ and $\bar{u}_1^{\mathrm{II}} = \bar{u}_2^{\mathrm{II}}$, respectively. We have

$$W^{\mathrm{I}} := \frac{w_m}{(\phi + \bar{\phi})\lambda - 1} \qquad \text{and} \qquad W^{\mathrm{II}} := \frac{w_m - \lambda p \phi}{\bar{\phi}\lambda - 1}, \tag{19}$$

where $\lambda := \left(2^{\beta+1} - 1\right)/(2^\beta - 1)$. We saw that in the case where the woman supplies all the childcare, fertility decreases with the woman's wage. In this discrete variable setting, this relationship is given through the following inequality:

$$\bar{u}_2^{\mathrm{I}} \geq \bar{u}_1^{\mathrm{I}} \Leftrightarrow w_f \leq W^{\mathrm{I}}. \tag{20}$$

Moreover, provided that fixed costs are sufficiently large, and more precisely provided that

$$(\bar{\phi} + \phi) \in \left(\frac{1}{\lambda}, \frac{1+\beta}{\beta}\frac{1}{\lambda}\right), \tag{21}$$

the threshold W^{I} is larger than βw_m. This implies that $\bar{u}_2^{\mathrm{I}} > \bar{u}_1^{\mathrm{I}}$, if the woman's wage belongs to $\left(\beta w_m, W^{\mathrm{I}}\right)$. Since $\partial \bar{u}_1^{\mathrm{I}}/\partial w_f > \partial \bar{u}_2^{\mathrm{I}}/\partial w_f$ for all $w_f > 0$, $\bar{u}_2^{\mathrm{I}}$ and $\bar{u}_1^{\mathrm{I}}$ will cross once for $w_f = W^{\mathrm{I}}$.

In the case where childcare is outsourced, fertility increases with the woman's wage, which could be expressed here as

$$\bar{u}_2^{\mathrm{II}} \geq \bar{u}_1^{\mathrm{II}} \Leftrightarrow w_f \geq W^{\mathrm{II}}. \tag{22}$$

Provided that $\bar{\phi}\lambda < 1$, the condition for $W^{\mathrm{II}} > W^{\mathrm{I}}$ becomes

$$p > \frac{w_m}{(\bar{\phi} + \phi)\lambda - 1}. \tag{23}$$

Then, the condition to obtain $\partial \bar{u}_2^{\mathrm{II}}/\partial w_f > \partial \bar{u}_1^{\mathrm{II}}/\partial w_f$ is $\phi p > w_m \bar{\phi}$, which (as we have seen in the previous section) implies that fertility increases with the woman's wage. This latter condition is compatible with the previous one provided that p is sufficiently large.

Figure 8 shows $\bar{u}_1^{\mathrm{I}}$, $\bar{u}_2^{\mathrm{I}}$, $\bar{u}_1^{\mathrm{II}}$, and $\bar{u}_2^{\mathrm{II}}$ with respect to w_f and for a large p (left panel) and a small p (right panel). The left panel of Figure 8 illustrates a situation in which the utility of having two children is larger for women with low or high wages than the utility of having only one child. Conversely, women with middle wages have one child. For $w_f < p$, the couple is in Case I in which the woman supports all the childrearing. For $w_f < W^{\mathrm{I}}$, $\bar{u}_2^{\mathrm{I}} > \bar{u}_1^{\mathrm{I}}$ so that the couple will have (at least) two children. When $W^{\mathrm{I}} \leq w_f < p$, $\bar{u}_1^{\mathrm{I}} \geq \bar{u}_2^{\mathrm{I}}$ and the couple will have one child. This is because for a woman with low wage, being out of the labor

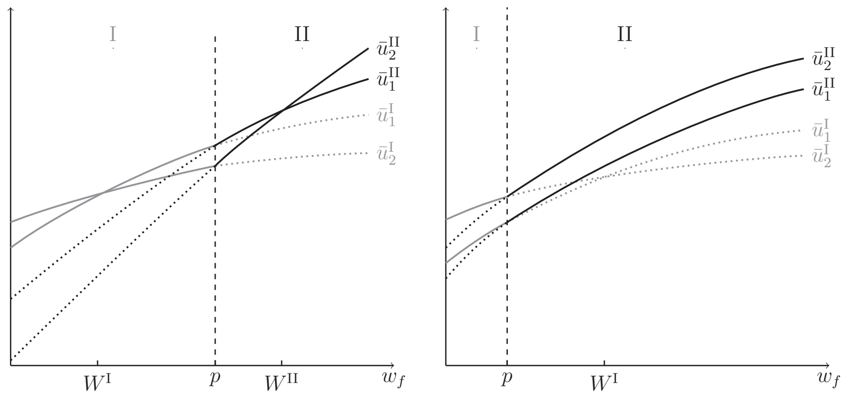

FIGURE 8. Indirect utilities of having one or two children, Case I in red and Case II in black, with a Large p (left) and a Small p (right).

market entails a low cost. As her wage increases, however, this cost increases and as each child costs her $\phi + \bar{\phi}$ units of time, it is optimal for the couple to have less children.

For $w_f \geq p$, the couple has enough income to be in Case II where it outsources childrearing. For $p \leq w_f \leq W^{\mathrm{II}}$, the couple has one child ($\bar{u}_1^{\mathrm{II}} \geq \bar{u}_2^{\mathrm{II}}$) because the marginal expected cost of an extra child is larger than the utility gains. The cost of an extra child includes an increase in the opportunity cost of childbearing for the woman and a higher expected amount to pay for childrearing services. For $w_f > W^{\mathrm{II}}$, $\bar{u}_2^{\mathrm{II}} > \bar{u}_1^{\mathrm{II}}$ and the couple will have at least two children. This is due to the income effect of the increase that allows for the purchase of more childcare services in the market.

The right panel of Figure 8 shows the effect of decreasing the price of external childcare on the indirect utilities. In such configuration, $\bar{u}_2^{\mathrm{II}} > \bar{u}_1^{\mathrm{II}}$ for all w_f. A lower price for childcare implies that a lower female wage will allow the couple to reach Case II, where they can outsource childcare. Moreover, the figure also shows that couples will enter Case II before the substitution effect of the female wage becomes too large. This explains why the indirect utility of having two children always dominates the indirect utility of having one. As already present in Figure 4, Figure 8 also shows that women at the middle of the wage distribution are the most affected by changes in the expected price of childcare services.

The two panels of Figure 8 illustrate the differences in fertility patterns with respect to female wage for low- (left panel) and high- (right panel) fertility countries. The next section provides empirical evidence that the relation within European countries between the probability of having a second child and female potential wages is affected by the expected price of childcare, which will be proxied by access to/coverage of formal childcare.

3.3. Empirical Application

We estimate the probability of having a second child for partnered women as a function of individual, partner, and household characteristics as well as of aggregate childcare coverage. Our main determinant of interest is the woman's education level, which serves as a proxy for her potential wage, and we analyze how the impact of education on the probability of second child birth differs with access to formal childcare. We thus do not study completed fertility, but we analyze the childbearing behaviour of women who are currently at childbearing age. This allows us applying panel data techniques that serve to reduce endogeneity between fertility and socioeconomic characteristics. We hereby focus on second child birth, as this birth order is crucial for explaining fertility differences between European countries.

Our analysis is based on 26 European countries, which, as illustrated in Figure 5, have either childcare coverage rates above or below the average of 0.31. To model the impact of education and other individual characteristics on women's probability of second child birth, we mobilize the longitudinal data set of the EU Statistics on Income and Living Conditions, covering survey years 2003 to 2011. Figure 7 in Section 3.1 illustrates each country's average of the probability of second child birth calculated with this data base. The longitudinal database is a rotational panel with individuals followed up for a maximum period of four years (individuals are observed from wave one to four). We select women aged 15 to 45, who already have a first child (at least one year old) in the beginning of the observed period, and their partners. The individual determinants of second child birth are observed during the year prior to the calendar year of potential second child birth. This helps reducing the risk of obtaining biased estimates due to reverse causality between the endogenous and the exogenous variables.

To allow for this time delay, individuals have to be observed for at least three consecutive waves: The third wave is needed to identify all births of birth order two that occur during the calendar year of the second wave. The first wave gives information about individual characteristics observed during the year prior to the calendar year of potential birth of a second child. Consequently, individuals who are observed for three waves have only one person-year in our compiled data base: This person-year contains information of the individual characteristics (education etc.) observed in the year prior to the calendar year of potential second child birth, as well as a dummy variable for second child birth.

For individuals who are observed for four waves, two calendar years of potential second child birth can be identified. Consequently, those who do not have a second child in the first period enter our sample with two person-years.

Individuals who are observed for only one or two waves are dropped. For these individuals, we cannot observe the individual characteristics in the year prior to the calendar year of potential second child birth. The panel contains individuals who are observed for less than four waves mainly due to the rotational design of the panel. Attrition in SILC is relatively small for individuals "at risk" of second child birth in comparison to first child birth, and attrition does not differ by socioeconomic characteristics, as shown by Greulich and Dasre (2017).

As the panel is short, our sample contains only either one or two person-years for each individual. This allows us applying a simple logit model, with a control for the number of person-years. We use a binary logit regression model while taking into account the characteristics of women, their partners, and the general household, as follows:

$$P(y = 1|X) = \frac{\exp\{\beta X'\}}{1 + \exp\{\beta X'\}}, \tag{24}$$

where $y \in \{0, 1\}$ is a dummy variable for second child birth, X denotes the microlevel characteristics taken into account, and β the estimated coefficient of these variables.

Education of women and their partners are observed at the time of the survey of the year prior to the calendar year of potential second child birth. Only couples with completed education are considered (no pupils, students, trainees etc.). We construct three categories for the education level of women and their partners (by highest ISCED level attained), namely: *low education* for preprimary, primary, and lower secondary education, *medium education* for upper secondary and postsecondary nontertiary education, and *high education* for tertiary education. Grouping the initial six education categories into three categories allows us to obtain a sufficiently large number of observations for each category.

Besides women's and their partners' education level, we include a series of control variables in order to isolate the impact of women's potential wage on the decision of having a second child from other determinants. We include information on women's and the partners' employment status. Information on employment status (self-declared) is available on a monthly basis in SILC, which allows us to observe the employment status during a certain period before the potential conception of a second child. In order to observe the same span of time for all individuals, we restrict this period to three months. For women, we distinguish between full-time employed (employed and self-employed), part-time employed (employed and self-employed), unemployed, and inactive. Those who experience a change in employment status during the observed period figure in an extra category, but this concerns only a minority of 2%. For partners, we distinguish only between full-time employed (employed and self-employed) and those who are not full-time employed, as those who are full-time employed represent the large majority of partners of women having one child (92%). Information on employment status is missing for only 1% of partners. The control for employment status allows us not only disentangling women's wage options (as proxied by education) from their actual labour market participation, but also taking into account country heterogeneity in terms of the labour market structure (prevalence of part-time employment for women, of unemployment etc.).

In addition, we control for the woman's age, the age and sex of the first child as well as for marital status. The model fits best when integrating age as a continuous variable – modeling a nonlinear impact for woman's age and a linear impact for the age of the first child.

Information on individual-level access to formal childcare is not available in the longitudinal database of the SILC, which is why we have to limit our measure to cross-country variations. We use the aggregate measure of a country's childcare coverage for children aged 0 to 2 (see Figure 5: OECD Family Database, 2012) as a proxy for parents' access to childcare. Childcare coverage rates represent participation rates for 0-to-2-year-old in formal childcare and preschool services. Data generally include children using center-based services (e.g., nurseries or day care centers and pre-schools, both public and private), organized family day care, and care services provided by (paid) professional childminders, and exclude those using unpaid informal services provided by relatives, friends, or neighbors. We use this measure in both an implicit and an explicit way in the regression models.

The implicit way consists of estimating the impact of education on the probability of second child birth by distinguishing between two groups of countries among the 26 European countries: a first group of countries with childcare coverage for children aged 0 to 2 years old that is below the European average of 31%, and a second group with childcare coverage above this average (as identified in Figure 5).[12]

The probability of having a second child varies considerably across countries, as already suggested in Figure 7. The weighted average for the probability of second child birth in our first group of countries is 0.075, while it amounts to 0.15 for the second group. For the first group of countries, we observe 18% of women with low education level, 60% with medium, and 22% with high education levels, whereas the distribution in the second group of countries is 20%, 42%, and 38%, respectively. As the distribution of women over education groups does not differ to a large extent in the two country groups, our estimation results are not too much sensitive to selection issues. Country-fixed effects capture, however, differences in the average returns to education between countries.

We group together all 26 countries while controlling for the country group and while interacting the country group dummy with woman's education. This avoids us dividing the sample in two subgroups. With this large sample size, we are able to analyze the effect of education on the probability of second child birth within countries of each group. To focus on these within-country variations, we introduce country-fixed effects besides the country group dummy. As some specific years may influence the probability of deciding for or against a second child, we also introduce year-fixed effects in all our regressions. The regressions are run with robust standard errors.

The explicit way for modeling access to childcare as a determinant of second child birth consists of applying a mixed-effects logistic regression. Multilevel models are useful when individuals are supposed to be nested into higher level structures [Snijders and Bosker (1999)] that may play a role in explaining events that occur at the individual level. This is of particular interest in international comparative research: We can indeed consider that individuals are nested in countries, each country being characterized by specific national institutions, such as childcare coverage, that may play a role on individual choices. Country effects induce correlations across observations which need to be addressed; otherwise standard errors risk to be downward biased. Multilevel models adjust for these intracountry correlations. Moreover, multilevel models can deal with unbalanced data sets [Skrondal and Rabe-Hesketh (2004)], which is important as our sample sizes vary across countries.

We integrate the country-specific contextual variable "childcare coverage" as a continuous variable in the model, and we interact childcare coverage with education. This serves to test if the effect of education differs across countries with different levels of childcare coverage, and if the effect of childcare coverage differs among education groups (cross-level effects). We apply a two-level random-intercept and random-coefficient model (by using the meqrlogit command in Stata), which fits mixed-effects models for binary responses. Country effects are specified in terms of a country error variance and fixed effects of our country-level predictor "childcare coverage." The multilevel model is thus able to analyze the impact of contextual variables on individual behavior without the assumption of homogeneity-of-regression slopes. The slope is allowed to vary randomly; random parameters have a different value for each group/country. In addition, with the interaction terms (cross-level effects), we do not only allow the intercept of the model but also the slope for the individual-level variable "education" to be random and to possibly explain it with the macrolevel variable "childcare coverage."[13]

Table 1 presents the regression results of a partnered woman's probability of having a second child as a function of her education. Model 1 implicitly controls for access to childcare by including a dummy variable for countries with childcare coverage above the European average, and model 2 shows regression results of the multilevel approach.

Model 1 shows that within countries with low childcare coverage, a woman's probability of having a second child is lowest among medium-educated women. Women with high and low education levels have a significantly higher probability of having a second child in comparison to women with middle education. This result holds when controlling for partner education and woman's as well as her partner's employment status. The estimated coefficient for low education is 0.228 and for high education 0.239 in model 1 for the first group of countries with childcare coverage below the European average. Within countries with childcare coverage above the European average, a woman's probability of having a second child is significantly increasing with education. This can be seen by combining the estimated coefficients of education with the interaction terms. The estimated coefficient for low education is −0.108 (0.228–0.336) and 0.2638 (0.229+0.0348) for high education in model 1 for the second group of countries. In countries with high levels of childcare coverage, low-educated women have thus the lowest probability of second child birth. The difference between middle- and high-educated women is significant, as indicated by the p-value of joint significance at the bottom of the table. In addition to the importance of women's education (figuring as potential

TABLE 1. Estimated probability of second child birth

	Model 1	Model 2
Woman's education:		
Low education (primary, lower secondary)	0.228*	0.444**
Middle education (upper and postsecondary)	*Ref.*	*Ref.*
High education (tertiary)	0.229**	0.219+
Partner education:		
Low education (primary, lower secondary)	−0.0672	−0.078
Middle education (upper and postsecondary)	*Ref.*	*Ref.*
High education (tertiary)	0.307***	0.310***
Woman's employment status:		
Employed full-time	*Ref.*	*Ref.*
Employed part-time	−0.0704	−0.058
Unemployed	−0.178+	−0.180+
Inactive	−0.118+	−0.102
Changing employment status	0.295+	0.293*
Partner's employment status:		
Employed (full-time or part-time)	*Ref.*	*Ref.*
Not employed	−0.133	−0.136
No information	−0.0527	−0.051
Control for childcare coverage:		
Country group 2 (childcare coverage≥0.31)	0.431*	–
Country group 2 * low education	−0.336*	–
Country group 2 * high education	0.0348	–
Childcare coverage (continuous)	–	0.026***
Childcare coverage * low education	–	−0.0114*
Childcare coverage * high education	–	0.0011
Demographic controls:		
Woman's age	0.579***	0.583***
(Woman's age)^2	−0.0108***	−0.011***
Age of first child:	−0.119***	−0.122***
Sex of first child is female	−0.00636	−0.005
Couple is married	0.194**	0.185**
Intercept	−8.214***	−9.292***
Year-fixed effects	Yes	Yes
Country-fixed effects	Yes	Random
Control for number of person-years	Yes	Yes
Number of observations	22143	
Proportion of second child arrival	0.11	
Number of countries	26	
Pseudo R^2	0.2158	–
Test of joint significance:		
p(low educated in country group 2)	0.31	–
p(high educated in country group 2)	0.00	–

TABLE 1. Continued

	Model 1	Model 2
Random effects:		
Variance of the intercept	–	0.250
Variance of the variable “low educated”	–	0.007
Variance of the variable “high educated”	–	0.023

Data Source: EU-SILC LT 2003-2011 (women aged 15 to 45)
+p<0.1, *p<0.05, **p<0.01, ***p<0.001.
Group 1: Low childcare coverage (age 0–2)<0.31: HU GR RO BG AT SK CZ PL EE IT LV IE LT FI
Group 2: High childcare coverage (age 0–2)≥0.31: NL FR IS BE NO UK DK SE SI ES PT LU
Control for number of person-years: dummy for the second person-year for individuals with two person-years in the panel.

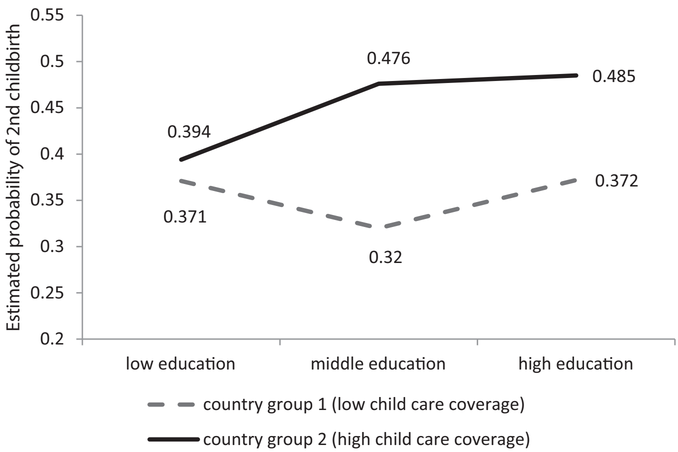

FIGURE 9. Estimated probabilities of second child birth according to woman’s education, countries with difficult vs. easy access to childcare.

wage) for family enlargement, we find that – in line with our argument that it is economic resources that are important for family enlargement – unemployed and inactive women have a lower probability of second child birth in comparison to employed women. Results are similar when running a probit instead of a logit model.[14]

We now quantify the estimation results of model 1 by transforming the logit coefficients into estimated probabilities.[15] Comparing the two country groups, Figure 9 illustrates the estimated probabilities for the reference category of women who are married to a middle-educated partner, who are 28 years old and who have a first child who is male and aged four. Within countries of the the first country group, there is a U-shaped pattern between women’s education and the birth of the second child, while the relation is positive for the second group of countries. With 0.371 and 0.394, the estimated probabilities are quite similar for low-educated women in the two country groups. At the same time, middle-educated women have a

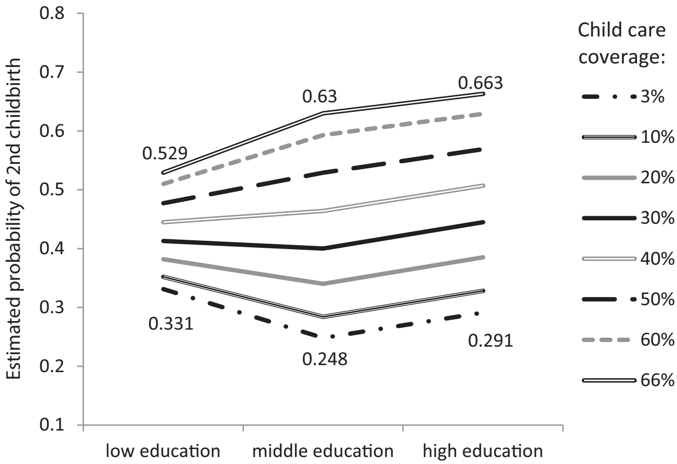

FIGURE 10. Estimated probabilities of second child birth according to woman's education, by levels of childcare coverage (children aged 0–2).

lower probability of second child birth in country group 1 (0.320) in comparison to low educated women, but a higher probability in country group 2 (0.476). The probability is highest for high-educated women in country group 2 (0.485). In country group 1, high-educated women have, with 0.372, a higher probability of second child birth than middle-educated women, but this probability is low in comparison to high-educated women in countries of group two.

Results of the multilevel analysis are shown in column 2. They show three main results. First, childcare coverage is significantly positively linked to women's probability of having a second child, independent of their educational level. Second, the interaction terms confirm that the impact of education on the probability of second child birth is influenced by the level of childcare coverage: For countries without formal childcare, women with low and high education have a higher probability of second child birth than middle-educated women. Increasing childcare coverage reduces the positive impact of low education and reinforces the positive impact of high education. Third, the interaction terms also suggest that the positive impact of childcare coverage on the probability of second child birth is lower for low-educated women and higher for high-educated women in comparison to middle-educated women. Education (at the individual level) and childcare coverage (at the macrolevel) thus both have a positive impact on the probability of having a second child and the positive impact is reinforced when these two features are combined. Results are similar when running a multilevel-probit instead of a multilevel-logit model.[16]

Figure 10 illustrates the estimated probabilities of the multilevel model for different levels of childcare coverage, varying between 3% (Slovakia) and 66% (Denmark), again for the reference category of women who are married to a middle-educated partner, who are 28 years old and who have a first child who is male and aged four. For low levels of childcare coverage below 31%, the relation between education and the probability of second child birth is U-shaped, while the relation gets positive for higher levels of childcare coverage. In addition, Figure 10 shows that in countries with high levels of childcare coverage, the probability of second child birth is generally higher for all levels of education in comparison to those countries with lower childcare coverage.

Access to childcare facilitates thus the birth of a second child for all levels of female education. However, our results also suggest that in countries with high childcare coverage, the birth of a second child is facilitated in particular for middle- and high-educated women, while in countries with low childcare coverage, it is in particular the middle-educated women who face barriers to second child birth. Given the fact that the transition to a second child is an important determinant for a country's aggregate fertility level, it seems that fertility levels are higher in countries with high childcare coverage in particular because more middle- and high-educated women pass from one to two children.

The model presented in Section 2.1 and the extended model in Section 3.2 allow us developing some intuitions for a better understanding of the patterns that are revealed by our empirical analysis. The empirical results correspond to the model's prediction of a U-shaped relationship between a couple's probability of having a second child and the woman's potential wage in countries with difficult access to childcare. The model also predicts that an easier access to childcare leads to the the fact that the probability of having a second child is increasing with woman's education. In countries with difficult access to childcare, middle-educated women face high opportunity costs and therefore tend to decide against second child birth, while high-educated women succeed in overcoming the substitution effect. An easier access to childcare reinforces the income effect, which explains that middle- and high-educated women have more facilities to enlarge the family than low-educated women.

Our results have to be interpreted with care, however, as the country-specific childcare levels can also capture other factors that might explain differences in the transition to second child birth between European countries. For example, countries might not only differ in access to childcare, but also in general wage levels for men and women. The higher the wages, the easier it may be for parents to decide in favor of an additional child. To test the robustness of our findings, we therefore run an additional specification where the country-specific wage level, gender wage inequality, and their interaction terms with education groups are also included.

To measure the wage level, we use median gross hourly wages for all employees (excluding apprentices), expressed in Euros, and in purchasing power standard (Eurostat Structure and Earnings Survey, 2010). The gender pay gap is calculated based on this measure and represents the difference between gross hourly earnings of male paid employees and of female paid employees as a percentage of gross hourly earnings of male paid employees.

The results of this robustness check (model 3) are presented in Table C.1 of Appendix C.

Even though childcare coverage itself is no longer significant, the results confirm that for low levels of childcare coverage, low-educated women have a significantly higher probability of having a second child than middle-educated women. The significantly negative interaction term "childcare coverage × low education" shows that the higher childcare coverage, the smaller gets the coefficient of low education. Combining information of the estimated coefficients of "low education" and the interaction term "childcare coverage × low education," we find that from a childcare coverage level of 47% on, low-educated women have a lower probability of having a second child than middle-educated women.

The general wage level is found to be significantly positively related to second childbirth, whereas the impact does not significantly differ between education groups.

The results of model 3 confirm that childcare coverage shapes the educational gradient of second childbirth: In countries with high levels of childcare coverage, the educational gradient is positive, whereas in countries with low childcare coverage, the educational gradient is U-shaped. However, model 3 suggests also that general level-differences between European countries in terms of transition to second childbirth are not, or at least not only, linked to differences in childcare coverage. The general wage level seems to be an important driver for parents' decisions in terms of family enlargement. This holds for all education groups. The higher a country's wage level, the easier it seems for families to bear the financial burden of a second child.

The importance of childcare coverage, should, however, not be rejected, as results of model 3 risk being biased by multicollinearity between the wage level and childcare coverage. Richer countries tend to have both higher wage levels and higher public investments in formal childcare. One might also think of other country-specific unobserved factors that are correlated with both childcare coverage and income levels, such as gender and family norms, for example. Recent research has shown that the re-increases in TFR, that can be observed since the early 2000s, are strongest in those developed countries which have the most experienced changing gender relationships towards more gender equality, as measured, for example, by gender-equitable attitudes towards female employment, by an increasing number of out-of-wedlock births reflecting modern family norms or by increasing men's involvement in the home [Balbo et al. (2013); Neyer et al. (2013); Arpino and Esping-Andersen (2015); Goldscheider et al. (2015)].

4. CONCLUSION

This paper shows that fertility differences across European countries are mainly due to fewer women having two children in low-fertility countries. It suggests that in high-fertility countries, the possibility to outsource childcare has a positive effect on the transition from the first to the second child for a household. This transition is facilitated especially for middle- and high-educated women.

Our theoretical framework illustrates the mechanism behind this idea, robust to European survey data. In countries with low childcare coverage, the relationship between female education, as a proxy for potential wage, and having a second child is U-shaped, while in countries with high childcare coverage, the probability of second child birth is increasing with education. In countries with low childcare coverage, the probability of second child birth is thus reduced in particular for middle- and high-educated women in comparison to countries with high childcare coverage. Fertility differences between European countries thus emerge in important parts due to the fact that in countries with high childcare coverage, middle- and high-educated women have a higher probability of having a second child in comparison to countries with low childcare coverage.

Our intuition behind the finding that access to childcare plays an important role in particular for middle- and high-educated women is that middle- and high-educated women have a higher opportunity cost in terms of foregone labor income when they have to provide childcare themselves. An easier access to childcare services reduces this cost and therefore increases fertility.

The U-shaped pattern implies that it is particularly the middle-educated women who decide against second child birth in countries with difficult access to childcare. A second child would urge women to stop or reduce their working activities, which makes it likely that they decide against a second child in order to maintain the family income. In these countries, high-educated women have a higher probability of second child birth than middle-educated women because the household can afford either that the woman stops or reduces her working activities or that the household purchases childcare from the private market (nannies etc.) Low-educated women have a higher probability of having a second child in comparison to middle-educated women in countries with low childcare coverage, as they have relatively low opportunity cost in terms of foregone income (indirect costs of children). In contrast, in countries with high childcare coverage where parents, and especially mothers, do not have to chose between work and childcare, the probability of second child birth increases with woman's education, as education (as proxy for income) allows to bear the direct costs of children more easily (income effect).

While childcare coverage is found to shape the educational gradient of transition to second child, our study also reveals the importance of the general wage level for explaining differences in progression probabilities between European countries. Other studies point to modern gender and family norms. Combining this information with our results, it seems thus that institutions encouraging parental employment and an egalitarian share of house and care work among partners emerge as policies that are likely to facilitate family enlargement in European countries. Childcare coverage plays here an important role, as well as access to secure employment and decent income for both partners.

This work can be extended in several directions. In particular, extending the analysis to births of other orders and improving the measures for individual access to different types of formal and informal childcare seem to be fruitful ways of future research.

NOTES

1 Amuedo-Dorantes and Sevilla (2014) also support a causal effect of low-skilled immigration to the United States on the reductions in the time allocated to basic childcare by college-educated mothers of nonschool age children.

2 See Himmelweit et al. (2013) for a discussion on the usefulness of formal modeling household decision making. Jones et al. (2011) also provide a clear discussion on different theoretical models that can explain the negative relationship between fertility and income.

3 In Appendix A, we show that the mechanisms made explicit in this benchmark model also hold if we introduce a good cost for children as well as a time cost.

4 The problem could have been written as an expected utility maximisation problem but this would not have changed the theoretical results.

5 Differences across childcare systems in Europe are explained in detail in Del Boca (2015).

6 See Thévenon (2015) for a literature review of the causal link between fertility levels and childcare coverage.

7 See, for example, Wrohlich (2008) for Germany, Kawabata (2014) for Japan, and the European CommissionEuropean Commission (2014) for Hungary.

8 Both of these factors can can lead to fertility differences across countries. Fertility levels significantly below replacement level can be due to difficulties in starting a family for certain women, resulting in one important group of women staying childless while another group of women have around two children (dichotomous fertility behavior). However, low fertility can also be a result of difficulties in increasing the family size rather than in starting a family, which would imply that, from a certain age on, most women are indeed mothers (i.e., childlessness is low), but few women have more than one child (homogeneous fertility behavior).

9 For the majority of countries, the classification into high- or low-fertility regimes also stays the same when using the period measure of total fertility rates (World Bank World Development Indicators, 2011). Exceptions include some Eastern European countries (Czech Republic, Slovenia, Hungary, Slovakia, Poland), which have completed fertility rates above the EU average and total fertility rates below EU average, suggesting the importance of birth postponement for younger women (tempo effect). Schmertmann et al. (2014) predict that the quantum measure of completed fertility rate will be below average for cohorts born after 1970 in these countries.

10 For a detailed discussion of measurement biases of fertility with SILC, see Greulich and Dasre (2017).

11 Furthermore, we find a somewhat higher difference between our two country groups for the transition probability from a second to a third child (women aged 38 to 44) in comparison to the one from a first to a second child, while differences in the transition to a first child are relatively small. As the transition to a third child requires having two children, and as we find that fewer children of birth order two are the main explanation for low-fertility levels, our following Section 3.2 focuses on the decision of having a second child.

12 The first group consists of Hungary, Greece, Romania, Bulgaria, Austria, Slovakia, Czech Republic, Poland, Estonia, Italy, Ireland, Lithuania, Finland, and Latvia (note that Germany is not covered by the longitudinal data base), whereas the second group consists of the Netherlands, France, Iceland, Belgium, Norway, the United Kingdom, Denmark, Slovenia, Spain, Portugal, Luxembourg, and Sweden.

13 Other macrolevel variables such as unemployment, public spending on family policies, parental leave duration and cash transfers towards families have also been integrated in the intercept equation besides childcare coverage. The effect of childcare coverage remains positive and significant, and the other macrolevel variables are less significantly correlated to second child birth than childcare coverage (results available on request). Our preferred model is thus the multilevel model with childcare coverage

as only macrolevel variable. This avoids problems caused by multicollinearity. Moreover, having a low number of countries implies that we have limited degrees of freedom at the country level, which also speaks in favor of integrating the country-level variables one by one instead of simultaneously.

14 Probit estimation coefficients: 0.11 for low education (90% significance level), 0.12 for high education (99% significance level), 0.26 for childcare coverage higher than 31% (99% significance level), −0.18 for the interaction of low education with high childcare coverage (95% significance level), 0.04 for the interaction of high education with high childcare coverage.

15 Probability of second child birth: $P(Y = 1|X) = e^L/(1 + e^L)$, where L contains the estimated coefficients and e is Euler's constant.

16 Multilevel-probit estimation coefficients: 0.22 for low education (95% significance level), 0.11 for high education (90% significance level), 0.01 for childcare coverage (99.9% significance level), −0.007 for the interaction of low education with childcare coverage (95% significance level), 0.001 for the interaction of high education with childcare coverage.

References

Aassve, Arnstein, Francesco C. Billari and Léa Pessin (2016) Trust and fertility dynamics. *Social Forces* 95(2), 663–692.

Amuedo-Dorantes, Catalina and Almudena Sevilla (2014) Low-skilled immigration and parenting investments of college-educated mothers in the United States: Evidence from time-use data. *Journal of Human Resources* 49(3), 509–539.

Arpino, B. and G. Esping-Andersen (2015) How do changes in gender role attitudes towards female employment influence fertility. A macro-level analysis. *European Sociological Review* 31(3), 370–382.

Attanasio, Orazio, Hamish Low and Virginia Sánchez-Marcos (2008) Explaining changes in female labor supply in a life-cycle model. *American Economic Review* 98(4), 1517–1552.

Baizán, Pau, Bruno Arpino and Carlos Eric Delclós (2015) The effect of gender policies on fertility: The moderating role of education and normative context. *European Journal of Population* 32(1), 1–30.

Baker, Michael, Jonathan Gruber and Kevin Milligan (2008) Universal child care, maternal labor supply, and family well-being. *Journal of Political Economy* 116(4), 709–745 (August).

Balbo, N., F. C. Billari and M. Mills (2013) Fertility in advanced societies. A review of research. *European Journal of Population* 29(1), 1–38.

Bick, Alexander (2016) The quantitative role of child care for female labor force participation and fertility. *Journal of the European Economic Association* 14(3), 639–668.

Billari, Francesco and Hans-Peter Kohler (2004) Patterns of low and lowest-low Fertility in europe. *Population Studies* 58(2), 161–176.

Blau, David M. and Philip K. Robins (1988) Child-care costs and family labor supply. *The Review of Economics and Statistics* 70(3), 374–381 (August).

Bongaarts, John and Tomáš Sobotka (2012) A demographic explanation for the recent rise in European fertility. *Population and Development Review* 38(1), 83–120 (March).

Borck, Rainald (2014) Adieu Rabenmutter – culture, fertility, female labour supply, the gender wage gap and childcare. *Journal of Population Economics* 27(3), 739–765.

Breton, D. and F. Prioux (2005) Deux ou trois enfants? Influence de la politique familiale et de quelques facteurs sociodmographiques. *Population-F* 60(4), 489–522.

Del Boca, Daniela (2015) Child Care Arrangements and Labor Supply. IDB working paper series no. IDB-WP-569.

Eurobarometer (2006) *Eurobarometer – Childbearing Preferences and Family Issues in Europe*. European Commission (Au: Maria Rita Testa, VID Austria).

Eurobarometer (2011) *Family Sizes in Europe: Evidence from the 2011 Eurobarometer Survey*. European Commission (Au: Maria Rita Testa, VID Austria).

European Commission (2014) Day-Care Capacities and Demand in Hungary in 2013. Technical Report, European Employment Policy Observatory(EEPO) and Directorate DG Employment, Social Affairs and Inclusion.

Frejka, Tomas (2008) Parity distribution and completed family size in Europe: Incipient decline of the two-child family model. *Demographic Research* 19(4), 47–71 (July).

Goldscheider, F., E. Bernhardt and T. Lappegard (2015) The gender revolution: A framework for understanding changing family and demographic behavior. *Population and Development Review* 41(2), 207–239.

Goldstein, Joshua R., Tomáš Sobotka and Aiva Jasilioniene (2009) The end of lowest-low fertility? *Population and Development Review* 35(4), 663–700.

Greulich, Angela and Aurelien Dasre (2017) Fertility Analysis with EU-SILC: A Quantification of Measurement Bias. Centre d'Economie de la Sorbonne working paper 2017.02.

Gustafsson, Siv and Frank Stafford (1992) Child care subsidies and labor supply in sweden. *The Journal of Human Resources* 27(1), 204–230. Special Issue on Child Care (Winter, 1992).

Hank, Karsten and Michaela Kreyenfeld (2003) A multilevel analysis of child care and women's fertility decisions in western Germany. *Journal of Marriage and the Family* 65(3), 584–596 (August).

Hazan, Moshe and Hozny Zoabi (2015) Do highly educated women choose smaller families? *The Economic Journal* 125(587), 1191–1226.

Himmelweit, Susan, Cristina Santos, Almudena Sevilla and Catherine Sofer (2013) Sharing of resources within the family and the economics of household decision making. *Journal of Marriage and the Family* 75(3), 625–639.

Jones, Larry E., Alice Schoonbroodt and Michèle Tertilt (2011) Chapter Fertility Theories: Can They Explain the Negative Fertility-Income Relationship? In John B. Shoven (ed.), *Demography and the Economy*, NBER volume, Chap. 2. University of Chicago Press.

Kawabata, Mizuki (2014) Childcare access and employment: the case of women with preschool aged children in Tokyo. *Review of urban and regional development studies* 26(1), 40–56.

Lesthaeghe, Ron (2010) The unfolding story of the second demographic transition. *Population and Development Review* 36(2), 211–251 (June).

Luci-Greulich, Angela and Olivier Thévenon (2013) The impact of family policy packages on fertility trends in developed countries. *European Journal of Population* 29(4), 387–416.

Luci-Greulich, Angela and Olivier Thévenon (2014) Does economic development 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960–2007). *European Journal of Population* 30, 187–221.

Myrskyla, Mikko, Hans-Petter Kohler and Francesco Billari (2009) Advances in development reverse fertility declines. *Nature* 460(6), 741–743.

Neyer, G., T. Lappegard and D. Vignoli (2013) Gender equality and fertility: Which equality matters? *European Journal of Population* 29, 245–272.

Schmertmann, Carl, Emilio Zagheni, Joshua R. Goldstein and Mikko Myrskyla (2014) Bayesian forecasting of cohort fertility. *Journal of the American Statistical Association, Taylor & Francis Journals* 109(506), 500–513 (June).

Schoonbroodt, Alice (2016) Parental childcare during and outside of typical work hours. *Review of Economics of the Household*. Forthcoming.

Skrondal, Anders and Sophia Rabe-Hesketh (2004) *Generalized Latent Variable Modeling: Multilevel, Longitudinal, and Structural Equation Models*. FL, USA: Chapman Boca Raton and Hall/CRC.

Snijders, T. and R. Bosker (1999) *Multilevel Analysis*. London: Sage Publications.

Sobotka, Tomáš (2013) Pathways to Low Fertility: European Perspectives. Expert Paper No. 2013/8, United Nations Department of Economic and Social Affairs, Population Division.

Sobotka, Tomáš and Éva Beaujouan (2014) Two Is best? The persistence of a two-child family ideal in Europe. *Population and Development Review* 40(3), 391–419 (September).

Thévenon, Olivier (2015) Chapter Decreasing fertility in Europe: Is it a policy issue? In Christiane Timmerman, Jacques Haers, Sara Mels, Koenraad Matthijs, and Karel Neels (eds.), *Population Change*

in Europe, the Middle-East and North Africa: Beyond the Demographic Divide. Ashgate, Routledge, New York, 81–118.
Wrohlich, Katharina (2008) The excess demand for subsidized child care in Germany. *Applied Economics* 40(10), 1217–1228.
Wrohlich, Katharina (2011) Labor Supply and Child care Choices in a Rationed Child Care Market. DIW Berlin discussion paper no. 1169.

APPENDIX A: EXTENSION WITH GOODS COST FOR CHILDREN

Here, we show that introducing a good cost for children in the budget constraint does not change the qualitative predictions of the theory.

Assuming all else equal as in Section 2.1, the budget constraint faced by couples can now be written as

$$(2+\alpha n)c = (1-(t_f+\bar{\phi})n)w_f + (1-t_m n)w_m - pt_n n,$$

where α represents the share of consumption that each child needs.

The three cases that were identified are then modified as shown below. In particular, we derived the optimal interior n in each case.

I. *The woman supplies all the childcare*. If $\mu, \nu > 0$ and $\lambda = 0$; $t_m, t_n = 0$,

$$n^{\mathrm{I}} = \frac{\alpha(\beta-1)(w_f+w_m) - 2(1+\beta)(\bar{\phi}+\phi)w_f}{2\alpha\beta\left(\bar{\phi}+\phi\right)w_f} + \frac{\sqrt{\left((2(\bar{\phi}+\phi)+\alpha)w_f+\alpha w_m\right)\left(\alpha(\beta-1)^2(w_f+w_m)+2(1+\beta)^2(\bar{\phi}+\phi)w_f\right)}}{2\alpha\beta\left(\bar{\phi}+\phi\right)w_f}.$$

II. *All of the childcare is outsourced*. If $\lambda, \mu > 0$ and $\nu = 0$; $t_f, t_m = 0$, $t_n = \phi$,

$$n^{\mathrm{II}} = \frac{\alpha(\beta-1)(w_f+w_m) - 2(1+\beta)(\bar{\phi}w_f+\phi w_m)}{2\alpha\beta\left(\bar{\phi}w_f+\phi w_m\right)} + \frac{\sqrt{\left((2\bar{\phi}+\alpha)w_f+(2\phi+\alpha)w_m\right)\left(\alpha(\beta-1)^2(w_f+w_m)+2(1+\beta)^2(\bar{\phi}w_f+\phi w_m)\right)}}{2\alpha\beta\left(\bar{\phi}w_f+\phi w_m\right)}.$$

III. *The man supplies all the childcare*. If $\lambda, \nu > 0$ and $\mu = 0$; $t_f, t_n = 0$, $t_m = \phi$,

$$n^{\mathrm{III}} = \frac{(\beta-1)\alpha(w_f+w_m) - 2(1+\beta)(\bar{\phi}w_f+p\phi)}{2\alpha\beta\left(\bar{\phi}w_f+p\phi\right)} + \frac{\sqrt{\left(2\bar{\phi}w_f+(w_f+w_m)\alpha+2p\phi\right)\left((\beta-1)^2\alpha(w_f+w_m)+2(1+\beta)^2(\bar{\phi}w_f+p\phi)\right)}}{2\alpha\beta\left(\bar{\phi}w_f+p\phi\right)}.$$

For the parameter values given above, and $\alpha = 0.4$ the mechanisms suggested in Section 2.1 and the relationship between fertility and female wage shown in Figure 4 do not change when adding a cost of children in terms of goods.

TABLE B.1. Approximate completed fertility rate (women aged 38–44), proportion of women with i children and proportion of women with at least i children for high- and low-fertility countries

	ACFR	p_0	p_1	p_2	p_3	p_4	p_5
Low-fertility countries (lf)	1.46	0.22	0.27	0.40	0.09	0.03	0.02
High-fertility countries (hf)	1.73	0.15	0.23	0.42	0.15	0.05	0.02
Difference $(hf - lf)$	0.27	−0.06	−0.04	0.02	0.06	0.02	0.00
			FR_1	FR_2	FR_3	FR_4	FR_5
Low-fertility countries (lf)			0.78	0.52	0.12	0.03	0.02
High-fertility countries (hf)			0.85	0.62	0.20	0.05	0.02
Difference $(hf - lf)$			0.06	0.10	0.08	0.02	0.00

Data Source: EU SILC CS 2011; women aged 38–44.
Low-fertility countries (lf): ACFR$<$1.6.
High-fertility countries (hf): ACFR$\geq$1.6.

APPENDIX B: DETAILS ON SECTION 3.1

Proportion of women with at least $i \in (0, N)$ children (fertility rate of rank i), FR_i:

$$\text{FR}_i = \sum_{i=1}^{N} p_i,$$

with N is five or more children and p_i is the proportion of women with i children.

Approximate completed fertility rate (women aged 38–44), ACFR_i:

$$\text{ACFR}_i = \sum_{i=1}^{N} \text{FR}_i.$$

Difference in fertility rates of rank i between high-fertility countries (hf) and low-fertility countries (lf):

$$\text{FR}_i^{hf} - \text{FR}_i^{lf}.$$

Absolute difference in the ACFR between high-fertility countries (hf) and low-fertility countries (lf):

$$\Delta\text{ACFR} = \sum_{i=1}^{N} \left(\text{FR}_i^{hf} - \text{FR}_i^{lf}\right).$$

Proportion of the difference in ACFR between high- and low-fertility countries that is explained by fewer children of rank i in low fertility countries:

$$\frac{\text{FR}_i^{hf} - \text{FR}_i^{lf}}{\sum_{i=1}^{N} \left(\text{FR}_i^{hf} - \text{FR}_i^{lf}\right)}.$$

APPENDIX C: ROBUSTNESS CHECK

Table C.1. Estimated probability of second child birth – robustness check

	Model 3
Woman's education:	
Low education (primary, lower secondary)	0.612+
Middle education (upper and post-secondary)	*Ref.*
High education (tertiary)	0.125
Partner education:	
Low education (primary, lower secondary)	−0.0794
Middle education (upper and post-secondary)	*Ref.*
High education (tertiary)	0.307***
Woman's employment status:	
Employed full-time	*Ref.*
Employed part-time	−0.0649
Unemployed	−0.176+
Inactive	−0.109
Changing employment status	0.289*
Partner's employment status:	
Employed (full-time or part-time)	*Ref.*
Not employed	−0.130
No information	−0.0589
Aggregate level variables:	
Childcare coverage (continuous)	0.00778
Childcare coverage * low education	−0.0130*
Childcare coverage * high education	0.000305
Wage level (continuous)	0.110***
Wage level * low education	0.00984
Wage level * high education	0.00369
Gender wage gap (continuous)	0.0210
Gender wage gap * low education	−0.0191
Gender wage gap * high education	0.00521
Demographic controls:	
Woman's age	0.580***
(Woman's age)^2	−0.0108***
Age of first child	−0.121***
Sex of first child is female	−0.00477
Couple is married	0.184**
Intercept	−10.13***
Year-fixed effects	Yes
Country-fixed effects	Random
Control for number of person-years	Yes
Number of observations	22143

TABLE C.1. Continued

	Model 3
Proportion of second child arrival	0.112
Number of countries	26
Random effects:	
Variance of the intercept	0.114
Variance of the variable "low educated"	0.000
Variance of the variable "high educated"	0.022

+p<0.1, *p<0.05, **p<0.01, ***p<0.001
Control for number of person-years: dummy for the second person-year for individuals with two person-years in the panel.

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COMITÉ DE RÉDACTION DE *POPULATION*

Paris, le 24 mars 2017

Attestation d'acceptation

Nous certifions que Madame Angela Greulich a déposé auprès de la revue *Population*, un projet d'article intitulé :

- « Employment and second childbirth in Europe », co-écrit avec Olivier Thévenon et Mathilde Guergoat-Larivière à paraître dans un prochain numéro de *Population*.

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Female employment and second childbirths in Europe

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Abstract
This article studies the effects of women's employment on second births in contemporary Europe. By mobilizing longitudinal data from the European Union's Statistics of Income and Living conditions (EU-SILC) and aggregated data from the OECD Family Database, we find evidence that being in employment significantly increases women's probability of second childbirth. The magnitude of the effect differs, however, among individuals. The positive impact is stronger for highly educated women and for women with partners who are themselves in employment. Dual employment favours thus family enlargement from one to two children more so than heterogenous employment patterns among partners. Multilevel models reveal, in addition, that the positive effect of employment on the transition to second childbirth is reinforced in countries with high child care coverage. The development of childcare at the country level – which is the most effective family policy to secure women's employment – increases the individual probability for women of having a second child, whereas other types of institutional support such as leave schemes or lump-sum cash transfers do not have such a positive effect. Our results include several controls for endogeneity.

Keywords: low fertility, female employment, work-life balance, Europe, family enlargement

JEL codes: J13, J16

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1. Introduction

Even though the recent economic crisis slows down fertility in all European countries, Europe is still characterized by quite heterogeneous fertility levels. While fertilty rates have been falling between the 1960s and the 1990s in all European countries, they stagnate since then below replacement level in some countries, while in others, they have significantly re-increased.

Fertility levels have important consequences for the macroeconomic equilibrium of a country, and they reflect individual and societal well-being (Lee and Mason, 2010; Kohler et al., 2005). This article aims at identifying the reasons behind low fertility in Europe by combining individual and institutional determinants of fertility behaviour.

The decline and re-increase in fertility in Europe has often been seen seen as a logical consequence of the process of postponement of childbearing (Goldstein et al., 2009; Bongaarts and Sobotka, 2012)[1]. However, the fact that the re-increase in fertility occurred in some European countries but not in others raises questions about factors that lead households to postpone but not forgo having children in low-fertility countries. Recent research suggests that fertility differentials between European countries cannot fully be explained by the process of postponement. Structural and cultural changes that go hand in hand with economic development are likely to affect fertility behaviours not only in terms of timing, but also in terms of quantum (Lesthaeghe, 2010; Goldstein et al., 2009; Myrskylä et al., 2009).

Female employment is hereby identified as a key parameter for explaining fertility differentials in Europe. Luci-Greulich and Thévenon (2013, 2014), for example, show that the re-increase in total fertility rates happened mostly in those highly developed countries in which economic development occurred concomitantly with increases in female employment. In parallel, the upturn in total fertility rates has occurred first and foremost in countries where public support for parents' work-life balance has been enhanced, for example by providing childcare services for young children. Low fertility countries are identified as those countries where parents face a strong conflict between work and family life.

It is still debatable, however, in how far the evidence of a positive link between fertility and female employment on the aggregate level reflects individual behaviour in contemporary Europe.

Pioneering studies using survey data either focus on completed fertility (e.g., Willis 1973) or on a limited set of countries (i.e. Blau and Robins, 1989; Hotz and Miller, 1988; Moffitt, 1984; Butz and Ward, 1979). Recent studies suggest that female labour force entry goes hand in hand with the birth of a first child in those developed countries where the institutional setting is comprehensive enough to support the combination between work and family (Rendall et al. 2014; Wood et al. 2015; Schmitt 2012; d'Albis, Greulich and Ponthière 2015). Adsera (2011) shows that the effect of working status on transitions to higher-order births in European countries differs significantly between sectors and depends on the length of the working contract. Matysiak and Vignoli (2008, 2013) also find high variations in the effect of female employment and first and second childbirth among institutional settings; they show that women's employment conflicts with childbearing in Italy, while in Poland women tend to combine the two activities. Ahn and Mira, (2002), Adsera (2004), Sobotka *et al.* (2011), Pailhe and Solaz (2012) or Goldstein *et al.* (2013), who show that fertility levels tend to decline in times of high and sudden unemployment.

However, there is still no systematic analysis of the impact of women's employment status on childbirth which covers most European countries and which comprehensively takes into account important factors such as partner and institutional characteristics.

[1] Fertility levels initially fall because births at young ages are postponed; they recover after a certain lapse of time, due to the 'recuperation' of births taking place at older ages.

This article responds to this research gap by investigating how far women's integration into the labour market affects her probability of childbirth. We hereby mobilize data from the European Statistics of Income and Living Conditions (EU-SILC) and the OECD Family Database. As EU-SILC provides detailed measures of employment status for all household members, the use of EU-SILC allows controlling for the employment status of the partner. In addition, the large sample size enables us to identify marginal effects, i.e. we differentiate the impact of women's employment status on fertility by education and by the employment situation of the partner. As EU-SILC covers the large majority of European countries, we are also able to take into account interactions with institutional settings (multi-level modelling). We hereby focus on national family policy settings (child care coverage, length of parental leave, cash transfers). Potential endogeneity between fertility behaviour and parents' employment status is taken into account by mobilizing longitudinal data (we observe labour market status before potential conception) and by applying an instrumental-variable approach (bi-probit modelling).

We focus our analysis on the birth of a second child. We chose second child birth as this birth order is found to be key for explaining fertility differences between European countries. Several studies have shown that differences in fertility among European countries emerge in important parts as a result of fewer children of birth order two in low fertility countries (Frejka and Sardon, 2007; Frejka and Sobotka, 2008; Breton and Prioux, 2009). By covering the majority of European countries, a D'Albis, Greulich and Gobbi (2016) find that fewer children of birth order two in low fertility countries contribute to nearly half of the fertility gap between high- and low-fertility countries in Europe, whereas the other birth orders are less influential.[2] On average in Europe, low fertility levels thus emerge mainly due to lower progression to a second child.[3] Against the background of rather homogenous preferences in European countries for a two-child family (Testa 2012; Sobotka and Beaujouan, 2014), this suggests that parents in low-fertility countries face barriers to having a second child. Our article contributers to a better understanding of individual as well as institutional determinants and barriers of transition to second child birth.

This paper is organized as follows. Section 2 provides the theoretical background of our analysis. Section 3 describes the empirical strategy used to identify the impact of women's labour market integration on second childbirth and section 4 presents our results. Section 5 provides our conclusions and discusses limitations as well as ways of future research.

2. Theoretical background

In the classic economic theory (Becker 1960, Mincer 1958), decreasing fertility are explained as an overall result of an increasing level of education among women, which is strengthening their labour market attachment and career aspirations. In the absence of possibilities for combining work and family life and the presence of strong traditional gender roles, increasing career and income options for women lead women to replace work with childbearing (substitution effect due to increasing opportunity costs of staying at home). In contrast, increasing career and income options for their male partners rather favour fertility behaviour (income effect).

Increasing possibilities for combining work and family life, which are often accompanied by weakening normative gender roles (McDonald, 2000; Neyer, Lappegard and Vignoli, 2013) may

[2] More precisely, fewer children of parity one are found to account for only one forth of the gap in the number of children of women aged 38 to 44 between high- and low-fertility countries, while fewer children of parity two account for almost 40% of the gap. Fewer children of parity three accounted for less than one third of the gap, and fewer children of parity four or higher accounted for less than 10% of the gap. The fact that there are fewer children of birth order two in low-fertility countries contributes therewith almost two times more to the fertility gap between high and low-fertility countries than the fact that there are fewer children of birth order one in low-fertility countries.

[3] Albeit the fact that in a couple of European countries, progression to parity one is also very low, notably in Germany, Austria, Spain and Italy, Luxembourg and Switzerland (see Greulich, Thévenon and Guergoat-Lavière; 2016 for a country-by-country analysis).

result in the income effect dominating the substitution effect for women: in those countries where parents can successfully combine work and family life, women's labour market participation is likely to facilitate the decision to start or enlarge a family. Women do not have to chose between work and childbearing any more (the negative substitution effect of female employment on fertility gets weaker) and their participation in the labour market generates (additional) household income which facilitates starting and enlarging a family (the positive income effect of female employment on fertility gets stronger). In this scenario, a woman's and her partner's career and income options no longer have opposite impacts on fertility. Both partners might first want to benefit from their educational investments and integrate themselves into the labour market before starting a family. The successful integration of both partners, hand in hand with increased household income, is then likely to facilitate family formation as well as family enlargement.

Following these arguments and the macroeconomic empirical evidence of a positive link between fertility and female employment, it seems that in countries with high fertility and high female employment rates, women succeed in combining work and family life. On the contrary, in low-fertility countries, parents, and women in particular, face barriers in combining work and family life, leading them to choose between labour market integration and childbearing.

Women's integration into the labour market has become one of the main key variables in fertility decisions for many reasons. First, the steep increase in female educational attainment has made it very costly for women and their households to interrupt employment for reasons of childbearing and/or child-raising. Women's labour force participation not only provides households with additional income, but it also ensures that the household will continue to earn income during times of growing uncertainty when partners are at risk of losing their jobs and becoming unemployed. Therewith, women's labour market participation not only reflects women's desire for self-fulfilment, but it is also an increasing response to economic necessity. In addition, the increasing risk of divorce and/or couple separation makes it preferable for women to work in order to gain economic independence. In these circumstances, it has become increasingly important for women not only to work before starting a family, but to secure their labour market situation after childbirth and during the years of family formation (Blossfeld, 1995). Follwing the economic argument that children are relatively costly and female employment represents an important contribution to family income, securing the employment position of mothers is likely to gain importance when the family plans to have additional children. In other words, the possibility of family enlargement is likely to depend more and more on women's ability to contribute continuously to household income.

As this ability also depends on a country's degree of support for combining work and family, the relation between female employment and fertility is likely to differ across countries. In countries that provide institutional support in the form of public childcare, it is possible that couples in which both partners are successfully integrated into the labour market are more likely to decide in favour of family enlargment than those in which at least one partner is inactive or unemployed: the couple's joint income creates a secure economic environment having an additional child. Income can be maintained after the birth of children thanks to institutional support in terms of childcare. In low-fertility countries, however, the impact of parents' successful labour market integration might be ambiguous, due to the absence of childcare options: a childbirth would imply a reduction in family income, as at least one partner has to stop or reduce his or her labour market activity in order to care for the child. For couples depending on both earnings to make ends meet, child birth becomes no option in countries with low access to formal childcare due to the resulting income reduction. This is particularly the case when a child birth of higher birth order is to debate, as the couple already has to finance one or more children. Consequently, with low institutional work-life balance support, couples with both partners active in the labour market might be more likely to decide against family enlargment as compared to couples with one partner already inactive. Besides access to formal child care, other family policy instruments are also successible to influence the impact of women's labour market integration on childbearing behaviour, such as parental leave schemes and cash transfers to families. These policies also have the potential to reduce the costs of fertility, either in monetary terms or in terms of opportunity costs. While parental leave schemes intend to secure women's position in the labour market (by allowing for a baby-pause while keeping the job), cash benefits intend to support families' standard of living (McDonald 2006; Rindfuss et al. 2010). However, long durations of parental leave are known to hamper rather than facilitate women's possibilities of re-integrating into the labour market, and generous lump-sum benefits encourage especially low educated women to reduce or stop working activities (Thévenon, 2011). Their influence on the impact of women's employment on fertility is therefore potentially ambiguous.

3. Data and methods

The data we use in this article comes, at the micro level, from the EU-SILC database (European Union Statistics on Income and Living Conditions) and, at the macro level, from the OECD Family database.

The EU-SILC is a harmonized survey covering the large majority of European countries. The survey captures individual and household situations by providing a large number of economic and social variables that may be considered as determinants in deciding to have children. It displays information on age and education level as well as variables on labour market status. Household members can be merged to each other, which allows observing not only woman's but also partner characteristics.

To analyse the impact of women's labour market status on the probability of having a second child, we mobilize the longitudinal sample of EU-SILC. The longitudinal dataset covers 25 European countries[4] and the waves 2003 to 2011. Within this period, individuals are followed up for a maximum period of four years in the majority of countries (rotational panel).

Our sample is restricted to women aged 15 to 45 who already have a first child in the beginning of the observed period. As EU-SILC contains information on labour market status on a monthly basis as well as on the quarter of birth of children, we are able to identify the labour market status before potential conception. Figure 1 illustrates our identification strategy.

[Insert figure 1 here]

In order to obtain the information needed for our analysis, individuals have to be observed over a period of at least three years (year *t-1*, year *t* and year *t+1*). Children born in the third and the fourth quarters of each year are generally declared in the interview of the following year, as interviews usually take place during the first half of each year. Births that occur at the end of the year are thus not detectable immediately. Three consecutive waves of interviews are thus needed: Based on wave 3 (the interview that occurs during year *t+1*), we identify all second births that occur during the calendar year *t*. Year *t-1* serves to observe the mothers' and her partner's labour market characteristics over a certain period before potential conception.[5]

For women who have a second child in year *t* (the test group), we observe their labour market status during the three months before conception, assuming that the pregnancy lasted nine month. More precisely, for women with a second child born in quarter one in year *t*, we observe women's labour market status in January, February and March in year *t-1*. For these women who are observed for three years only and who have had a second child in the first quarter of year *t*, three months is the maximum time period we are able to observe in terms of labour market status. In order to obtain the largest possible number of observations and a homogenous measure of labour market

[4] The 25 countries are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxembourg, Latvia, Netherlands, Norway, Poland, Portugal, Sweden, Slovenia and Slovakia. UK and Romania are excluded due to serious measurement errors in terms of childbirth and employment status. Longitudinal data is not available for Germany and Switzerland.

[5] This is possible as at the survey interview in year *t* (wave 2), individuals give information about their month-by-month employment status of year *t-1*.

status for all individuals, we limit the observed time period to three months for all individuals: For women with a second child born in quarter two in year *t*, we observe women's labour market status in April, May and June in year *t-1*. For those with a second child born in quarter three in year *t*, we observe women's labour market status in July, August and September in year *t-1*. And for those with a second child born in quarter four in year *t*, we observe women's labour market status for October, November and December in year *t-1*. For women without second child birth in *t* (the control group), we arbitrarily chose a three month period during the year *t-1*. Women observed for four years who have not had a first child in year *t* are included twice in our data base (two person-years: two calendar-years of potential child birth). We therewith obtain a homogenous data set in which labour market status is observed for a period of three month before (potential) conception for all individuals (respectively person-years). This allows us running a simple probit model, while we control for the number of person-years, i.e. a dummy is created for those individuals who are observed twice.

Covering three months rather than using information given at a certain moment of time allows smoothing out short-term periodical fluctuations in employment to some extent: We consider an individual as "employed" only if he or she is employed during each of the three months, while those who change employment status during the observed time period figure separately. Note, however, that three months is too short to interpret our measure of employment as an indicator of stability of employment[6].

Overall, we obtain 36,729 observations (person-years) for women aged 15 to 45 with one child in the beginning of the observed period, who are thus 'at risk' of having a second child in the following year. All countries combined, the event 'birth of a second child' can be observed for 9% of observations in our sample. This proportion varies from 4% (Lithuania) to 18% (Netherlands).

[Insert table 1 here]

Table 1 shows that, on average, the majority of women surveyed in the 25 observed countries are in employment during the three months before potential conception of a second child. The distribution between part-time and full-time employment is, however, quite heterogenous among European countries, as discussed in more detail in Greulich *et al.* (2016). The second group is inactive, and the third group is unemployed[7].

We include a series of control variables in order to isolate other potential determinants from the impact of women's employment on second child birth. Demographic controls include women's age as well as the age and sex of the first child. We also control for women's education, observed at the time of the survey in *t-1* (using UNESCO ISCED classification[8] to distinguish between three categories). Most importantly, SILC enables us to include information on the partner in our models. We control for the presence of a partner and the couple's marital status, and we observe the partner's employment status during three month before potential conception of a second child. Table 1 shows that on average in the EU, the large majority of partners are in employment. Interaction terms allow us identifying marginal effects, i.e. we distingish the impact of women's employment status on the probability of having a second child by education and parter status.

The fact that we observe determinants of second childbirth before the event potentially occurs allows us reducing the risk of obtaining biased estimation results due to endogeneity. However, using time lags can not completely rule out inverse causality. To increase the control for endogeneity, we apply an instrumental variable-approach. We implement the IV-approach using a bivariate probit

[6] See Rendall and Greulich (2016) for employment-stability measures in SILC. By applying multiple imputation for left-cesored predictor variables, they find that in Poland, increasing the length of the observed period in terms of labour market status increases the significance of the empirical findings. Being fulltime-employed for two or more years is found to be strongly predictive of a first birth in Poland, while being fulltime-employed for only one year is not.

[7] SILC registers individuals on maternity and paternity leave as employed, while those in parental leave are coded as inactive.

[8] *Low education* for pre-primary, primary and lower secondary education; *medium education* for upper secondary and post-secondary non-tertiary education; and *high education* for first stage of tertiary education (not leading directly to an advanced research qualification) and second stage of tertiary education (leading to an advanced research qualification).

model that is estimated using full information maximum likelihood. Regional unemployment rates (matched with our individuals using NUTS-2 codes) are used as instruments for women's employment status, as they are found to be much more associated with women's labour market situations than with their fertility behaviour[9].

All models are run with year- and country- fixed effects. This allows to capture the effects of country-specific unobserved characteristics, thereby focussing only on within-country variations. The country-fixed effects are then made random and the impacts of some selected country-specific variables are specified in multi-level models.[10] We anlyse how the probability of having a second child is correlated with different family policies and how the correlation between second child birth-probabilities and family policies differs with the labour market status of the mother.

Three aggregated indicators are used as macro institutional variables in the multilevel analysis, coming from the OECD Family Database (2011)[11]. These indicators are chosen since they represent the three main options for public policies to support families, namely leave schemes, childcare coverage and cash transfers to families (Thévenon, 2011; Thévenon and Gauthier, 2011). Table 2 gives a descriptive overview of these three variables by country.

[Insert table 2 here]

Leave schemes are quantified by the maximum duration for which a mother can be on leave with employment protection. Childcare coverage is measured by the proportion of children under age 3 who are enrolled in formal care sevices, either home- or centre-based, refering not only to public and publicly subsidized but also to private formal childcare[12]. Cash benefits represent the transfers a couple with 2 children receives over a period of 3 years after the birth of a second child. This total is estimated as the sum of cash leave and family benefits, plus the fiscal reduction the household gets in comparison to the tax burden of a childless household with same earnings. Each partner is assumed to receive the average earnings. This indicator is expressed in % of the net income for a family with no child .

4. Main results

In the following, we present the core results of our regression analysis. Additional specifications and robustness checks are presented in Greulich, Thévenon and Guergoat-Lavière (2016). These include a differenciation between full-time and part-time, controls for wage income, analyses by region and fertility regime (high vs. low) as well as IV-2SLS and IV-probit models[13].

Our models estimate the impact of women's labour market status on transition to 2nd childbirth of women aged 15 to 45 with one child. The results in table 3 are based on survey data only, while the models presented in table 4 integrate aggregate-level information.

[Insert table 3 here]

[9] More technical details about the IV approach used in this study can be found in Greulich et al. (2016).
[10] More details about the multi level modelling technique can be found in Greulich et al. (2016).
[11] The multi-level models are only based on 24 (or sometimes 21 countries), as the OECD Family Data Base does not provide any policy measures for Cyprus and not on cash transfers for Bulgaria, Latvia and Lithuania.
[12] Since there is no comparative data available on childcare supply, we use this indicator as a global measure of the total cross-national differences in formal childcare capacities.
[13] For the IV-2SLS and IV-probit models, the first stage equation assumes a linear function with an OLS estimation, which is guaranteed to produce first-stage residuals that are uncorrelated with fitted values and covariates. In these models, the error terms of the two equations appears to be not correlated, which suggests, first, that the employment status can be considered with limited risk as an exogenous factor; and, second, that results from the simple probit estimation are consistent.

The first model (column 1) of table 3 analyses the effect of employment against all other possible situations, while model 2 distinguishes between all possible alternative employment situations. Model 1 shows a significantly positive effect of employment on transition to 2^{nd} childbirth, after controlling for the existence of a partner, marital status, age, age and sex of the first child, country and year fixed effects, and the number of person years[14]. This implies that within European countries, women in employment have a higher probability of second childbirth than women who are not engaged in labour market activities. The model further shows that women with no partner have a significantly lower probability of having a second child than women who have a partner and are married. Partnered women who are not married have a somewhat smaller probability of second childbirth than those who are married.

Model 2 shows that unemployed women and students have a significantly lower probability of having a second child in comparison to women in employment. For the very small minority of women with a change in the employment status during the observed three-month period, we see that women finding a job during this period have a higher probability of having a second child in the following year when compared to those who are in employment over the whole three months-period. Even though women in unemployment over the observed period have a lower probability of having a second child, we find that job loss actually has a positive impact. This paradox might be partly explained by the fact that, within this very small group of women who lost their jobs during the three observed months, some women may have already anticipated the conception of a second child, whereas others may take advantage of the occasion to conceive a second child.

Model 3 takes into account the employment status of the partner as well as its interaction with women's employment status. For women with a partner who is not in employment, being in employment themselves is insignificant for having a second child (estimated coefficient: -0.04). However, the effect of being in employment is significantly positive for women who have an employed partner. For this group, the estimated coefficient of employment is positive (-0.04+0.0.113= + 0.153), with a joint confidence level of 99% (p-value of 0.0052 presented in the last rows of the table). The effect of having a partner in employment is important for second childbirth, and even more important for women who are themselves in employment (0.0784+0.113= 0.1914).

It thus seems that dual employment favours family enlargement from one to two children more so than heterogenous employment patterns among partners. For women, having a partner who is employed is a fundamental determinant for having a second child, but at the same time their own successful labour market integration after first childbirth also favours second childbirth. The finding that employment is less important for women whose partners are not in employment suggests that having a partner in employment is a crucial determinant for having a second child. Once this condition is fulfilled, employment for women increases the chance of family enlargement: couples in which both the man and woman are in employment have a higher probability of having a second child when compared to couples in which the man but not the woman is in employment. Employment for both the woman and her partner is likely to generate a secure economic situation that facilitates family enlargement.

Model 4 tests in how far the impact of women's employment on second childbirth differs among education groups. The difference in the probability of second childbirth between employed and non-employed women is insignificant among the low-educated, as is the difference among middle-educated women (estimated coefficient for the impact of employment on the probability of second childbirth: -0.0128 for middle-educated and -0.0128-0.0479 for low-educated women). The impact of employment is, however, found to be significantly positive for high-educated women (-0.0128+0.152). It seems that for highly educated women, receiving a return on their educational investment after the birth of a first child is important for family enlargement. At the same time, being

[14] Converting the estimated probit coefficients into probabilities leads to the following quantification of estimation results (for women whose characteristics correspond to the reference category: partnered and married, aged 25 to 34 and having a first child that is male and aged one or two, Austria, year 2003): Women without employment have a 26.7% probability of having a second child, while employed women have a 28.6% probability of second childbirth.

high educated has a significantly positive effect on second childbirth in particular for those women who are in employment (0.0866+0.152), which most likely reflects a positive income effect.

[Insert table 4 here]

Table 4 shows results of specifications which contain contextual variables among the regressors. First of all, model 5 shows results of a bi-probit model which uses regional unemployment rates as instruments for women's probability of being in employment. This serves to reduce endogeneity between labour market participation- and fertility-behaviour. Model 5 shows results for fertility (column 1) and employment (column 2), estimated simultaneously. This robustness check confirms the main results of the simple probit models, namely an average positive effect of employment on the probability of having a second child for all women, all education levels combined[15].

Models 6 and 7 present results of the multi-level analysis including family-policy indicators. Model 6 shows that women's employment is confirmed to have a positive impact on the probability of having a second child when controlled for child care coverage, length of parental leave and cash transfers. The policy variable that displays a significant and positive effect on second child birth is childcare coverage, while no significant effect is found for length of leave schemes and total cash transfers.

The positive effect of childcare and the relative inefficiency of leave duration and cash transfers for encouraging 2nd child birth shows that reconciliation issues play a crucial role for family enlargment. The possibility to combine work and family life appears as a key determinant for the decision in favour of a second child whereas the opportunity to stop working for a relatively long period does not seem to have such a positive effect.

Model 7 tests for a differentiated effect of child care coverage on the probability of 2nd child birth according to women being in employment or not. This model also tells us how the positive individual effect of being in employment may be reinforced or reduced by the country's level of child care coverage. The interaction term between the individual variable *'employment'* and the macro-level variable *'childcare coverage'* displays a positive and significant coefficient, showing that the positive effect of employment on the probability of having a second child is reinforced by childcare development. This positive interaction also means that the positive effect of childcare development on second child birth is stronger for women who are in employment in comparison to those who do not work. Thus, being in employment (at the individual level) and the development of formal childcare (at the macro level) both have a positive impact on the probability of having a second child and this is even more true when these two features are combined.

5. Conclusion

This article studies the effects of women's employment on second births in contemporary Europe. By covering the majority of European countries, observing partner characteristics and controlling for family policy settings, the paper provides an important piece of comparative research in this field. So far, to our knowledge there exists no comprehensive analysis of fertility determinants at the microeconomic level which focusses on employment status and provides at the same time a large-scale comparative perspective.

[15] This effect reduces in size and turns out to be no longer significant when education is added among the regressors (see Greulich, Thévenon and Guergoat-Lavière, 2016). Education is omitted in the core specifications presented in this paper due to its strong correlation with employment.

By mobilizing the longitudinal sample of the European Union's Statistics of Income and Living Conditions (EU-SILC, covering waves 2003 to 2011), we find evidence that within European countries, being in employment significantly increases women's probability of second childbirth. The magnitude of the effect differs, however, among individuals. The positive impact is stronger for highly educated women and for women with partners who are themselves in employment. For women without a partner or with a partner who is not working, their own employment status seems to be less important for having a second child, as having a partner in employment is found to be crucial for the decision to have another child. Once this condition is fulfilled, women who are themselves in employment are more likely to have a second child when compared to those who are not integrated into the labour market. Multilevel models reveal, in addition, that the positive effect of employment on the transition to second childbirth is reinforced in countries with high child care coverage. The development of childcare at the country level seems to increase the individual probability for women of having a second child, whereas other types of institutional support such as leave schemes or lump-sum cash transfers do not seem to have such a positive effect.

The positive interaction between childcare development at the country level and employment at the individual level suggests that reconciliation issues are at the core of fertility choices. Being successfully integrated into the job market after the birth of a first child emerges as a crucial determinant for family enlargment. This concerns the woman as well as her partner. Dual-earner couples are found to be more prone to have a second child than couples with heterogeneous employment patterns. It seems that families in which both partners participate in the labour market succeed the most in generating the financial security that is needed to have an additional child.

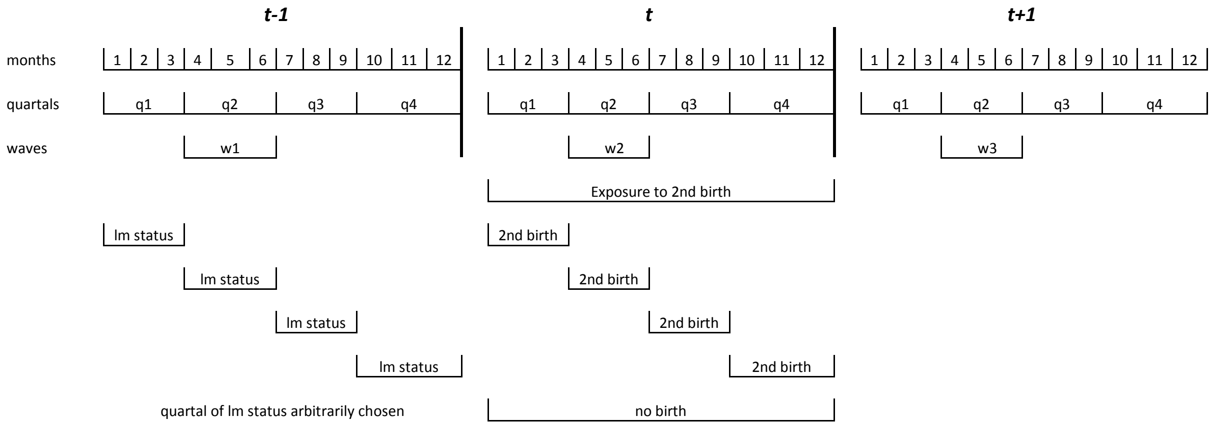
Even though the use of EU-SILC implies several advantages in comparison to more demographic suveys (large country coverage, control for partner characteristics, detailed employment information), it includes also several limits. As EU-SILC is not conceived for demographic analysis, fertility measures risk to be biased. In addition, important individual determinants of fertility, besides socio-economic characteristics, as for example health, the quality of the partner relation as well as norms and values, are not observed. However, our focus on second childbirth allows circumventing some of these isssues, a least to a certain extent, in comparison to analyzing first childbirths: as women in our sample already have one child, we implicitly control for general sterility and 'aversion' against children. We are also less exposed to attrition, as couples with children have a higher probability of being followed up in SILC in comparison to singles and couples without children, even though attrition is linked to fertility in SILC. Greulich and Dasre (2016) find that SILC underreports second childbirth only to a negligible extent in comparison to unbiased measures coming from the Human Fertility Database. They also find no evidence for significant socioeconomic differerences in attrition for the majority of countries covered by EU-SILC[16].

We acknowledge, however, that the focus on second childbirth bears the risk of obtaining transition rates that are biased by selection effects, as we only look at individuals that already displayed some family orientation in the past (as they already gave birth to a first child). Including other child parities in the analysis seems therefore a fruitful way of further research, which would also allow substantiating conclusions about the impact of female employment on aggregate levels of fertility. The macro-economic framework also merits to be expanded, for example by considering labour market institutions and their interplay with economic fluctuations. This seems particularly important in view of the recent economic crisis. Finally, and in relation with this point, efforts to accurately trace individual long-term stability of employment seem to be meaningful research investments.

[16] Greulich and Dasre (2016) show that SILC underestimates the probability of first childbirth for women aged 20-30 due to attrition, but births of higher order are well reported for all ages in SILC. First child birth can go hand in hand with a household split, i.e., women move away from their parents' household and set up their own household. As these women are not likely to be the principal survey respondents, they risk dropping out of the survey once they have moved. SILC is more successful in following up moving households if the whole household moves, which is why the attrition problem is much lower for the birth of a child of higher order.

6. Figures and Tables

Figure 1: Identification Strategy



with lm = labour market

Table 1 : Descriptive overview of the exogenous variables

		No 2nd child birth	2nd child birth	Significance of difference
Employment status	*Full-time employment*	0,55	0,46	***
	Part-time employment	0,13	0,19	***
	Unemployment	0,08	0,07	**
	Inactivity	0,18	0,23	***
	Student	0,02	0,02	
	Military	0,001	0,003	
	Retirement	0,005	0,002	*
	Change: found job	0,01	0,02	*
	Change: lost job	0,009	0,012	
	Change: full-time to part-time	0,0009	0,0012	
	Change: part-time to full-time	0,002	0,002	
	Other change in employment status	0,003	0,005	
Partner information	*Partner in employment (ft and pt)*	0,69	0,86	***
	Partner not in employment	0,08	0,06	*
	No partner	0,23	0,08	***
	Partner and married	0,62	0,68	***
	Partner but not married	0,15	0,24	***
Both partners in employment		0,48	0,58	
Woman's educational attainment	*Low education*	0,21	0,16	***
	Medium education	0,53	0,44	***
	High education	0,26	0,40	***
Woman's age	*15-24*	0,07	0,10	***
	25-34	0,39	0,71	***
	35-45	0,54	0,18	***
Age of first child	*0*	0,11	0,06	***
	1-2	0,18	0,49	***
	3-6	0,21	0,33	***
	7+	0,50	0,12	***
First child is female		0,49	0,49	

Note: * p<0.05, ** p<0.01, *** p<0.001

Data source: EU-SILC longitudinal sample, waves 2003 to 2011, women aged 15-45 who already have one child.

Table 2: Country-level policy variables used in multilevel models

	Childcare coverage (%)	Maximum length of leave (weeks)	Total cash transfers (conditioned earnings percentage)
Austria	10,94	112	34,62
Belgium	45,03	27	20,81
Bulgaria	14,63	63	.
Czech Republic	2,63	164	40,51
Denmark	65,66	50	21,94
Estonia	17,02	180	44,59
Spain	39,31	162	16,69
Finland	24,99	156	37,71
France	42	159	30,82
Greece	14,16	28	5,33
Hungary	9,03	108	65,49
Ireland	29,03	62	17,46
Iceland	56,33	26	12,54
Italy	25,76	47	22,92
Lithuania	26,87	125	.
Luxembourg	38,39	40	34,04
Latvia	15,64	19	.
Netherlands	54,94	29	11,5
Norway	47,33	57	30,81
Poland	9,06	174	16
Portugal	32,52	29	14,43
Sweden	46,66	84	24,86
Slovenia	35,88	52	31,77
Slovakia	3	156	30,32

Data source: OECD Family Data Base (2011) – variables observed for the year 2007

Table 3: Estimated coefficients of second childbirth for women aged 15-45 with one child

25 European countries[1], EU-SILC longitudinal sample (covering years 2003 to 2011)

Probit regressions with robust standard errors, country- and year-fixed effects and control for number of person-years

	Model 1		Model 2		Model 3		Model 4	
	Basic probit model		Distinction between different labour market statuses		Interaction with partner's employment status		Interaction with education and control for partner's labour market status	
	estim. coeff.	t-stat.	estim. coeff.	t-stat.	estim. coeff.	t-stat.	estim. coeff.	t-stat.
Woman's employment status:								
Employed(ft & pt, employed and self-employed)	0.06*	2.41	*Ref.*		-0.04	-0.76	-0.01	-0.38
Not employed	*Ref.*				*Ref.*		*Ref.*	
Unemployed			-0.11*	-2.47				
Inactive			-0.04	-1.51				
Student			-0.29***	-3.86				
Retired			-0.15	-0.67				
Military service			0.06	0.24				
Change: Found job			0.18+	1.86				
Change: Lost job			0.20+	1.82				
Change: From full-time to part-time			0.09	0.25				
Change: From part-time to full time			-0.05	-0.16				
Other change in employment status			0.13	0.84				
Woman's education:								
Low education							0.016	0.36
Middle education (upper and post secondary)							*Ref.*	
High education (tertiary)							0.09+	1.77
Partner information:								
No partner	-0.48***	-13.07	-0.47***	-12.87	-0.34***	-6.32	-0.35***	-6.52
Partnered but not married	-0.06*	-2.19	-0.06*	-2.15	-0.06*	-2.03	-0.05*	-1.72
Partner is employed					0.08	1.50	0.12**	2.97
Interaction terms:								
Employed with employed partner					0.11*	1.98		
Employed and low educated							-0.05	-0.78
Employed and high educated							0.15**	2.73

Table 3 (continued):

	(1)	t	(2)	t	(3)	t	(4)	t
Woman's age:								
15-24	0.03	0.79	0.05	1.17	0.03	0.81	0.09**	2.23
25-34	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
35-45	-0.57***	-19.20	-0.57***	-19.23	-0.57***	-19.17	-0.59***	-19.81
Age of first child:								
0	-0.86***	-20.75	-0.87***	-20.66	-0.87***	-20.77	-0.88***	-20.92
1-2	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
3-6	-0.16***	-5.89	-0.15***	-5.78	-0.16***	-5.86	-0.13***	-4.78
7+	-0.78***	-22.27	-0.78***	-22.19	-0.78***	-22.13	-0.72***	-20.00
First child is female	-0.003	-0.15	-0.003	-0.13	-0.002	-0.13	-0.004	-0.18
Intercept	-0.62***	-6.00	-0.58***	-5.60	-0.70***	-6.21	-0.76***	-6.77
Year fixed effects	*yes*		*yes*		*yes*		*yes*	
Country fixed effects	*yes*		*yes*		*yes*		*yes*	
Control for number of person-years	*yes*		*yes*		*yes*		*yes*	
Test of joint significance:								
p (employed if partner employed)[4]					0.005			
p (partner employed if employed)					0.0001			
p (employed if low educated)							0.25	
p (employed if high edcuated)							0.003	
Pseudo R²	0.17		0.17		0.17		0.1754	
Number of observations	35401							
Number of events	2972							

+ $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

[1] 25 European countries: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxembourg, Latvia, the Netherlands, Norway, Poland, Portugal, Sweden, Slovenia and Slovakia.

[4] test H_0: β_1(employed) + β_2(interaction)=0

Table 4: Estimated coefficients of second childbirth for women aged 15-45 with one child

25 European countries[1], EU-SILC longitudinal sample (covering years 2003 to 2011) and OECD Family Database, year 2007

Bi-probit and multi-level regressions

	Model 5 Bi-probit model with regional unemployment rates as instrument for women's labour market status				**Model 6** Multi-level model with control for family policies		**Model 7** Multi-level model - interaction with child care coverage	
	dep. var.: 2nd childbirth		**dep. var.: employment**					
	estim. coeff.	t-stat.	estim. coeff.	t-stat.	estim. coeff.	t-stat.	estim. coeff.	t-stat.
Woman's employment status:								
Employed	0.65***	0.09			0.09+	0.05	0.10+	0.06
Woman's education:								
Low education			-0.52***	-0.02				
Middle education (upper and post secondary)			*Ref.*					
High education (tertiary)			0.46***	0.02				
Partner information:								
No partner	-0.45***	-0.04	0.05*	0.02	-0.73***	-0.11	-0.79***	-0.09
Partner but not married	-0.07*	-0.03	0.06**	0.02	-0.15**	-0.05	-0.14***	-0.03
Partner is employed					0.34***	0.09	0.25**	0.08
Contextual variables:								
Regional unemployment rate			-0.04***	-0.003				
Childcare coverage (children aged 0-2)					0.02**	0.005	0.02***	0.003
Maximum length of leave					0.001	0.002		
Total cash (3 years)					0.001	0.006		
Interaction terms:								
*Stable employment * child care cov.* (ages 0-2)							0.007*	0.003

Table 4 (continued):

	(1)		(2)		(3)		(4)	
Woman's age:								
15-24	0.22***	0.05	-0.60***	-0.03	0.07	0.07	0.07	0.07
25-34	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
35-45	-0.58***	-0.03	0.10***	0.02	-1.09***	-0.06	-1.10***	-0.08
Age of first child:								
0	-0.91***	-0.04	0.34***	0.03	-1.69***	-0.08	-1.67***	-0.11
1-2	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
3-6	-0.22***	-0.03	0.45***	0.02	-0.24***	-0.05	-0.24*	-0.11
7+	-0.8594***	-0.04	0.75***	0.02	-1.66***	-0.07	-1.58***	-0.15
First child is female	-0.002	-0.02	-0.0166	-0.02	0.005	0.04	0.003	0.03
Intercept	-0.9087***	-0.11	0.13	0.08	-2.83***	-0.08	-2.94***	-0.07
Year fixed effects	*yes*		*yes*		*yes*		*yes*	
Country fixed effects	*yes*		*yes*		*no*		*no*	
Control for number of person-years	*yes*		*yes*		*yes*		*yes*	
Random effects:								
Variance of the intercept					0.10***		0.13***	
Variance of 'Employed'							0.04*	
Pseudo R^2					0.17		0.18	
Athrho	-0.40***							
Number of observations	35401				31300		34691	
Number of countries	25				21		24	

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001, regressions with robust standard errors

[1] 25 European countries: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxembourg, Latvia, the Netherlands, Norway, Poland, Portugal, Sweden, Slovenia and Slovakia.

[4] test H_0: β_1(employed) + β_2(interaction)=0

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8. References

Adserà, A. (2004): "Changing fertility rates in developed countries. The impact of labour market institutions," *Journal of Population Economics*, Springer, vol. 17(1), pages 17-43, February.

Adsera, A. (2011): "Labor Market Conditions and Fertility in Europe" *European Journal of Population*, 27 (1), 1-32, *2011*

Ahn, N., Mira, P. (2002): "A note on the relationship between fertility and female employment rates in developed countries." *Journal of Population Economics* 15(4): 667-682.

Becker, G.S. (1960): "An Economic Analysis of Fertility", *Demographic and Economic Change in Developed Countries, a Conference of the Universities*, National Bureau Committee for Economic Research. Princeton, NJ: Princeton University Press.

Blau *D.*, Robins *P.* (1998): "A dynamic analysis of turnover in employment and childcare," *Demography*, Springer, vol. 35(1), pages 83-96, February

Blossfeld, H.-P. (ed.) (1995): "*The New Role of Women: Family Formation in Modern Societies.*" Boulder: Westview Press.

Bongaarts J., Sobotka T. (2012): "A demographic explanation for the recent rise in European fertility." *Population and Development Review*, V. 38, Issue 1, pages 83–120, March 2012.

Breton D., Prioux F. (2009): "The one-child family: France in the European Context", *Demographic Research*, 20(27:657-692).

Butz W. P., Ward M.P. (1979): "The emergence of countercyclical U.S. fertility." *American Economic Review*, 69(3), 318-328.

D'Albis H., Greulich A., Ponthière G. (2015): "*Avoir un enfant plus tard. Enjeux sociodémographiques du report des naissances.*" Opuscule du CEPREMAP N°39.

D'Albis H., Greulich A., Gobbi P. (2015): "Having a second child and access to childcare : evidence form European countries." Centre d'Economie de la Sorbonne Working Paper 2016-17: ftp://mse.univ-paris1.fr/pub/mse/CES2016/16017.pdf (forthcoming: *Journal of Demopgraphic Economics*)

Greulich A., Dasre A. (2017): "Fertility analysis with SILC: A quantification of measurement bias." *Demographic Research,* forthcoming.

Frejka, T., Sobotka T.(2008): "*Fertility in Europe: Diverse, delayed and below replacement.*" Overview Chapter 1 in: T. Frejka, T. Sobotka, J. M. Hoem, and L. Toulemon (eds.)

Childbearing trends and policies in Europe. Demographic Research, Special Collection 7, Vol. 19, Article 3, pp. 15-46.

Frejka, T., Sardon J.P. (2007): “Cohort birth order, parity progression ratio and parity distribution trends in developed countries”, *Demographic Research*, 16(11), pp. 315-374.

Goldstein J.R. Sobotka T., Jasilioniene A. (2009): “The end of ‘lowest-low fertility?’”, *Population and Development Review*, 35 (4), pp. 663-99.

Goldstein J., Kreyenfeld M., Jasilioniene A., Örsal D. (2013): “Fertility Reactions to the ‘Great Recession’ in Europe: Recent Evidence from Order-Specific Data”, *Demographic Research*, 2013, 29(4):85-104.

Greulich, A., Thévenon O., Guergoat-Lavière M. (2016): *“Securing women's employment: a fertility booster in European countries?”* Centre d’Economie de la Sorbonne Working paper 2016-24: ftp://mse.univ-paris1.fr/pub/mse/CES2016/16024.pdf

Hotz V.J., Miller R.A. (1988): “An Empirical Analysis of Life Cycle Fertility and Female Labor Supply.” *Econometrica*, Vol. 56, No. 1. (Jan., 1988), pp. 91-118.

Kohler H.P., Behrman J.E., Skytthe A. (2005): “Partner+Children=Happiness? The effects of partnerships and fertility on well-being.” *Population and Development Review* Vol. 31, No. 3 (Sep., 2005), pp. 407-445.

Lee R., Mason A. (2010): “Fertility, human capital and economic growth over the demographic transition.” European Journal of Population, 2010 May; 26(2): 159–182.

Lesthaeghe, R. (2010): “The Unfolding Story of the Second Demographic Transition,” *Population and Development Review*, The Population Council, Inc., vol. 36(2), pages 211-251.

Luci-Greulich A., Thévenon O. (2013): “The impact of family policies on fertility trends in developed countries”, *European Journal of Population*, Vol.2 N° 2, 203.

Luci-Greulich, A., Thévenon, O. (2014): “Does Economic Advancement ‘Cause’ a Re-increase in Fertility? An Empirical Analysis for OECD Countries (1960–2007)”, *European Journal of Population*, Vol. 30, pp.187-221.

McDonald, P. (2000): “Gender equity, social institutions and the future of fertility.” *Journal of Population Research*, 17(1), 1–16.

Mincer, J. (1958): “Investment in Human Capital and Personal Income Distribution.’’ *Journal of Political Economy* 66 (August1958): 281-302.

Matysiak A., Vignoli D. (2008): “Fertility and women’s employment: a meta-analysis,” *European Journal of Population*, 24(4),384-404.

Matysiak A., Vignoli D. (2013): “Diverse Effects of Women's Employment on Fertility: Insights from Italy and Poland.” *European Journal of Population* 29: 273-302.

McDonald, P. (2006): “Low fertility and the state: The efficacy of policy.” *Population and Development Review*, 32(3), 485–510.

Moffitt,R. (1984): “Profiles of Fertility, Labour Supply and Wages of Married Women: A Complete Life-Cycle Model" *Review of Economic Studies*, Oxford University Press, vol. 51(2), pages 263-278

Myrskylä M., Kohler H.P., Billari F. (2009): “Advances in development reverse fertility declines.” *Nature*, 460(6), pp. 741-43.

Neyer G, Lappegard T., Vignoli D. (2013): “Gender equality and fertility : Which equality matters ?” *European Journal of Population* (2013) 29:245–272.

Pailhe A., Solaz A. (2012): "The influence of employment uncertainty on childbearing in France: A tempo or quantum effect?" *Demographic Research*, Vol 26, Article 1, p 1-40.

Rendall M., DeRose A., Evans A., Gray E., Hanappi D., Kreuter F, Lappegard T., Reeder L., Rønsen M., and Laurent Toulemon (2014): "*Employment Impacts on Partnership and Parenthood Entry in Different Family-Policy Regimes",* European Population Conference.

Rendall M., Greulich A. (2016): "Multiple imputation for demographic hazard models with left-censored predictor variables. Application to employment duration and fertility in the EU-SILC." Demographic Research, Vol. 35, Art. 38, pages 1135-1148., October 2016.

Rindfuss, R., Guilkey, D., Morgan, Ph,, Kravdal, O. (2010): "Childcare availability and fertility in Norway." *Population and Development Review*, 36(4), 725–748.

Schmitt, Ch. (2012): "Labour market integration, occupational uncertainties and fertility choices in Germany and the UK", *Demographic Research* Vol. 26, Art. 12, pages 253-292.

Sobotka, T., Beaujouan E. (2014): "Two Is Best? The Persistence of a Two-Child Family Ideal in Europe." *Population and Development Review* 40 (3): 391419.

Sobotka T., Skirbekk V., Philipov D. (2011): "Economic recession and fertility in the developed world." *Population and Development Review* 37(2): 267-306.

Testa, M.R. (2012): "Family Sizes in Europe: Evidence from the 2011 Eurobarometer Survey". *European Demographic Research Papers* 2. Vienna: Vienna Institute of Demography of the Austrian Academy of Sciences.

Thévenon, O. (2011), "Family Policies in OECD Countries: A comparative Analysis", *Population and Development Review*, 37(1): 57-87.

Thévenon O., Gauthier A. (2011): "Family Policies in Developed Countries: A „Fertility Booster" with Side-effects", *Community, Work and Family*, Vol. 14, No. 2

Willis, R. (1973): "A new approach to the economic theory of fertility behaviour." *Journal of Political Economy* 81: S14-S64.

Wood J., Vergauwen J., Neels K. (2015),: "*Economic Conditions and Variation in First Birth Hazards in 22 European Countries between 1970 and 2005*", Work in progress.

H. D’Albis, A. Greulich, G. Ponthière (2017): “Education, Labour, and the Demographic Consequences of Births Postponement in Europe.” *Demographic Research,* Vol. 36, Art. 23, pages 691-728 (revue classée en section 19).

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Research Article

Education, labour, and the demographic consequences of birth postponement in Europe

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Angela Greulich

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Contents

Demographic Research: Volume 36, Article 23
Research Article

Education, labour, and the demographic consequences of birth postponement in Europe

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Abstract

BACKGROUND
This article questions the demographic consequences of birth postponement in Europe.

OBJECTIVE
Starting from the fact that there is no obvious link between the timing of first births and fertility levels in Europe, we find that under certain circumstances, birth postponement potentially facilitates rather than impedes starting a family.

METHODS
We apply a synthetic cohort approach and distinguish between different socioeconomic determinants of the timing of first births by using the European Union Statistics on Income and Living Conditions (EU–SILC). Data is compiled specifically to reduce endogeneity and to eliminate structure effects.

RESULTS
We find that the probability of becoming a mother is higher for women who postpone first childbirth due to education and career investment than for women who postpone due to unrealized labour market integration.

CONCLUSION
Educated and economically active women certainly postpone first childbirth in comparison to women who are less educated and who are not working, but they end up with a higher probability of starting a family.

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CONTRIBUTION
The article contributes to the academic discussion of circumstances that may lead to birth postponement resulting in higher fertility for younger cohorts in European countries.

1. Introduction

The postponement of first childbirth has been occurring in most European countries for some decades now. In France, Portugal, Sweden, the Netherlands, and Norway, for example, the mean age of women at first childbirth rose from 24/25 in 1970 to 28/29 in 2010. In most Eastern European countries the increases have been even more drastic: for example, from 23 to 28 in Hungary and the Czech Republic (Human Fertility Database 2013). In public and media discussion, birth postponement is often rather glibly associated with the fact that more women are going to university and getting jobs, and consequently want fewer children. This article focuses on these correlations on the basis of survey data from the European Union Statistics on Income and Living Conditions (EU–SILC). The advantage of this survey is that it can be used to examine the interaction between demographic and socioeconomic variables for a large number of European countries. This distinguishes our research from most previous studies, which until recently have generally focused on a single country.

The hitherto existing literature shows that investment in education leads to postponement of first births (Happel, Hill, and Low 1984; Cigno and Ermisch 1989; Gustafsson 2001; Lappegård and Rønsen 2005). For older cohorts (cohorts born in the 1940s), birth postponement due to education and career investment has been found to decrease completed fertility, as shown by country-specific studies such as Schulz (1985) and Heckman and Walker (1990) for Sweden, Tasiran (1995) for Sweden and the USA, Ermisch and Ogawa (1994) for Japan, Merrigan and St-Pierre (1998) for Canada, and Joshi (1990) for Great Britain. For more recent cohorts (up to the 1965 cohort) the educational gradient of completed fertility is still found to be negative, albeit diminishing (for example, Andersson et al. (2008) for the Nordic countries; Kravdal and Rindfuss (2008) for Norway; Neyer and Hoem (2008) for Sweden; Wood, Neels, and Kil (2014) for progression to first birth in 14 European countries). For cohorts currently of childbearing age, the most recent studies covering more than one country find strong variation between European countries in the association between female education and birth hazard (for example, Klesment et al. 2014; d'Albis, Greulich, and Gobbi 2017).

While the literature is unambiguous when it comes to the impact of education on the timing of childbirth, the impact of economic uncertainty is less clear. Some country-specific studies detect a counter-cyclical relation for certain periods (i.e., increasing childbirths in times of high unemployment), while the effect of advanced childbirths on completed fertility is found to be negligible (for example, Kravdal (1994, 2002) for Norway; Hoem (2000) and Andersson (2000) for Sweden; Schmitt (2012) for Germany and the UK). However, for the rest of Europe, the majority of studies find that unemployment postpones childbirth and decreases completed fertility (Meron, Widmer, and Shapiro 2002; Pailhé and Solaz (2012) for France; Impens (1989) for Belgium; Frejka and Sardon 2006; Goldstein et al. 2013, Sobotka, Skirbekk, and Philipov 2011; Wood, Vergauwen, and Neels (2015) for Central, Southern, and Eastern Europe).

The common feature of the cited literature is the finding that for women of the 1965 cohort and older, birth postponement, be it caused by education and career investments or by economic uncertainty, has led to higher childlessness and lower family size in Europe (see also Philipov and Kohler 2001; Kohler, Billari, and Ortega 2002; Frejka and Sardon 2006; Sobotka 2003 and 2004).

This article delivers some indication that the picture is less clear for women who are currently of childbearing age. By taking into account younger cohorts and a larger set of European countries and by differentiating between socioeconomic determinants of birth postponement, we find evidence that under certain circumstances, birth postponement can facilitate rather than impede starting a family.

Based on a synthetic cohort approach, we find that the probability of becoming a mother is higher for those women who postpone first childbirth due to education and career investments than for those who postpone due to unrealized labour market integration. The data is compiled specifically to reduce endogeneity and to eliminate structure effects. A division of European countries into regional groups suggests that in countries where public institutions facilitate parents' work-life balance, educated and economically active women certainly postpone first childbirth in comparison to women who are less educated and who are not working, but eventually they have a significantly higher probability of starting a family.

Thus, our article contributes to the academic discussion of the circumstances that may lead birth postponement to result in higher fertility for younger cohorts in European countries (Sobotka et al. 2011).

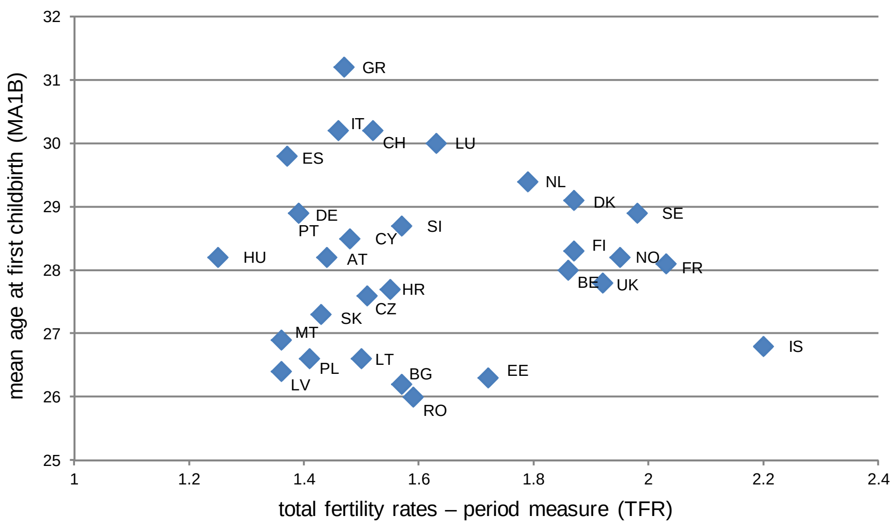
The article is organized as follows. Section 2 illustrates some empirical facts about the link between birth postponement and fertility in Europe, section 3 presents the data and methodology, section 4 presents our results, and section 5 concludes.

2. The relation between age at first childbirth and fertility

A cursory analysis of the relation between age at childbirth and fertility might seem to suggest that the two variables are negatively correlated. In most European countries, from the 1970s until the late 1990s, there was a massive postponement of childbirth accompanied by a fall in both total fertility rates and completed cohort fertility.

However, a more recent snapshot of European countries gives a different picture of the relation between age at childbirth and fertility. Figure 1 plots for 30 European countries women's mean age at first childbirth (MA1B) against the Total Fertility Rate (TFR) observed in 2010, and shows that there is no obvious link between the variables. Those countries in which the mean age at first childbirth is highest do not necessarily display lower fertility rates.

Figure 1: Mean age at first childbirth against total fertility rates, 30 European countries, 2010



Data sources: World Bank WDI, UNESCE
AT–Austria, BE–Belgium, BG–Bulgaria, CH–Switzerland, CY–Cyprus, CZ–Czech Republic, DE–Germany, DK–Denmark, EE–Estonia, GR–Greece, ES–Spain, FI–Finland, FR–France, HR–Croatia, HU–Hungary, IS–Iceland, IT–Italy, LT–Lithuania, LU–Luxembourg, LV–Latvia, MT–Malta, NL–Netherlands, NO–Norway, PL–Poland, PT–Portugal, RO–Romania, SE–Sweden, SI–Slovenia, SK–Slovakia, UK–United Kingdom.

Clearly, the use of a period indicator like the TFR may bias the analysis. For example, a rise in age at first childbirth may well reduce fertility among young women without necessarily increasing it among older women in the preceding cohorts not affected by birth postponement. This would involve a temporary lowering of the period TFR, which then would return to its initial level. Seen in this way, the lack of an obvious link in Figure 1 might be due to the effects of a gap in timing between countries that are not all at the same stage in terms of birth postponement. If some high-fertility countries began birth postponement earlier than others, they may well display higher period fertility levels simply because their birth postponement has come to an end, as compared with other countries where the postponement process began later.

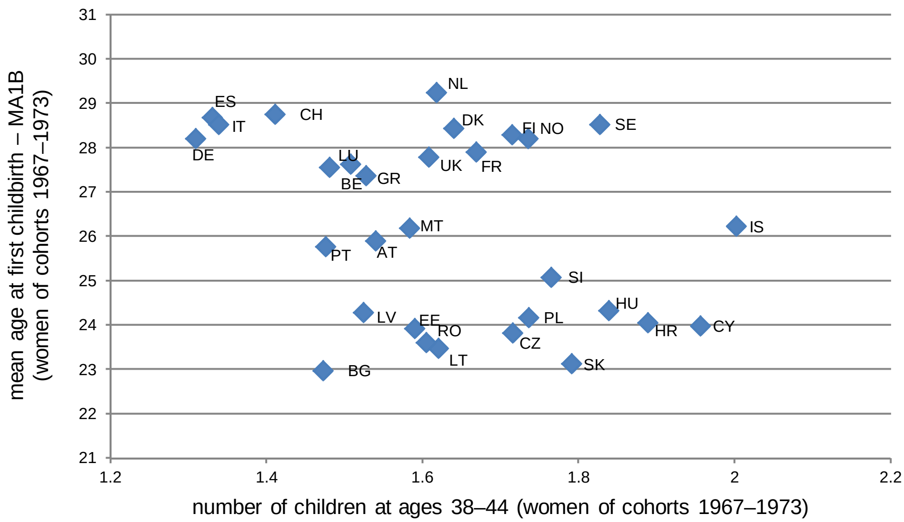
Consequently, it is important to complement the use of period fertility indicators with indicators of completed fertility by cohort. We can formulate two hypotheses here. Birth postponement might simply be a time shift in births within each cohort of women, involving only a temporary reduction in the number of births and not leading to any reduction in the total number of births a woman has experienced by the end of her childbearing period. In this case, the tempo effect associated with birth postponement has no impact on the total number – the quantum – of births. Alternatively, birth postponement might lead not only to a reduction in the period number of births but also to a reduction in the mean completed fertility by cohort. In this second case, birth postponement would be part of a real reduction in the fertility rate: the quantum of births would indeed be affected by birth postponement.

In order to get an idea of the relation between the timing of fist childbirths and the quantum of fertility in Europe, we use data from a cross-sectional sample of the EU–SILC (European Union Statistics on Income and Living Conditions), which allows us to cover 30 European countries. Figure 2 plots, for each country, women's mean age at first childbirth against the average number of children per woman for the cohorts 1967 to 1973 (i.e., women aged 38 to 44 in 2011 (cross-sectional sample).[4] Like Figure 1, Figure 2 shows that there is no obvious correlation between women's mean age at first childbirth and the average number of children per woman.[5]

[4] We aggregate several cohorts to obtain a sufficient number of observations per country and to smooth out cohort fluctuations, and we stop at age 44 to avoid a significant downward bias in the fertility measure. These data issues are discussed in more detail in section 3.

[5] The cohorts born from 1967 to 1973 are not representative of younger cohorts. To assess the robustness of the result, we also observe cohorts currently of childbearing age while using a fertility indicator that controls for tempo effects. For this purpose, we plot women's mean age at first childbirth (a period indicator measured in 2010, UNECE) against tempo-adjusted fertility rates (see Bongaarts and Feeney 1998; Sobotka 2004; Bongaarts and Sobotka 2012) for 2010 (Human Fertility Database). Here again, we find no obvious link between age at childbirth and tempo-adjusted fertility. Tempo-adjusted fertility rates are only available for 14 European countries, which is why the data is not presented here (results available on request).

Figure 2: Mean age at first childbirth and average number of children at ages 38–44 (women of cohorts 1967–1973)



Data source: EU–SILC CS 2011
AT–Austria, BE–Belgium, BG–Bulgaria, CH–Switzerland, CY–Cyprus, CZ–Czech Republic, DE–Germany, DK–Denmark, EE–Estonia, GR–Greece, ES–Spain, FI–Finland, FR–France, HR–Croatia, HU–Hungary, IS–Iceland, IT–Italy, LT–Lithuania, LU–Luxembourg, LV–Latvia, MT–Malta, NL–Netherlands, NO–Norway, PL–Poland, PT–Portugal, RO–Romania, SE–Sweden, SI–Slovenia, SK–Slovakia, UK–United Kingdom.

Figures 1 and 2 both show that countries in which women postpone childbirth are not necessarily the ones with lower (or higher) fertility levels. In fact, cross-country variation between European countries in the link between age at first childbirth and fertility is large. The low-fertility countries Italy and Spain show highest average ages at first childbirth, but mean age at first childbirth in other low-fertility countries like Poland and the Czech Republic are amongst the lowest in Europe. Norway and Sweden have high fertility rates together with relatively high mean ages at first childbirth. Finally, France, Belgium, Germany, and the UK have similar mean ages at first childbirth, but differ in terms of fertility.

The absence of a clear pattern suggests that the factors causing the cross-country variations in fertility level and childbearing age patterns are complex and context-based. Norms, institutions, and policies that shape the national context differ among European countries. When discussing the link between institutional and societal context and European fertility patterns, the literature mostly distinguishes between four welfare-state types, more or less dividing the countries into four European regions: Nordic, Western European, Southern European, and Central and Eastern European (CEE) countries (Esping-Andersen 1990, 1999; Gauthier 2002; Thévenon 2008, 2011, and 2015; OECD 2011).

Given the fact that each welfare state is the outcome of a country-specific history, attempts to classify European countries into a small number of welfare-state types necessarily involves significant simplification. The classification is even more difficult in light of the numerous dimensions of the welfare state (fiscal policy, pensions, unemployment insurance, health insurance, etc.). It is possible that for some welfare state dimensions a country belongs to a particular group, whereas for another, distinct, dimension the same country is closer to another group. Moreover, it is also possible that a given welfare-state group includes countries that differ in some important dimensions. Thus, classifications of welfare states are fragile, but are nonetheless widely used, since they can cast some light on important differences across countries in terms of public policy.

In particular, focusing on family policies, the distinction between the four types of welfare state (which coincide with the four European regions mentioned above) can help us describe how different family policies are across countries.[6] The literature on comparative family policies shows that these four groups exhibit important differences in terms of family policies supporting the combination of work and family life, and in terms of the redistributive impact of these policies within and between households (see Thévenon 2011). Let us present briefly the main differences across the four welfare-state types in terms of family policy.

Although there are significant differences between their welfare states, in comparison to other countries the Nordic countries (Sweden, Finland, Iceland, Denmark, and Norway) are characterized by continuous strong support for the combination of work and family life and promotion of gender equity in the workplace and family. Coverage of public childcare is high in comparison to the other European countries, especially for young children aged 0 to 2. Parental leave is an independent and nontransferable right for both parents and is paid as a percentage of salary. In addition, partners are taxed on an individual basis.

By contrast, the Southern European countries (Spain, Italy, Portugal, Greece) provide more limited assistance for dual-earner families. As shown in Gauthier (1996) and Bettio and Plantenga (2004), these countries are characterized by institutional and normative climates that hinder rather than encourage mothers to work, as male-

[6] Note here again that separating family policies from other dimensions of the welfare state, such as fiscal policies and pensions, itself constitutes a simplification. Indeed, government budget constraints impose some relation between the generosity of the various policies (child allowances, pensions, etc.) and the level and progressivity of taxes. Moreover, the impact of a particular policy on, for instance, fertility (in quantum and tempo) may be affected not only by family policies but also, indirectly, by other policies such as income taxation (see Pestieau and Ponthière 2013).

breadwinner couples are often considered the best environment for childbearing. In addition, the labour market structure in these countries makes it more difficult for women to re-enter the labour market after a baby pause and/or to adapt working hours. Although the larger prevalence of the male-breadwinner model in those countries is not the only determinant of fertility and labour market participation choices, it nonetheless contributes to reducing the capacity of many mothers to combine childbearing with full-time work, which can affect both the quantum and the tempo of births.

The male breadwinner model is still also quite strong in several Western European countries. The German-speaking countries, and to a lesser extent the Netherlands and Luxembourg, are characterized by attitudes that regard women as supplementary income providers, thus resulting in a male breadwinner/female part-time-career model. Dual-earner families with young children under age 3 receive limited support, even though these countries have recently made some effort to increase formal childcare supply. Although this limited support is obviously not the only factor affecting fertility and labour choices, since Barro and Becker (1989) the economic theory of fertility choice has largely underlined that the time cost of children (in terms of foregone labour income) can significantly affect fertility choices. A corollary of this is that policies that facilitate the combination of childbearing and full-time work (by relaxing time and budget constraints) can have a significant impact on fertility and labour supply decisions. In the absence of such policies, women who prefer to combine a full-time career with family life may often resign to start or enlarge a family. However, in other Western European countries like France and Belgium, support for dual earners through formal childcare was expanded during the 1970s and 1980s, and today many mothers work in full-time jobs. The UK and Ireland also encourage maternal employment, but they are characterized by relatively expensive private childcare and a high reliance on informal childcare, with a policy focus on financial support for low-income parents. What the Western European countries have in common is a tradition of relatively generous lump-sum cash benefits, which in general still tend to be higher than in other European countries.

Finally, history distinguishes the Central and Eastern group of European countries from the rest. During communism, countries in Central and Eastern Europe encouraged maternal employment through high childcare coverage for children of all ages and extensive leave arrangements. However, some of these countries also experienced repressive pro-natalist measures such as restrictions on family planning and abortion, especially Romania and Bulgaria. After the fall of the Soviet Union, childcare coverage and financial assistance to families decreased dramatically. Here again, this policy shift is not the only factor at work during the transition to capitalism, and probably many other changes affect fertility choices (Frejka 2008). However, the drastic reduction in childcare coverage and financial assistance, together with a more unstable labour market, may have prevented many families from realizing their fertility intentions in post-communist countries. Today, CEE countries such as Estonia, Latvia, and Bulgaria provide relatively high childcare coverage, while others (Hungary, Slovakia, the Czech Republic, Romania, and Poland) have low levels of childcare, similar to Germany and Austria, and support a more traditional division of household labour (Matysiak and Weziak-Bialowolska 2016).

The heterogeneity between European countries suggests that beside individual and household characteristics, the institutional, normative, and economic contexts also influence the link between timing and quantum of fertility. Depending on individuals as well as context, postponement of childbirth can happen by choice (due to education investments and/or career development, for example) or under constraint (for example, due to economic uncertainty). The resulting impact on completed fertility can be negative (limited time left for progression to higher-order births) or positive (easier progression due to lower economic constraints).

This article attempts to account for the multidimensionality in the relation between age at first childbirth and fertility. Covering a large set of European countries, we analyse how far education and employment status are related to the timing of first childbirth, and how far education and employment-related postponement of first childbirth influence quantum measures of fertility. We take into account women who are currently of childbearing age, as well as women who are at the end of their childbearing period. In order to quantify the role of (policy and institutional) context dependencies in the first-birth decision, we will also, as a first approximation, rely on the classification of countries into four groups of welfare-state types.

3. Data and methodology

To analyse the link between women's educational level and activity status, and the timing of first childbirth and quantum measures of fertility, we mobilize data from the European Union Statistics on Income and Living Conditions (EU–SILC). This survey was created in 2003 as a replacement for the European Community Household Panel (ECHP) and now includes 31 European countries. The data contains cross-sectional samples as well as a rotational panel with a short follow-up period of four years for the majority of countries. The advantage of this data is the large number of European countries included and the comparability of the socioeconomic variables.

We distinguish between women who are currently of childbearing age and women who are at the end of their childbearing period.

For cohorts who are currently of childbearing age, we apply a synthetic cohort approach. Based on a sample of women aged 15 to 45 years, we first calculate the probability of having a first child by age. The probability of having a first child by age can then be used to calculate the intensity of the 'first childbirth' phenomenon. To obtain intensity and mean age at first childbirth, we create a fictional cohort. The hypothesis is that women aged x at date t will display the same fertility behaviour at $t+1$ as women aged $x+1$ at t. This hypothesis is certainly fragile where births are postponed for a long time and where cohorts vary considerably in behaviour. However, compared to simple distribution calculations (distribution of age at first childbirth for each education group, taking into account only those women who have given birth), our calculations based on probabilities, which also take into account those women 'at risk' who have not yet given birth, eliminate structure effects. The intensity can be interpreted as the percentage of women, by age, who have at least one child. This is the inverse of a survival probability of childlessness by age. In contrast to Kaplan Meier or Cox analysis, we do not follow a real cohort but observe women of different ages at a given moment. The results of our synthetic cohort approach can thus be interpreted as the average number of children of birth order one that would be born to a woman by the time she ended childbearing if she were to pass through all her childbearing years conforming to the age-specific fertility rates of order one of the observed time period (which is similar to the interpretation of total fertility rates, except we only consider progression to birth order one).

When calculating the probability by age, we distinguish between education groups and between women who are working and who are not.

For the variable measuring education we use the UNESCO ISCED classification to distinguish three levels (uniform categories across all countries): 'low education' for pre-primary, primary, and lower secondary education; 'medium education' for upper secondary and post-secondary nontertiary education; and 'high education' for first stage of tertiary education (not leading directly to an advanced research qualification) and second stage of tertiary education (leading to an advanced research qualification).

The aim is to analyse the impact of education on the probability of having a first child at a given age for a population at risk of having a first child. Note that calculating the probability of having a first child by age and educational level presents a number of difficulties. The main problem is simply that educational level increases with age. Consequently, when calculating the probability of having a first child at the age of 20, the denominator of the probability may well include women whose educational level at that stage is only average but who within a year or two will achieve a high level. This overestimation of the denominator leads to an underestimation of the probability of having a first child at the age of 20 for women with low and middle education. To avoid this underestimation we apply a retrospective approach for ages 15 to 27. We therefore use the cross-sectional sample of year 2011 and women aged 28,[7] and observe their education level and the number and age of their children. Based on this information, we retrospectively calculate the probability of having had a first child, by age, for ages 15 to 27, differentiated by education group. We stop the retrospective calculus at age 27 because this is the age by which most women have completed their education. This retrospective calculation enables us to subtract from the denominator all those women who will continue their studies, and thus to obtain unbiased probabilities of having a first child while still young for women of middle educational attainment. The retrospective approach also allows eliminating the attrition-caused downward bias of observed first childbirths for young women in EU–SILC (see Greulich and Dasré (2017) for more details on this issue).

From age 28 on, the probability of first childbirth by age and education is observed without the retrospective approach; i.e., we observe women aged 28 to 45 who are currently 'at risk' of first childbirth. In comparison to a complete retrospective approach for women aged 45+, observing younger cohorts allows focusing on women who are actually of childbearing age. We therefore mobilize the longitudinal EU–SILC database and observe, for childless women aged 28 to 45, the educational level in the year preceding the year of (potential) first childbirth. The years of potential childbirth are 2005 to 2010. The fact that we observe education before first childbirth reduces reverse causality to some extent, and therefore facilitates interpreting the observed link between education and age at first childbirth as a causal impact of education on the timing of the first childbirth. However, it is possible that the level of education and age at first childbirth are chosen simultaneously, so that it remains difficult to identify the specific channel of causality.

Besides education, the second variable we examine as a determinant of the timing and intensity of first childbirth is women's activity status. The EU–SILC provides a harmonized measure of activity status for all countries, which corresponds to self-defined economic status.[8] We distinguish between working women (working full-time or part-time, whether employed or self-employed) and those who are not working (mainly the economically inactive and the unemployed). As activity status is not time-constant, a retrospective approach for ages below 28 makes no sense. In order to avoid too great confusion of education with activity status, we only include women aged 25+ in our analysis of the link between employment status and timing of first childbirth. We again mobilize the longitudinal database in order to observe women's activity status

[7] We chose women aged 28 at the time of the survey (and not 27) in order to be able to observe potential first childbirths during their entire 27th year of life.

[8] This variable captures the person's own perception of their main activity and differs from the International Labour Organization (ILO) concept to the extent that people's own perception of their main status can differ from the strict definitions used by the ILO (for example, people who consider themselves as students, homemakers, or job searchers while working part-time).

before childbirth. Like for education, this reduces, but cannot eliminate, potential reverse causality bias due to the fact that the birth of a child affects the mother's activity status.

The EU–SILC data contains information about women's labour market status on a monthly basis, as well as about the quarter and year when their children are born. This enables us observing the activity status during a certain period before (potential) conception of a first child.

Figure A-1 in the Appendix illustrates how the necessary information is collected.

In order to obtain the information needed, individuals have to be observed over a period of at least three years (in the following called year *t-1*, year *t*, and year *t+1*).[9] Children born in the third and the fourth quarters of each year are generally declared in the interview of the following year, as interviews usually take place during the first half of each year. Births that occur at the end of the year are thus not detectable immediately. Three consecutive waves of interviews are thus needed. Based on wave 3 (the interview that occurs during year *t+1*) we identify all first births that occur during the calendar year *t*. Year *t-1* serves to observe the mothers' labour market characteristics over a certain period before potential conception. This is possible as in the survey interview in year *t* (wave 2), individuals give information about their month-by-month activity status in year *t-1*.

We observe labour market status during the three months before conception for women who had a first child in year *t* (the test group), assuming that the pregnancy lasted nine months. More precisely, for children born in quarter 1 in year *t*, we observe women's labour market status for January, February, and March in year *t-1*. For children born in quarter 2 in year *t*, we observe women's labour market status for April, May, and June in year t-1, and so on. For children born in quarters 2, 3, and 4 we could observe the labour market status over a longer time period than three months, but we use only the three-month information in order to avoid distortion in the measure of labour market status. For women without a childbirth in year *t* (the control group), we arbitrarily chose a three-month period during year *t-1*. As our observation of labour market status is limited to a three-month period, it cannot be interpreted as an indicator of employment stability. In order to integrate a better quantum measure of fertility, we complete our analysis of the impact of education and employment on the timing and intensity of first childbirths by investigating the link between education and the number of children of women who are at the end of their childbearing period. For that purpose,

[9] Around 40% of women are observed not only for three but for four consecutive years. Women observed for four years who have not had a first child in year *t* are included twice in our database (two person-years: two calendar-years of potential childbirth). We refrain from observing a longer period of labour market status for these women in order to avoid distortions caused by heterogeneous measures. This procedure also allows us to increase the number of observations. Estimations of the probability of first childbirth are controlled for the number of person-years.

we use the 2011 cross-sectional module of the EU–SILC survey. We choose women who were aged 38–44 at the time of the survey. Education is observed at the time of the survey, and their number of children is calculated retrospectively for ages 15 to 38–44. Grouping together cohorts 1967 to 1973 allows obtaining sufficient sample sizes for each age and education group.

We cannot assess the link between activity status and the number of children of women aged 38–44 based on a retrospective approach, as we did for education, because, unlike education, which remains largely unchanged from a certain age on, activity status varies throughout a person’s life.

We do not observe women older than 44 because in the EU–SILC, children are only observed if they are still living in the parental household. Consequently, any calculations of fertility at higher ages are likely to be subject to a downward bias. Furthermore, measurements of mean age at first childbirth are likely to have an upward bias because some women’s first children have already left the family home and consequently cannot be recorded as their ‘first child,’ which may artificially raise mean age at first childbirth as measured in the EU–SILC survey. For the group of women aged 38 to 44, Greulich and Dasré (2016) find that the average downward bias is less than 10% for most countries when compared to unbiased measures from the Human Fertility Database (HFD). The downward bias is likely to differ by education, however. Lower-educated women are found to have a slightly higher number of children outside the household who are not observed in the EU–SILC, which is why our results have to be interpreted with care.

To test the robustness of our results, we complete our statistical analysis with estimation models. The advantage of the latter is that it is possible to control for various factors such as partner characteristics and year- and country-specific effects.

Our analysis covers 28 European countries. Germany and Switzerland are not covered, as the EU–SILC does not provide longitudinal data for these countries.

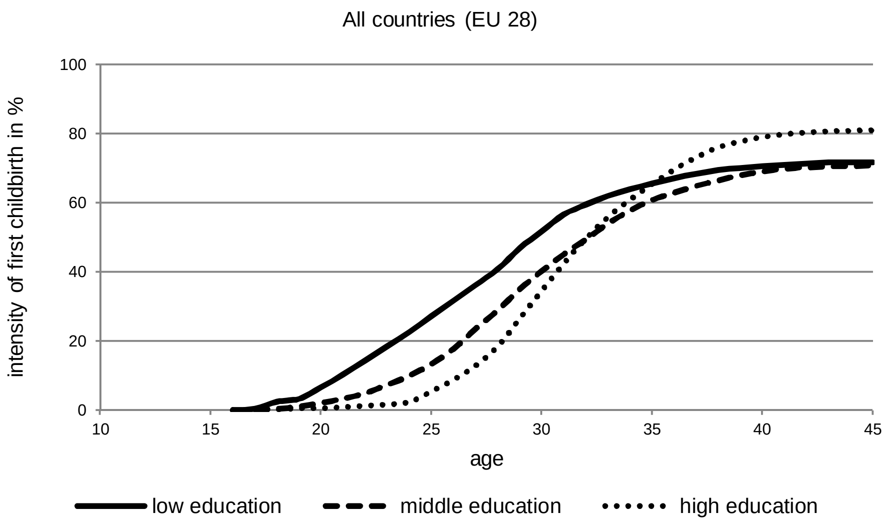
Finally, we account for context-dependencies by dividing the countries into four regional groups (Nordic, Southern European, Western European, Central and Eastern European), which reflect different welfare state settings, as discussed in section 2. As Germany and Switzerland are not included, the group of Western European countries covers a rather homogenous set of countries with relatively high fertility rates in comparison to Southern European and Central and Eastern European countries. A country-by-country analysis of birth probabilities by age, education, and activity status is not possible due to small sample size, especially for the longitudinal sample.

4. Results

4.1 Female education, birth postponement, and fertility

Figure 3 shows the intensity of the 'first childbirth' phenomenon, by age, for various educational levels. The curves show for each education group and age the percentage of women who have at least one child. These intensities increase with age. For the last age considered, 45, Figure 3 shows that the intensity is 71.6% for women with low education, 70.8% for those with middle education, and 81.0% for those with high education.

Figure 3: Intensity of women's first childbirth by women's age and education, weighted averages for 28 European countries



Data sources: EU–SILC LT 2003–2011, CS 2011

Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education

For ages 17 to 27: Education observed at age 28; probability of 1st childbirth for ages 17–27 calculated retrospectively (SILC CS 2011)

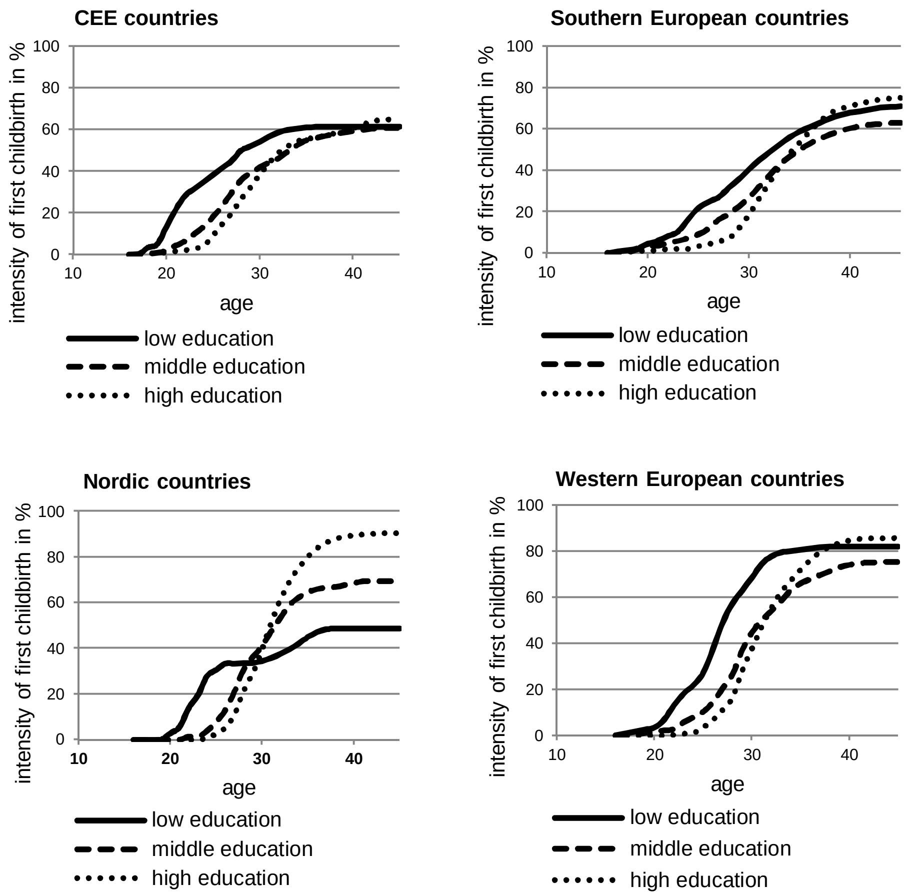
For ages 28+: Education observed at the wave preceding the year of potential conception of a first child (SILC LT 2003–2011)

Weighted average for 28 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Figure 3 illustrates that higher education is associated with birth postponement. Low-educated women are more likely to have a child while they are young than women with middle and high education. Their ‘first childbirth’ intensity is higher up to age 32. Conversely, women with high education have their first child later than other women, as seen in their lower intensity curve up to age 32. Mean age at first childbirth for the three educational categories is 27.0, 29.5, and 31.0 respectively. However, Figure 3 shows that although high-educated women on average have their first child later than those with middle or low education, they are still more likely to become mothers.

We now divide the 28 European countries into four regional groups. Figure 4 shows that in all regions the intensity of ‘first childbirth’ is higher for less-educated women than for more-educated women during the younger childbearing years. However, at higher ages the two intensity curves cross. Hence, in all regions the intensity of first childbirth is greater for more-educated women at higher ages. The intensity of high-educated women outnumbers that of low-educated women quite late in Central and Eastern European countries (around age 38), and the intensity at age 45 is not significantly higher than for the other two education groups. The overtaking is earliest and most drastic in Nordic countries, where high-educated women have a much higher intensity of first childbirth at age 45 than low-educated women (49.0% vs. 90.0%). Southern European and Western European countries represent intermediate groups, with the intensity of high-educated women outnumbering that of low-educated women around age 30. In these countries, middle-educated women have the lowest intensity of first childbirth at age 45. Our calculations also reveal that for highly educated women the mean age at first childbirth is highest in Southern European countries (33 years), followed by the Nordic and Western-European countries (31 years) and CEE countries (30 years).

Figure 4: Intensity of women's first childbirth by age and education, weighted averages for European regions



Data sources: EU–SILC LT 2003–2011, CS 2011

Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education

For ages 17 to 27: Education observed at age 28; probabilities of 1st childbirth for ages 17-27 calculated retrospectively (SILC CS 2011); for ages 28+: Education observed at the wave preceding the year of potential conception of a first child (SILC LT 2003–2011)

Central and Eastern European (CEE) countries: Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria, Slovenia; Southern European countries: Italy, Spain, Portugal, Greece, Cyprus, Malta; Nordic countries: Denmark, Finland, Norway, Sweden, Iceland; Western European countries: Austria, Belgium, France, Netherlands, Luxembourg, Ireland, United Kingdom.

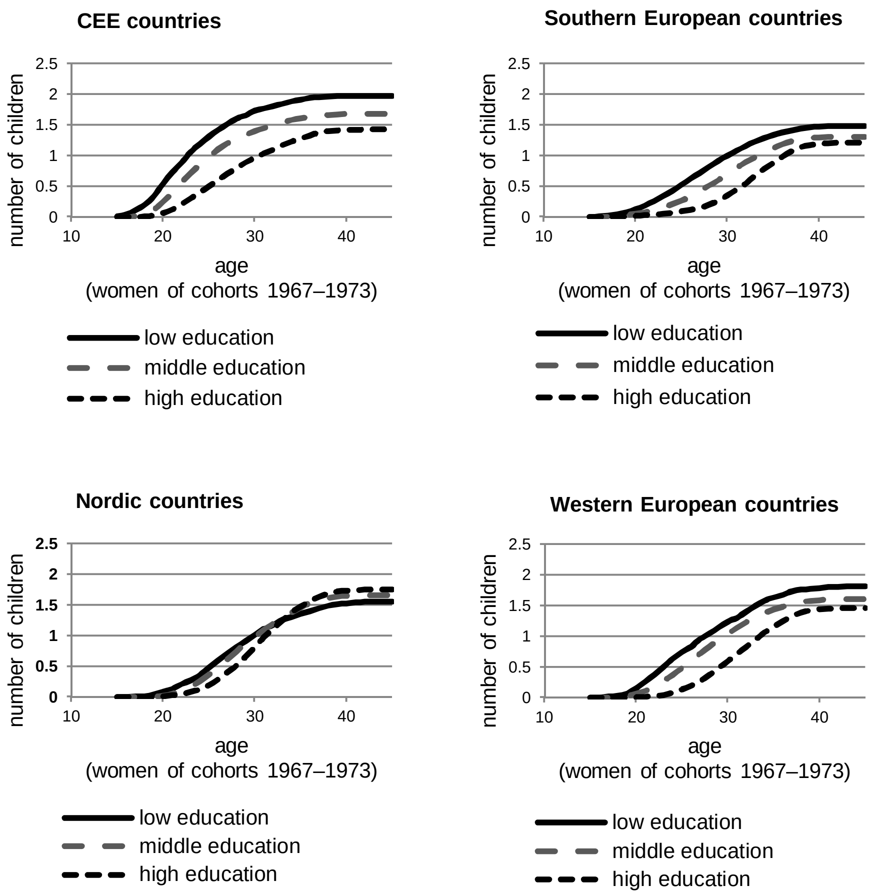
Thus, in all regions we find the same stylized fact: more-educated women wait longer before having their first child than less-educated women, but ultimately, among women at the end of their childbearing years, highly educated women are more likely to have become mothers. At the same time, the regions differ in terms of the size of the gap in intensity between women of different education levels. In the Nordic countries, the gap between high- and low-education women is substantial. In Central and Eastern Europe the gap is negligible, while intensities of all education groups are at a relatively low level. Consequently, educational level is a much greater marker for the probability of being childless at 45 in the Nordic countries than in other European regions.[10] The fact that highly educated women are most likely to become mothers in Nordic countries might be linked to the fact that in this region, public institutions facilitate maternal employment more than in other regions. Other labour-market-related issues such as job stability and income security might also be related to the regional differences illustrated in Figure 4.

It is naturally tempting to interpret the findings on first childbirth intensity as showing highly educated women catching up with the fertility of less-educated women. However, the figures should not be seen in this way because they are based on a cross-sectional sample including 30 cohorts, rather than a single cohort monitored over time. Nevertheless, the figures show a picture of the current fertility behaviour of those cohorts who are actually of childbearing age.

To properly analyse, for each region, the ability of the most educated women to catch up in fertility with the less educated, we have to focus on those cohorts which have already reached the end of their childbearing years. We thus examine fertility differences between education groups by focusing on women aged 38–44 in 2011, while calculating their number of children by age in a retrospective way. Figure 5 shows their average number of children by age, educational level, and region.

[10] Note that the proportion of highly educated women is highest in the Nordic countries, followed by Western European and CEE countries, while the proportion is lowest in Southern European countries (women aged 28, EU–SILC CS, 2011). Women's distribution over education is 65% (high), 31% (middle), 4% (low) in Nordic countries; 59% (high), 35% (middle), 6% (low) in Western European countries; 51% (high), 43% (middle), 6% (low) in CEE countries; 41%(high), 40% (middle), 19% (low) in Southern European countries.

Figure 5: Number of children by age and education, for women of cohorts 1967–1973, weighted averages for European regions



Data source: EU–SILC CS 2011

Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education

Education observed at age 38 (cohort 1973) to 44 (cohort 1967) in 2011

Central and Eastern European (CEE) countries: Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria, Slovenia; Southern European countries: Italy, Spain, Portugal, Greece, Cyprus, Malta; Nordic countries: Denmark, Finland, Norway, Sweden, Iceland; Western European countries: Austria, Belgium, France, Netherlands, Luxembourg, Ireland, United Kingdom.

Figure 5 illustrates first that in all regions, women with less education start to have children earlier than those with more education, while women with higher education postpone first childbirth. However, only in the Nordic countries is the number of children at ages 38–44 higher for highly educated women than for low-educated women. For the other regions, highly educated women did not ‘catch-up’ to the fertility level of lower-educated women. This time the differences between education groups are most striking in CEE countries, where low-educated women have relatively high fertility levels, but the fertility of highly educated women stays at quite low levels. By contrast, in Southern European countries fertility levels are rather low for all education groups, with highly educated women nevertheless having the lowest fertility levels.

These findings suggest that difficulties in highly educated women catching up in terms of fertility play an important role in explaining differences in average fertility between the four regions (1.70 children in CEE countries, 1.40 children in Southern European countries, 1.74 children in Nordic countries, 1.51 children in Western European countries, for women aged 38 to 44 in 2011). It seems that these difficulties are strongest in CEE countries and weakest in Nordic countries. Differences in institutional support for combining work and family life may explain this regional heterogeneity, but other economic and social factors may also be crucial. For example, in CEE countries, economic uncertainty during the transition period in the 1990s may have led highly educated women of these cohorts to especially postpone first childbirth, while insufficient economic recovery in later years made it impossible for them to ‘catch-up’ (Frejka 2008).

When comparing Figure 5 to Figure 4 an important question emerges: what can explain the fact that Figure 4 suggests a fertility ‘catch-up’ of highly educated women in all regions, while Figure 5 reveals a catch-up in only one region? First of all, the two figures are based on different cohorts. It is possible that the potential ‘catch-up’ in fertility will be higher for cohorts who are currently of childbearing age. Second, Figure 4 only considers births of order one, while the data presented in Figure 5 includes all birth orders. It is possible that low-educated women currently have a higher probability of staying childless, but once they have a first child they are more likely to have children of higher orders in comparison to highly educated women. For cohorts 1967 to 1973 the proportion of childless women is higher for highly educated women than for low-educated women. However, it is possible that for younger cohorts, completed fertility will be more unevenly distributed among less-educated women: while a significant proportion stays childless, those who do have children might have, on average, more than one child.

To empirically estimate if and how far the impact of the timing of first childbirth on the final number of children differs between education groups, we run a linear regression with country-fixed effects and robust standard errors based on our 28

European countries. We estimate the number of children for partnered women aged 38 to 44 with at least one child as a function of the woman's age at first childbirth, while controlling for the woman's and her partner's education. We distinguish between women having their first child before or after age 26, which is the mean age of first childbirth in our sample. Marginal effects are represented by the interaction terms.

Table 1: Number of children for partnered women (cohorts 1967–1973) with at least 1 child, 28 European countries, 2011: Linear regression with country fixed effects and robust standard errors

Covariates	estimated coeff.	p-value	t-stat.
Woman's education:			
Low education (primary, lower secondary)	0.160***	0.000	5.52
Middle education (upper and post-secondary)	*Ref.*	/	/
High education (tertiary)	–0.0390	0.151	–1.44
Partner education:			
Low education (primary, lower secondary)	0.0864***	0.000	4.22
Middle education (upper and post-secondary)	*Ref.*	/	/
High education (tertiary)	0.129***	0.000	7.70
Age at first childbirth (A1CB)			
≥ 26	–0.485***	0.000	–26.27
< 26	–		
Interaction terms:			
A1CB ≥ 26 and low educated	–0.173***	0.000	–5.01
A1CB ≥ 26 and high educated	0.101**	0.001	3.21
Intercept	2.166***	0.000	61.04
Test of joint significance:			
p(A1CB ≥ 26 and low educated)	0.0000		
p(A1CB ≥ 26 and high educated)	0.0000		
Country-fixed effects	*yes*		
Number of observations	19,099		
Number of countries	28		
R^2	0.11		

* p<0.05, ** p<0.01, *** p<0.001
Data source: EU–SILC CS 2011
Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education.
Education observed at age 38 (cohort 1973) to 44 (cohort 1967) in 2011
28 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Table 1 shows that in European countries, having a first child at age 26 or later significantly reduces the final number of children for middle-educated women (estimated coefficient –0.485). For low-educated women, having a first child at age 26 or later is even more negatively correlated with the number of children at ages 38–44 (estimated impact: –0.485-0.173=–0.658). For high-educated women, the impact of postponement of first childbirth to ages later than 25 on the number of children at ages 38–44 is still significantly negative, but to a lesser extent than in the other education groups (estimated impact: –0.485+0.101=–0.384; p-value for the test of joint significance 0.00).

The regressions also show that among women who have had their first child before age 26, low-educated women have the highest number of children at ages 3–44 in comparison to middle- and high-educated women, but there is no significant difference between middle- and high-educated women. Among women who have had their first child later than age 25, high-educated women have a significantly higher number of children at ages 38–44 than middle-educated women (estimated coefficient: –0.039+0.101=0.062; p-value of joint significance 0.0005), while the difference between low- and middle-educated women becomes insignificant.

The negative impact of child postponement on the number of children at ages 38–44 is thus found to decrease with education in European countries. These findings may be interpreted as follows. Among educated women birth postponement is associated with an investment that pays off later, whereas among less-educated women it may reveal other negative factors such as infertility, couple-related problems, or financial constraints.

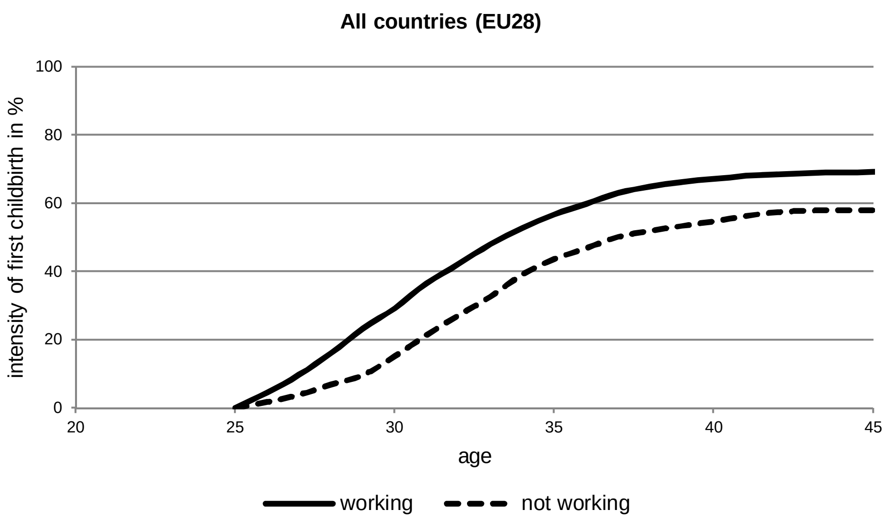
However, the regressions show that postponing births does reduce fertility for women of cohorts 1967–1973. This may not hold for younger cohorts. Figure 3 shows that educated women did postpone their first childbirth but had a higher intensity in becoming mothers. To analyse the effect of timing of births on the completed fertility of those cohorts that are now in their childbearing years, it is necessary to develop models for forecasting fertility by cohort and birth order, controlling for socioeconomic characteristics such as education and activity status. This is an interesting avenue for research but exceeds the scope of this article.

4.2 Female working status, birth postponement, and fertility

Now we examine the effect of women's activity status on the timing and intensity of first childbirth. Therefore, this analysis is limited to the actual childbearing behaviour of women who are currently of childbearing age.

Figure 6 shows the intensity of first childbirth by age and activity status. At all ages, the intensity is higher for women who are working than for those who are not. The gap between the two curves is significant and remains wide until the end of the childbearing years. Note that the final intensity of first childbirth at age 45 is a conditional intensity, i.e., it only applies to the selected group of women who have not had a first child by age 25: among women who have not had a first child by age 25, 73.0% of working women have one by the age of 45. However, only 57.5% of nonworking women who have not had a first child by age 25 have one by age 45. The mean age at first childbirth is 31.0 for working women and 34.0 for the others. We do not include women under 25 in order to avoid too great confusion of education with activity status. As the calculation of intensities only starts at age 25, the final intensities at age 45 are naturally lower than those presented in Figure 3.

Figure 6: Intensity of women's first childbirth by age and activity status, weighted averages for 28 European countries



Source: EU–SILC LT 2003–2011
"working": Employed or self-employed (full-time or part-time) during the three months previous to potential conception of a first child
"not working": Inactive, unemployed, student, military service, early retirement, disability, or any change in activity status during the three months preceding the potential conception of a first child
Weighted average for 28 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

The finding that being economically active facilitates the arrival of a first child for women is consistent with other recent studies showing that couples' fertility choices depend not only on the father's activity status but also on the mother's (Ahn and Mira

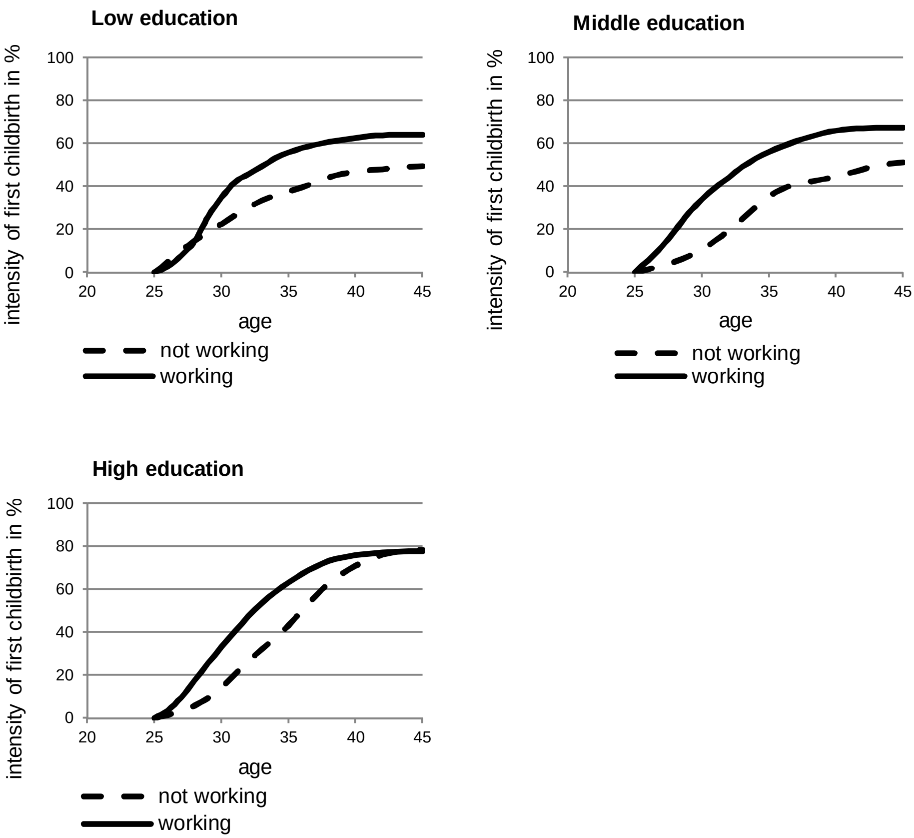
2002, Adserà 2004 and 2011, Sobotka, Skirbekk, and Philipov 2011, Pailhe and Solaz 2012, Goldstein et al. 2013, Greulich, Thévenon, and Guergoat-Larivière 2016). Not having a job emerges as an obstacle to mothers' fertility. Difficulties in entering the labour market are likely to delay or even prevent the start of a family, most likely because parents need a secure economic environment to start a family, which often can only be guaranteed if both partners have earnings.

When our country sample is divided into four regional groups (Figure A-2 in the Appendix), we find that in all regions, economically active women have their first child earlier and have a higher intensity of first childbirth over all ages. The difference in intensity between working women and those who are not working is highest in Western European and Nordic countries and lowest in CEE countries. However, the intensities for both groups are higher in Nordic and Western European countries than in CEE countries. Indeed, the intensities of first childbirth for nonworking women in Nordic and Western European countries are greater than the intensity for working women in CEE countries. Thus, not having a job appears to be a brake on fertility especially in the Nordic and Western European countries, while fertility is hampered for working women in CEE countries. In Southern European countries, working women have a greater chance of becoming a mother than women who are excluded from the labour market, but, in comparison to Nordic and Western Europe, it seems that working women in Southern Europe also face barriers to becoming a mother.

4.3 The impact of activity status on the timing and intensity of first childbirth, differentiated by education

We now combine information on education and activity status to identify the effect of activity status while controlling for differences in education. Figure 7 shows the intensity of first childbirth by age and activity status, for low-, middle-, and high-educated women aged 25 to 45 (for 28 European countries). It is still important to limit this analysis to women aged 25+ so as to not erroneously include women who have not completed their education among those with less education. As in Figure 6, this age limit reduces the final intensities, as we do not observe first childbirths before age 25. As low-educated women are more likely than high-educated women to have their first child before the age of 25, intensities at 45 risk being particularly underestimated for low-educated women. Therefore, in Figure 7 (and in Table 2) only differences between working and nonworking women within each education category are interpretable, and not differences between education categories.

Figure 7: Intensity of first childbirth by age and activity status, for low-, middle-, and high-educated women, weighted averages for 28 European countries



"working": Employed or self-employed (full-time or part-time) during the three months previous to potential conception of a first child; "not working": Inactive, unemployed, student, military service, early retirement, disability or any change in activity status during the three months preceding the potential conception of a first child

Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education; Education observed at the wave preceding the year of potential conception of a first child

Weighted average for 28 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Figure 7 shows that, whatever their education, working women have their first child earlier and have a higher probability of having at least one child. The difference between working and nonworking women is particularly wide among those with middle education. For low-educated women the gap is narrower, but does increase with age. For high-educated women the reverse is the case: the gap is wide at younger ages and then decreases.[11] Figure A-3 in the Appendix shows that for highly educated women the gap between working and nonworking women reduces with age especially in Southern European and Western European countries, but not in CEE and Nordic countries. Once again, we see that highly educated women have most difficulty founding a family in CEE countries compared to other European regions, and especially those who do not succeed in integrating into the labour market.

Figure 7 suggests that on average in Europe, working is particularly relevant for first childbirth for middle-educated women. To see if this conclusion is valid when controlling for age, partner characteristics, and year- and country-specific effects, we estimate women's probability of first childbirth with a logit regression with robust standard errors. Table 2 shows the results. We see that among middle-educated women, those who are working have a significantly higher probability of having a first child than those who are not (estimated coefficient: +0.342). Among low-educated women, however, there is no significant difference between those who are working and those who are not (estimated impact of stable employment: +0.342-0.269=0.073; test of joint significance: 0.6226). The difference is also insignificant for highly educated women (estimated impact of stable employment: +0.342-0.236=0.106; test of joint significance: 0.2691).

[11] Low-educated and working: intensity (of first childbirth at age 45) 64.0%, MA1B (mean age of first childbirth) 30.6; low-educated and not working: intensity 50.0%, MA1B 31.4. Middle-educated and working: intensity 67.5%, MA1B 31.0; middle-educated and not working: intensity 53.0%, MA1B 34.0. High-educated and working: intensity 78.0%, MA1B 31.5; high-educated and not working: intensity 78.0%, MA1B 34.0.

Table 2: Probability of first childbirth for childless women aged 25–46, 28 European countries, 2003–2011
Logit regression with country- and year-fixed effects and robust standard errors

Covariates	estimated coeff.	p-value	t-stat.
Woman's activity status:			
Working	0.342***	0.000	(3.67)
Not working	*Ref.*	/	/
Partner information:			
No cohabiting partner	–1.803***	0.000	(–20.04)
Partner working	0.468***	0.000	(5.33)
Partner not working	*Ref.*	/	/
Woman's education:			
Low education (primary, lower secondary)	0.138	0.347	(0.94)
Middle education (upper and post-secondary)	*Ref.*	/	/
High education (tertiary)	0.342**	0.004	(2.86)
Age	1.147***	0.000	(16.23)
Age²	–0.0186***	0.000	(–17.18)
Interaction terms:			
Working and low-educated	–0.269	0.125	(–1.53)
Working and high-educated	–0.236	0.071	(–1.80)
Intercept	–19.99***	0.000	(–17.33)
Test of joint significance:			
p(working and low-educated)	0.6226		
p(working and high-educated)	0.2691		
Country-fixed effects	*yes*		
Year-fixed effects	*yes*		
Number of observations	39,692		
Number of countries	28		
R²	0.1874		

* p<0.05, ** p<0.01, *** p<0.001

Data source: EU–SILC LT 2003–2011

"working": Employed or self-employed (full-time or part-time) during the three months previous to potential conception of a first child; "not working": Inactive, unemployed, student, military service, early retirement, disability, or any change in activity status during the three months preceding the potential conception of a first child

Low education: pre-primary, primary, lower secondary education; Middle education: (upper) secondary, post-secondary nontertiary education; High education: tertiary education; Education observed at the wave preceding the year of potential conception of a first child

28 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

5. Conclusions

This paper investigates the link between timing of first childbirth and women's likelihood of becoming a mother. By mobilizing data from the EU–SILC, we show that educated and economically active women postpone first childbirth in comparison to women who are less educated and who are not working, but these women also have a higher probability of becoming a mother.

Factors behind birth postponement are distinct. Where birth postponement is associated with education and career investment it appears to facilitate rather than hinder the formation of a family later in life. Birth postponement can, however, also be caused by difficulties in finding a job, in which case it decreases women's likelihood of becoming a mother.

Successful labour market integration, which is achieved especially by highly educated women, facilitates starting a family. This is particularly the case in the Nordic countries, where educated and economically active women have a significantly higher probability of starting a family than those who are less-educated and not working. By comparison, in Central and Eastern European countries educated and economically active women also postpone first childbirth, but they do not end up with a higher (or lower) probability of becoming a mother. It rather seems that in countries of this region, women of all categories face barriers to starting a family.

The regional heterogeneity identified in this article suggests that region-specific contextual factors are important determinants of the link between the timing of first birth and birth intensity. In the Nordic countries, and to a lesser extent also in Western European countries, institutional support for combining work and family life is important and labour markets are stable in comparison to most countries in Central, Eastern, and Southern Europe. In this context, successful labour market integration for women emerges as a key factor in starting a family, even if it delays first childbirth. In Central and Eastern European countries, and to a lesser extent in Southern European countries, it seems that being employed does not necessarily facilitate women having a child. Lower childcare coverage, more rigid gender and family norms, and unstable labour market conditions may explain this finding. For example, it is possible that women who have succeeded in integrating into the labour market in CEE and Southern European countries consider that childbirth is associated with a high risk of losing their job, while those who do not work do not have the financial means to start a family. Consequently, both working and nonworking women have difficulty starting a family.

Our results indicate that public policies that enable and secure employment and facilitate parents to combine work and family life have the potential to increase fertility, despite birth postponement (as long as birth postponement happens within the biological range of female fecundity). Recent studies actually show that these policies are an important determinant of upturns in total fertility rates (Myrskilä, Kohler, and Billari 2009; Thévenon and Gauthier 2011; Neyer, Lappegård, and Vignoli 2013; Luci-Greulich and Thévenon, 2013, 2014; Arpino and Esping-Andersen 2015).

One way of extending this analysis is to forecast birth intensities of all orders by differentiating between education, activity status, and institutional context. This would allow pursuing the hypothesis that under certain circumstances birth postponement can be associated with higher fertility levels for those cohorts who are currently of childbearing age.

The EU–SILC is a unique data set that makes such an analysis possible. It provides a wide range of harmonized socioeconomic measures for a large set of countries and allows merging women with their partners. Yet the EU–SILC is not conceived for demographic analysis, which implies that birth events risk being underreported, mainly because fertility is linked to attrition. However, Greulich and Dasré (2017) find for the majority of countries that there are no significant socioeconomic differences in attrition in the EU–SILC. In addition, our retrospective approach allows circumventing the downward bias to some extent, as for women aged 15 to 27 we do not observe first births shortly after they occurred but with some time delay. For later ages the downward bias for first births is found to be much smaller. Finally, several important determinants of fertility, such as health, the quality of the partnership, and attitudes towards childbearing, are not observed in the EU–SILC. This points to the importance of enlarging the analysis to other data sources.

References

Adserà, A. (2004). Changing fertility rates in developed countries. The impact of labour market institutions. *Journal of Population Economics* 17(1): 17–43. doi:10.1007/s00148-003-0166-x.

Adserà, A. (2011). Where are the babies? Labor market conditions and fertility in Europe. *European Journal of Population* 27(1): 1–32. doi:10.1007/s10680-010-9222-x.

Ahn, N. and Mira, P. (2002). A note on the relationship between fertility and female employment rates in developed countries. *Journal of Population Economics* 15(4): 667–682. doi:10.1007/s001480100078.

Andersson, G. (2000). The impact of labour-force participation on childbearing behaviour: Pro-cyclical fertility in Sweden during the 1980s and the 1990s. *European Journal of Population* 16: 293–333. doi:10.1023/A:1006454909642.

Andersson, G., Rønsen, M., Knudsen, L., Lappegård, T., Neyer, G., Skrede, K., Teschner, K., and Vikat, A. (2008). Cohort fertility patterns in the Nordic countries. Stockholm: 2. Stockholm University Demography Unit (Stockholm Research Reports in Demography, SRRD–2008).

Arpino, B. and Esping-Andersen, G. (2015). How do changes in gender role attitudes towards female employmet influence fertility. A macro-level analysis. *European Sociological Review* 31(3): 370–382. doi:10.1093/esr/jcv002.

Barro, R. and Becker, G. (1989). Fertility choices in a model of economic growth. *Econometrica* 57(2): 481–501. doi:10.2307/1912563.

Bettio, F. and Plantenga, J. (2004). Comparing care regimes in Europe. *Feminist Economics* 10(1): 85–113. doi:10.1080/1354570042000198245.

Bongaarts, J. and Feeney, G. (1998). On the quantum and tempo of fertility. *Population and Development Review* 24(2): 271–291. doi:10.2307/2807974.

Bongaarts, J. and Sobotka, T. (2012). A demographic explanation for the recent rise in European fertility. *Population and Development Review* 38(1): 83–120. doi:10.1111/j.1728-4457.2012.00473.x.

Cigno, A. and Ermisch, J. (1989). A microeconomic analysis of the timing of births. *European Economic Review* 33(4): 737–760. doi:10.1016/0014-2921(89)90023-8.

D'Albis, H., Greulich, A., and Gobbi, P. (2017). Having a second child and access to childcare: Evidence from European countries. *Journal of Demographic Economics*, forthcoming.

Ermisch, J. and Ogawa, N. (1994). Age at motherhood in Japan. *Journal of Population Economics* 7(4): 393–420. doi:10.1007/BF00161474.

Esping-Andersen, G. (1990). *The three worlds of welfare capitalism*. Cambridge: Polity Press.

Esping-Andersen, G. (1999). *Social foundations of postindustrial economies*. New York: Oxford University Press. doi:10.1093/0198742002.001.0001.

Eurostat: European Union Statistics on Income and Living Conditions [electronic resource]. http://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions.

Frejka, T. and Sardon, J.-P. (2006). First birth trends in developed countries: Persisting parenthood postponement. *Demographic Research* 15(6): 147–180. doi:10.4054/DemRes.2006.15.6.

Frejka, T. (2008). Overview Chapter 5: Determinants of family formation and childbearing during the societal transition in Central and Eastern Europe. *Demographic Research* 19(7): 139–170. doi:10.4054/DemRes.2008.19.7.

Gauthier, A.H. (1996). *The state and the family: A comparative analysis of family policies in industrialized countries*. Oxford: Clarendon Press. doi:10.3917/pope.203.0447.

Gauthier, A.H. (2002). Family policies in industrialized countries: Is there convergence? *Population* 57(3): 447–474.

Goldstein, J., Kreyenfeld, M., Jasilioniene, A., and Örsal, D. (2013). Fertility reactions to the 'Great Recession' in Europe: Recent evidence from order-specific data. *Demographic Research* 29(4): 85–104. doi:10.4054/DemRes.2013.29.4.

Greulich, A. and Dasré, A. (2016). *Quality of measures of the number of children in EU–SILC*. Work in Progress.

Greulich, A. and Dasré, A. (2017). Quality of periodic fertility measures in EU–SILC. *Demographic Research* 36(17): 525–556. doi:10.4054/DemRes.2017.36.17.

Greulich, A., Thévenon, O., and Guergoat-Larivière, M. (2016). Securing women's employment: A fertility booster in European countries? Paris: Centre d'Economie de la Sorbonne (working paper 2016–17).

Gustafsson, S. (2001). Theoretical and empirical considerations on postponement of maternity in Europe. *Journal of Population Economics* 14(2): 225–247. doi:10.1007/s001480000051.

Happel, S., Hill, J.K., and Low, S. (1984). An economic analysis of the timing of child-birth. *Population Studies* 38(2): 299–311. doi:10.1080/00324728.1984.10410291.

Heckman, J. and Walker, J. (1990). The relationship between wages and income and the timing and spacing of births: Evidence from Swedish longitudinal data. *Econometrica* 58(6): 1411–1441. doi:10.2307/2938322.

Hoem, B. (2000). Entry into motherhood in Sweden: The influence of economic factors on the rise and fall in fertility, 1986–1997. *Demographic Research* 2(4). doi:10.4054/DemRes.2000.2.4.

Human Fertility Database [electronic resource]. Germany: Max Planck Institute for Demographic Research and Austria: Vienna Institute of Demography. http://www.humanfertility.org.

Impens, K.K. (1989). The impact of female unemployment on fertility in Flanders. In: Cliquet, R.L., Dooghe, G., De Jong-Gierveld, J., and Van Poppel, F. (eds.). *Population and family in low countries VI*. The Hague: NIDI/CBGS Publications: 119–140.

Joshi, H. (1990). The cash alternative costs of childbearing: An approach to estimation using British data. *Population Studies* 44(1): 41–60. doi:10.1080/0032472031000144376.

Klesment, M., Puur, A., Rahnu, L., and Sakkeus, L. (2014). Varying association between education and second births in Europe: Comparative analysis based on the EU–SILC data. *Demographic Research* 31(27): 813–860. doi:10.4054/DemRes.2014.31.27.

Kohler, H.-P., Billari, F.C., and Ortega, J.A. (2002). The emergence of lowest-low fertility in Europe during the 1990s. *Population and Development Review* 28(4): 641–681. doi:10.1111/j.1728-4457.2002.00641.x.

Kravdal, O. (1994). The importance of economic activity, economic potential and economic resources for the timing of first births in Norway. *Population Studies* 48(2): 249–267. doi:10.1080/0032472031000147786.

Kravdal, O. (2002). The impact of individual and aggregate unemployment on fertility in Norway. *Demographic Research* 6(10): 263–294. doi:10.4054/DemRes.2002.6.10.

Kravdal, O. and Rindfuss, R. (2008). Changing relationships between education and fertility: A study of women and men born 1940 to 1964. *American Sociological Review* 73(5): 854–873. doi:10.1177/000312240807300508.

Lappegård, T. and Rønsen, M. (2005). The multifaceted impact of education on entry into motherhood. *European Journal of Population* 21(1): 31–49. doi:10.1007/s10680-004-6756-9.

Luci-Greulich, A. and Thévenon, O. (2013). The impact of family policy packages on fertility trends in developed countries. *European Journal of Populatio*n 29(4): 387–416. doi:10.1007/s10680-013-9295-4.

Luci-Greulich, A. and Thévenon, O. (2014). Does economic development 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960–2007). *European Journal of Population* 30(2): 187–221. doi:10.1007/s10680-013-9309-2.

Merrigan, P. and St-Pierre, Y. (1998). An econometric and neoclassical analysis of the timing and spacing of births in Canada from 1950 to 1990. *Journal of Population Economics* 11(1): 29–51. doi:10.1007/s001480050057.

Matysiak, A. and Weziak-Bialowoska, D. (2016). Country-specific conditions for work and family reconciliation: An attempt at quantification. *European Journal of Population* 32(4): 475–510. doi:10.1007/s10680-015-9366-9.

Meron. M., Widmer. I., and Shapiro, D. (2002). Unemployment leads women to postpone the birth of their first child. *Population* 57(2): 301–330. doi:10.3917/pope.202.0301.

Myrskylä, M., Kohler, H.-P., and Billari, F.C. (2009). Advances in development reverse fertility declines. *Nature* 460(6): 741–743. doi:10.1038/nature08230.

Neyer, G. and Hoem, J. (2008). Education and permanent childlessness: Austria vs. Sweden. In: Surkyn, J., van Bavel, J., and Deboosere, P. (eds.) *Demographic challenges for the 21st century: A tribute to the continuing endeavours of Prof. Dr. Em. Ron Lesthaeghe in the field of demography*. Brussels: Academic Press: 91–112.

Neyer, G., Lappegård, T., and Vignoli, D. (2013): Gender equality and fertility: Which equality matters? *European Journal of Population* 29(3): 245–272. doi:10.1007/s10680-013-9292-7.

OECD (2011). *Doing better for families*. Paris: OECD Publishing.

Pailhé, A. and Solaz, A. (2012). The influence of employment uncertainty on childbearing in France: A tempo or quantum effect? *Demographic Research* 26(1): 1–40. doi:10.4054/DemRes.2012.26.1.

Pestieau, P. and Ponthière, G. (2013). Childbearing age, family allowances, and social security. *Southern Economic Journal* 80(2): 385–413. doi:10.4284/0038-4038-2012.061.

Philipov, D. and Kohler, H.-P. (2001). Tempo effects in the fertility decline in Eastern Europe: Evidence from Bulgaria, the Czech Republic, Hungary, Poland, and Russia. *European Journal of Population* 17(1): 37–60. doi:10.1023/A:1010740213453.

Schmitt, C. (2012). Labour market integration, occupational uncertainties and fertility choices in Germany and the UK. *Demographic Research* 26(12): 253–292. doi:10.4054/DemRes.2012.26.12.

Schulz, T.P. (1985). Changing world prices, women's wages and the fertility transition: Sweden 1860–1910. *Journal of Political Economy* 93(6): 1126–1154. doi:10.1086/261353.

Sobotka, T. (2003). Tempo-quantum and period-cohort interplay in fertility changes in Europe. Evidence from the Czech Republic, Italy, the Netherlands and Sweden. *Demographic Research* 8(6): 151–213. doi:10.4054/DemRes.2003.8.6.

Sobotka, T. (2004). Is lowest-low fertility in Europe explained by the postponement of childbearing? *Population and Development Review* 30(2): 195–220. doi:10.1111/j.1728-4457.2004.010_1.x.

Sobotka, T., Skirbekk, V., and Philipov, D. (2011). Economic recession and fertility in the developed world. *Population and Development Review* 37(2): 267–306. doi:10.1111/j.1728-4457.2011.00411.x.

Sobotka, T., Zeman, K., Lesthaeghe, R., Frejka, T., and Neels, K. (2011). Postponement and recuperation in cohort fertility: Austria, Germany and Switzerland in a European Context. *Comparative Population Studies* 36(2–3): 417–452.

Tasiran, A. (1995). *Fertility dynamics: Spacing and timing of births in Sweden and the United States*. Amsterdam: Elsevier.

Thévenon, O. (2008). Family policies in Europe: Available databases and initial comparisons. *Vienna Yearbook of Population Research* 6: 165–177. doi:10.1553/populationyearbook2008s165.

Thévenon, O. (2011). Family policies in OECE countries. A comparative analysis. *Population and Development Review* 37(1): 57–87. doi:10.1111/j.1728-4457.2011.00390.x.

Thévenon, O. and Gauthier, A.H. (2011). Family policies in developed countries: A "fertility-booster" with side-effects. *Community, Work and Family* 14(2): 197–216. doi:10.1080/13668803.2011.571400.

Thévenon, O. (2015). Decreasing fertility in Europe: Is it a policy issue? In: Matthijs, K., Neels, K., Timmerman, C., Haers, J., and Mels, S. (eds.). *Population change in Europe, the Middle-East and North Africa: Beyond the demographic divide*. Burlington: Ashgate: 81–119.

Wood, J., Neels, K., and Kil, T. (2014). The educational gradient of childlessness and cohort parity progression in 14 low fertility countries. *Demographic Research* 31(46): 1365–1416. doi:10.4054/DemRes.2014.31.46.

Wood, J., Vergauwen, J., and Neels, K. (2015). Economic conditions and variation in first birth hazards in 22 European countries between 1970 and 2005. In: Matthijs, K., Neels, K., Timmerman, C., Haers, J., and Mels, S. (eds.). *Population change in Europe, the Middle-East and North Africa. Beyond the demographic divide*. Burlington: Ashgate: 45–81.

Appendix

Figure A-1: Illustration of the construction of the database

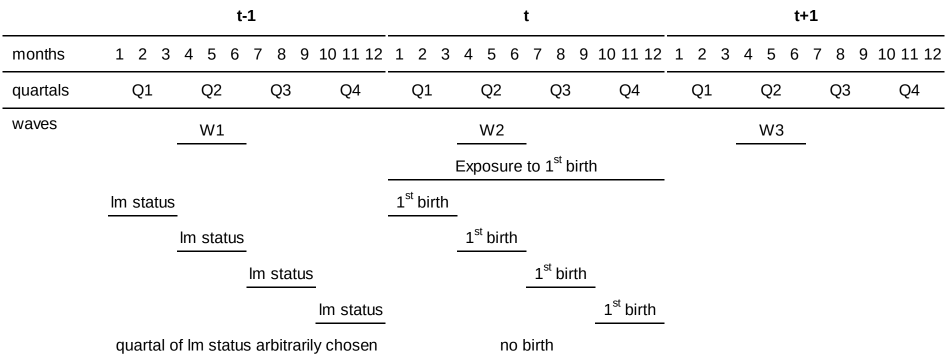
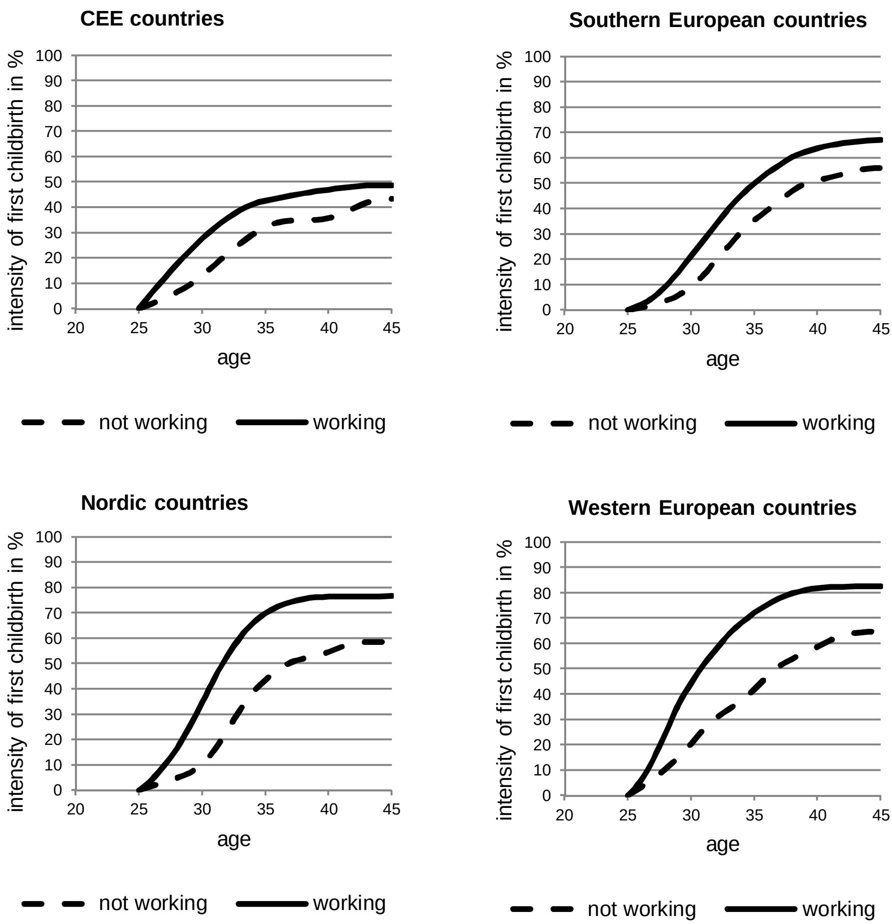
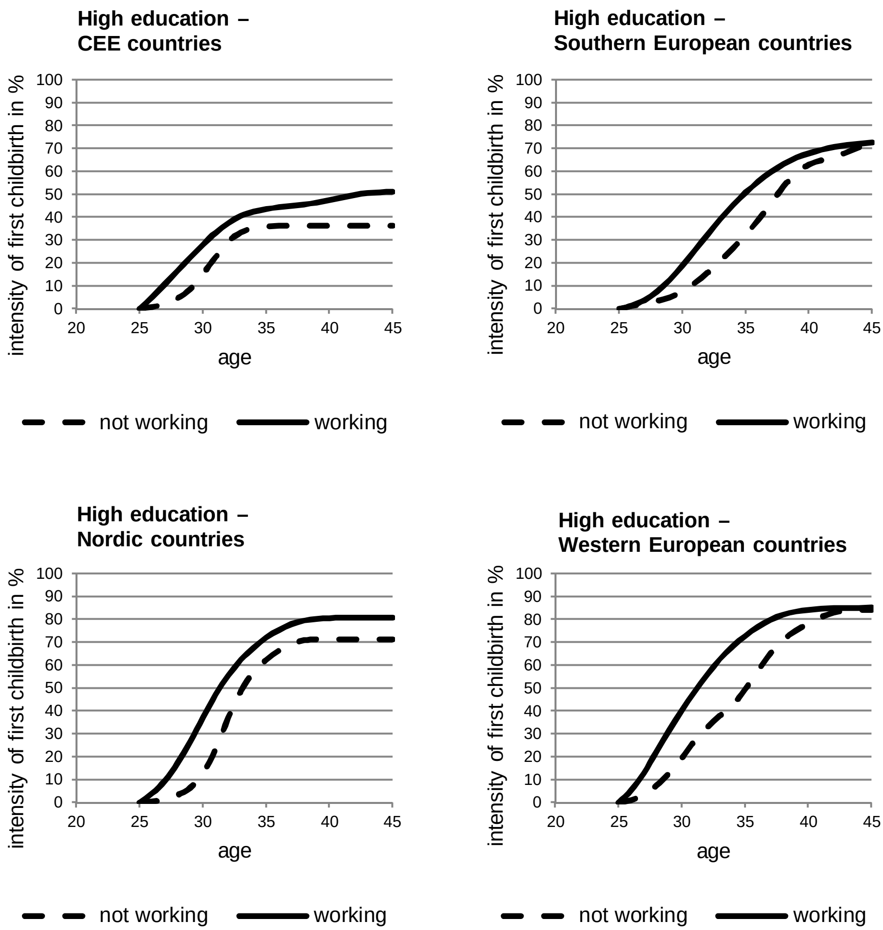


Figure A-2: Intensity of women's first childbirth by age and activity status, weighted averages for European regions



Source: EU–SILC LT 2003–2011
"working": Employed of self-employed (full-time or part-time) during the three months previous to potential conception of a first child
"not working": Inactive, unemployed, student, military service, early retirement, disability, or any change in activity status during the three months preceding the potential conception of a first child
Central and Eastern European (CEE) countries: Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria, Slovenia; Southern European countries: Italy, Spain, Portugal, Greece, Cyprus, Malta; Nordic countries: Denmark, Finland, Norway, Sweden, Iceland; Western European countries: Austria, Belgium, France, Netherlands, Luxembourg, Ireland, United Kingdom.

Figure A-3: Intensity of first childbirth by age and activity status, for high-educated women, weighted averages for European regions



Data Source: EU–SILC LT 2003–2011

"working": Employed of self-employed (full-time or part-time) during the three months previous to potential conception of a first child; "not working": Inactive, unemployed, student, military service, early retirement, disability, or any change in activity status during the three months preceding the potential conception of a first child

High education: tertiary education; Education observed at the wave preceding the year of potential conception of a first child

Central and Eastern European (CEE) countries: Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria, Slovenia; Southern European countries: Italy, Spain, Portugal, Greece, Cyprus, Malta; Nordic countries: Denmark, Finland, Norway, Sweden, Iceland; Western European countries: Austria, Belgium, France, Netherlands, Luxembourg, Ireland, United Kingdom.

A. Greulich, A. Dasré, C. Inan (2016): "Two or Three Children? Turkish Fertility at a Crossroads" *Population and Development Review*, 42(3): 537-559. (cnrs cat. 2)

Two or Three Children? Turkish Fertility at a Crossroads

Angela Greulich
Aurélien Dasre
Ceren Inan

"If you have a young population, the future is yours," Turkey's current President (and former Prime Minister) Recep Erdogan said about the challenge of population aging in Turkey. "At the moment, thank God, 60 per cent of our population is under 30. But when we look at the increase, if we continue like this, alarm bells are ringing for 2037–40."[1]

Erdogan's fear of an increase in the proportion of elderly people in Turkey is mainly driven by fertility rates that have been rapidly decreasing over the last several decades. Turkish women still have more than two children on average, but trends suggest an eventual decline below replacement level. At the same time, female education and employment have been increasing over the past 15 years. Even though female employment rates are still relatively low in Turkey in comparison to other European countries, they are rising especially for young cohorts of better-educated women, who also tend to have lower fertility.

This article examines the determinants of Turkey's fertility decline using census and survey data. We show that the transition from a second to a third child is crucial for the future of fertility levels in Turkey. In a context of increasing education and employment opportunities for women, our results suggest that the decline in fertility reflects an important conflict between work–life balance in Turkey, which affects in particular mothers in formal employment. When women who have two children are employed, their contribution to household income is crucial. In the absence of possibilities to combine employment and family life, mothers who are active in formal jobs are thus most likely to decide against having a third child.

Enabling women to work while raising children would allow families to generate the financial means that are needed for larger family size. However, the current policy setting in Turkey is conducive to impeding rather than facilitating fertility. To stop the fertility decline, the leading AKP party advances a traditional and pronatalist policy. The approach involves not only birth grants and proposals to limit abortion rights, but also a critical view of maternal employment, as Erdogan has suggested that women should focus more on maternity.[2]

The dominant conservatism in the public discourse is mitigated by ministerial plans to promote female employment in addition to raising fertility. The country's Tenth Development Plan (2014–18), for example, seeks to facilitate women's employment through parental leave regulations and investments in formal child care. Nevertheless, official communications denounce mothers' full-time work,[3] and the Development Plan encourages mothers to limit employment to part-time jobs.

The focus on motherhood as the principal role for women illustrates that gender equality is not on the political agenda of the present government in Turkey. Childbearing and female employment are both identified as important factors in achieving demographic and economic targets, but gender equality is not considered a goal per se. International evidence shows that a traditional approach to gender roles is detrimental to fertility, while promoting couples' full-time employment increases fertility rates. Countries that focus their institutional support for families mainly on cash transfers and on reduced working hours for mothers, such as Germany, tend to have total fertility rates below the European average. Part-time working women risk being trapped in low-paid jobs without career options. Their precarious situation in the labor market increases the volatility of household income, which can dissuade families from having (additional) children (Greulich et al. 2016). In contrast, countries that enable women to have children without having to stop or to substantially reduce their working activities, like France and the Nordic countries, tend to have total fertility rates above the European average. In these countries, female employment is a driving force rather than a barrier for fertility (Luci-Greulich and Thévenon 2014). By encouraging female employment, the provision of child care services is found to have the largest potential to increase fertility in comparison to other family policy instruments (Luci-Greulich and Thévenon 2013).

Surveys indicate that the majority of Turkish women, including highly educated women, seek to have at least two children.[4] Thus it is institutional barriers rather than fertility preferences that lead Turkish women to reduce their family size in order to remain in employment. With its dominant traditional gender discourse and insufficient provision of formal child care, particularly for young children,[5] Turkey is denying women the support needed to realize their fertility intentions. The Development Plan promises investments in child care, but provides no benchmarks in terms of coverage rates and hours of operation. Facilitating access to high-quality nurseries and child care services would allow parents to maintain their household's income following the birth of a child.

Fertility and women's employment in Turkey

Turkey has experienced a remarkable decline in fertility starting around 1960. The decline was accompanied by greater access to contraception, as well as later childbearing ages for women (Koç et al. 2010; Inan 2007). Women's education has also been increasing, in particular with a rising proportion of women with completed primary education. Increasing education is often considered as the main determinant of the country's fertility decline. Güneş (2013) and Kirdar, Tayfur, and Koç (2011) show that the 1997 reform, which increased the duration of compulsory education from five to eight years, has significantly increased women's mean age at first childbirth, mainly by reducing the number of teenage pregnancies, as marriage in Turkey is closely followed by birth of a first child (HIPS 1979, 2009 and 2014). According to Kirdar, Tayfur, and Koç (2011), the 1997 reform on compulsory education had a greater impact on fertility than the Civil Code law of 2002 raising the legal age of marriage from 15 to 17 years.

Higher education and lower fertility generally lead to greater participation of younger women in Turkey's labor market (Ince 2010). Female employment rates show two distinctive trends. First, from the 1980s until the mid-2000s, female employment rates (ages 15–64) actually decreased from 36 percent to 25 percent, mainly owing to a reduction of the agricultural sector (World Bank *World Development Indicators* 2015). Uraz et al. (2010) confirm that it was particularly poorly educated women, formerly family workers in agriculture, who lost their jobs during that period, especially when migrating to urban areas. A counter trend has emerged since the mid-2000s. After having largely overcome their educational disadvantage by increasing engagement in secondary and tertiary education, women now increasingly find jobs in the service sector in urban areas (Dayıoğlu and Kırdar 2010). As a result, female employment rates have rebounded to 32 percent in 2013 (World Bank *World Development Indicators* 2015). The increase has occurred in particular among younger cohorts and better-educated women (World Bank 2009). In 2012, 40 percent of women aged 25–29 participated in the labor force compared to only 25 percent of women aged 45–49. Among the latter cohort, only 20 percent of women worked at ages 25–29 (Turkstat Labour Force Surveys 1992, 1997, 2002, 2007, 2012).[6]

Nevertheless, at only slightly above 30 percent on average, the country's female employment rate is still low in comparison to the male rate (76 percent) and to the European average for women (67 percent). At the same time, the level of part-time work for women in Turkey is similar to that in most other European countries: about one fourth of women participating in the labor force work part time both in Turkey and on average in the

EU (World Bank *World Development Indicators* 2015). In 2012, 50 percent of women worked in services, which is the largest sector of employment for women in Turkey today, followed by agriculture (40 percent) and industry (10 percent). Women's jobs in the service sector are on the rise, but lag behind the European average of 80 percent (World Bank *World Development Indicators* 2014). Even though agricultural employment is in decline, agriculture was the dominant sector for women in Turkey until recently (2008), while only 6 percent of active women work in agriculture on average in the EU.

Today, most Turkish men and women intend to have two or three children, and intentions are not significantly lower for highly educated groups (HIPS 2014). The fact that Turkey's total fertility rate is at replacement level suggests that many families are unable to have the number of children they desire. Reconciling work and family life is also difficult, especially in urban areas where family networks are weaker. There are no binding parental leave regulation for Turkish companies (only 16 weeks of maternity leave), as longer leave is costly and policymakers fear the risk of discouraging companies from hiring women. Child care coverage is weak on average, especially for very young children (Çarkoğlu, Kafescioğlu, and Mitrani 2011). Pre-primary enrollment rates are among the lowest in the world (Kılıç et al. 2009) and well below the European average. Less than 1 percent of children aged 0–2 are enrolled in formal child care, while the EU average is around 30 percent (Council of Europe 2009). It is mainly children in economically well-off households who benefit from privately organized early child care before being enrolled in compulsory education (Aran and Ridao-Cano 2013).

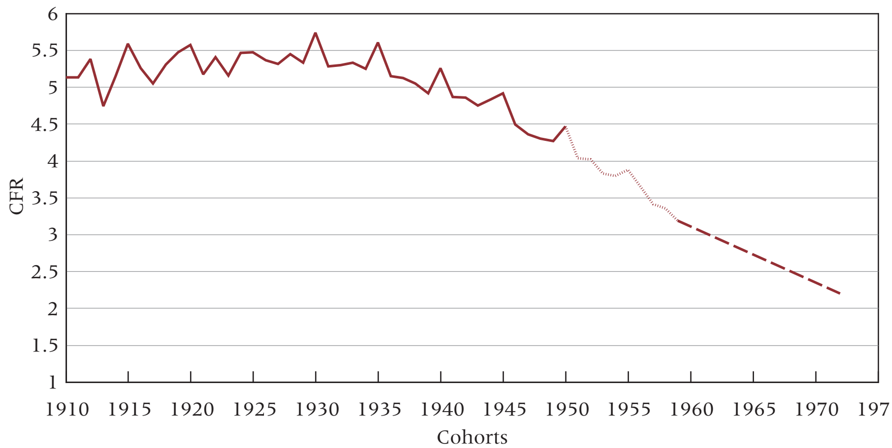
Against the background of difficulties in realizing fertility intentions, our analysis addresses the question of what type of family is most likely to decide not to have a child. We highlight in particular determinants of having a third child, as this birth order crucial for the future rise of fertility levels in Turkey.

Trends in Turkish fertility and its components

Total and completed fertility rates

Period total fertility in Turkey fell from over 6 children per women in 1960 to 2.1 in 2011. As a result, the TFR rapidly converged with the EU average,[7] which fell from 2.7 in 1960 to 1.8 over the same period (World Bank *World Development Indicators* 2014). As with period TFRs, completed fertility rates have been declining over time. The latest available wave of census data for Turkey is for 2000.[8] Census data provide measures of completed fertility for cohorts from 1910 to 1950 (women who were at least 50 in 2000 and have thus completed their childbearing). We nevertheless report the census data

FIGURE 1 Completed fertility rate (CFR) by cohort in Turkey, 1910–1972 cohorts



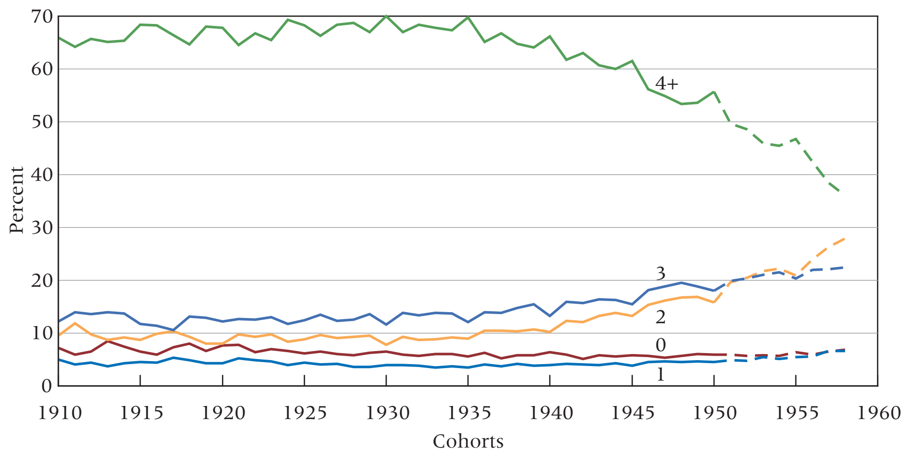
Solid line = average number of children for cohorts 1910–1950 reported by census 2000; dotted line: average number of children for cohorts 1950–1960 reported by census 2000; endpoint of dashed line: average number of children for cohorts 1969–1974 reported by SILC 2011.
SOURCE: Census (I-PUMS) 2000 and SILC 2011.

through the 1960 cohort (women aged 40, observed in 2000), acknowledging that this measure risks having a downward bias, as some Turkish women aged 40 have not yet completed their childbearing. In order to obtain information about fertility for younger cohorts, we use the 2011 wave of the cross-sectional module of the European Survey of Income and Living Conditions (EU-SILC 2011) for Turkey.

The main advantage of SILC is the availability of detailed information about education, labor market participation, and income—variables that are collected at both the household and individual level (thus allowing women to be matched with their partners). Some pitfalls emerge, however, because SILC does not report information on the number of children directly. Children are observed only if living in their parents' households. Therefore, there is a risk of downward bias of observed fertility for women at the end of their childbearing years, whose children may already have moved out. The weighted mean of women's age-specific number of children decreases after age 42 in the 2011 SILC. To limit this downward bias while obtaining a large number of observations, we calculate approximate completed fertility in 2011, based on women aged 37–42.

Figure 1 illustrates trends in completed fertility rates in Turkey. The line is divided into three parts: the bold portion depicts completed fertility for women aged 50+, who have completed their childbearing (census 2000, cohorts through 1950).[9] The dotted portion depicts women aged 40–50 (census 2000, cohorts 1950–1960). Some of these women might not have completed their fertility at the time of observation. Finally, the endpoint of

FIGURE 2 Completed parity fertility by cohort in Turkey, 1910–1960 cohorts



Solid line = proportions of women having specified number of children for cohorts 1910–1950; dashed line: proportions of women having specified number of children for cohorts 1950–1960.
SOURCE: Census (I-PUMS) 2000.

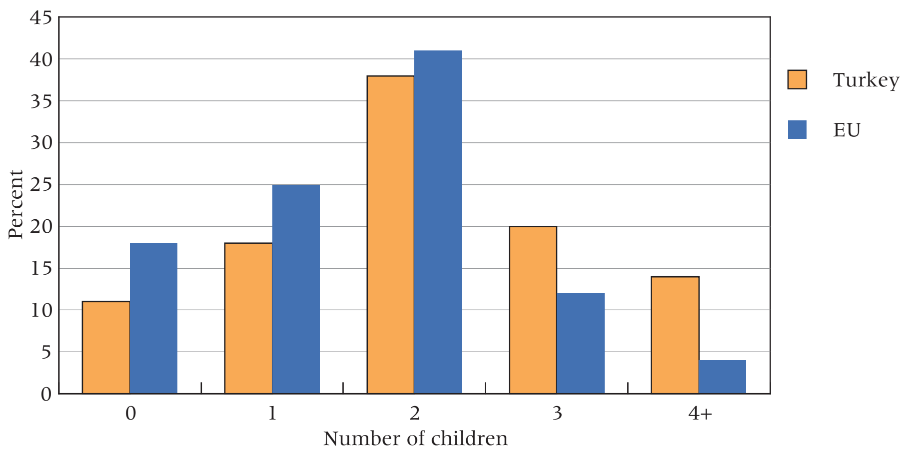
the dashed line represents the average number of children observed for cohorts 1969–1974, reported by SILC for 2011 (women aged 37–42, some of whom have not completed their fertility). At 2.2 children per woman, approximate completed fertility rates in Turkey are still above the EU average (1.6 as measured by SILC; individual weights are taken into account when calculating the average of each country).

Components by birth order

Census data illustrated in Figure 2 report a substantial decline in the proportion of women having four or more children between the 1930 and 1960 cohorts, while the proportion of women having two and three children increased. Childless women and those having one child are a minority in Turkey through the 1960 cohort.

Figure 3 illustrates the same proportions for younger cohorts and compares them to the EU-26 average (SILC 2011). The proportion of childless women remains low for women aged 37–42 in 2011, but the proportion having one and two children is higher in comparison to the older cohorts illustrated in Figure 2. The proportion of women having three children is almost identical, while the proportion having at least four is smaller for younger cohorts. Most importantly, Figure 3 indicates that the majority of Turkish women of cohorts 1969–1974 have either two or three children. Like the average for Europe, having two children is the norm for cohorts born around 1970 in Turkey, which was not the case for older cohorts born before 1960. At the same time, the proportion of women having three

FIGURE 3 Completed parity fertility in Turkey in comparison with the EU average, 1969–1974 cohorts



SOURCE: EU SILC CS 2011 (cohorts 1969–1974: women aged 37–42).

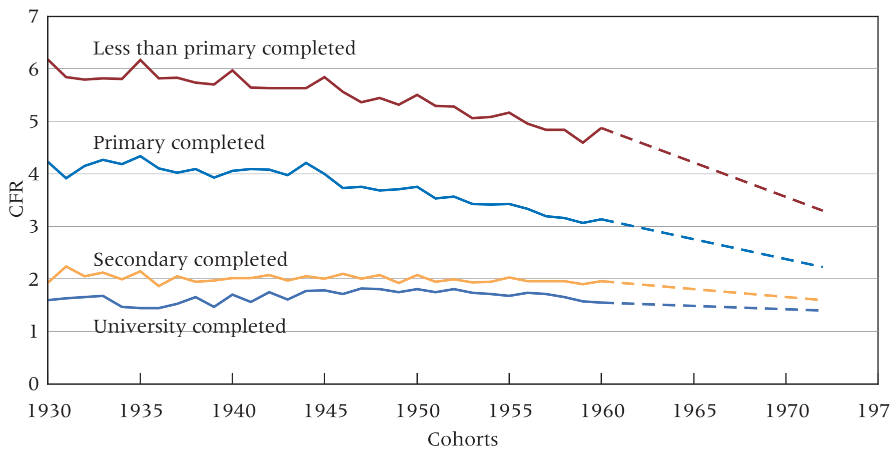
or more children is larger in Turkey than on average in other European countries.

When calculating parity progression ratios based on the proportions illustrated in Figure 3, we find that the difference between Turkey and the European average increases with the birth order of the child: 89 percent of Turkish women have at least one child compared with 82 percent in the EU; 80 percent of Turkish women having one child progress to have a second, while the EU average is 70 percent. Among women having two children, 47 percent are likely to have a third child in Turkey, compared to 28 percent on average in the EU. Parity progression ratios for the fourth child are 40 percent in Turkey, 24 percent in the EU.

A calculation of components by birth order[10] reveals that the greater likelihood of third births in Turkey is the key element of the difference in completed fertility between Turkey and the EU. Some 30 percent of the gap in approximate completed fertility (1.6 vs. 2.2 children per women) can be explained by more children of birth order three in Turkey, while the fact that there are more children of birth order two in Turkey explains only 25 percent. The somewhat higher level of childlessness in the EU accounts for only 13 percent of the gap in completed fertility. The proportion of Turkish women having four children is higher than the European average (7.5 percent vs. 3 percent), but this difference explains only 16 percent of the gap in completed fertility between Europe and Turkey.

When comparing fertility of the 1960 cohort with that of the 1969–1974 cohorts in Turkey, the calculation of components by birth order reveals that the drop in completed fertility from 3.2 to 2.3 children per women is explained primarily by fewer younger women having a third child. Parents'

FIGURE 4 Completed fertility by cohort and women's education in Turkey, 1930–1974 cohorts



Solid line = average number of children by women's education for cohorts 1930–1960 reported by Census 2000; endpoint of dotted line: average number of children by women's education for cohorts 1969–1974 reported by SILC 2011.
SOURCE: Census (I-PUMS) 2000 and EU SILC CS 2011.

decision for or against a third child thus emerges as crucial for the question whether fertility in Turkey will stabilize at around replacement level or whether it has the potential to increase.

Components by education

The decline over cohorts in completed fertility in Turkey can be observed for all levels of education, but is most pronounced for poorly educated women. Figure 4 illustrates two trends. First, poorly educated women (less than primary education or primary diploma) experience a sharp fertility decrease over time, while more educated women (secondary and tertiary) show a much less dramatic fertility decline. Figure 4 also reveals that the average number of children has always been much lower for women with at least secondary education, who tend to have just under two children on average.

In parallel, the distribution of education among women has been changing substantially over time. Figure A in the Appendix[11] illustrates a substantial increase in the proportion of women having at least a primary diploma.[12] This increase implies that the decline in completed fertility in Turkey is due not only to a level effect, but also to a structural effect.[13] Fertility is declining only slightly among educated women, but fertility levels are generally lower among highly educated women than among poorly educated women, and women in Turkey are increasingly attaining higher levels of education. This structural effect explains about half of the fertility decline in Turkey. The other half is explained by the fact that within each educational group, the average number of children is declining, and this decline is most pronounced among poorly educated women. It seems thus that more highly educated women (with at least secondary education), who tend not to have a child of third or higher birth order, contribute to an important extent to the fertility decline in Turkey as they become more numerous. Whether this group of women can be encouraged to have children of higher birth order is crucial for the future evolution of fertility in Turkey.

Men's education levels also need to be taken into account, although we find that they are less determinant for fertility than women's education. When we calculate completed fertility rates by comparing mother's and father's education level (see Figure B in the Appendix), we observe that the couple's fertility level is more closely correlated with the woman's educational level than with the level of her partner. The more highly educated the woman, the lower her completed fertility, relatively independent of the education of her partner. This does not mean that fertility decisions are made by women alone. However, the finding that the couple's joint fertility decision is more driven by the woman's than by the man's education level points to important income and substitution effects of women's employment and earnings.

Regional heterogeneity in fertility

Fertility in Turkey is characterized by significant regional differences, which are closely linked to differences in ethnic composition (Koç, Hanciogly, and Cavlin 2008). Our decomposition analysis suggests, however, that it is mainly differences in female education that explain the regional heterogeneity of fertility in Turkey.

The Western-oriented city of Istanbul has long been characterized by low fertility, even at times of high overall fertility. Today, western regions of Turkey have lower fertility rates than the central Anatolian and eastern regions. In the west, fertility levels have been at or somewhat below replacement level since the late 1980s. In the east, especially in Kurdish areas, fertility rates remain high. Central Anatolian regions have an intermediary fertility profile (Inan 2007).

Turkish census data report the province of birth of the mother and reveal that completed fertility levels are significantly higher for women in south-east Turkey than in the north-west. While the fertility decline over generations can be observed for both regions, the fertility gap between the two regions is constant over time. For the 1960 cohort, the average number of children reported by the 2000 census is 3.0 for women in the north-west and 5.5 for women in the south-east. For the 1969–1974 cohorts, SILC also reports a clear south-east/north-west gradient.[14] Approximate completed fertility levels are the lowest in Marmara (1.6) and the highest in southeast Anatolia (3.5).[15]

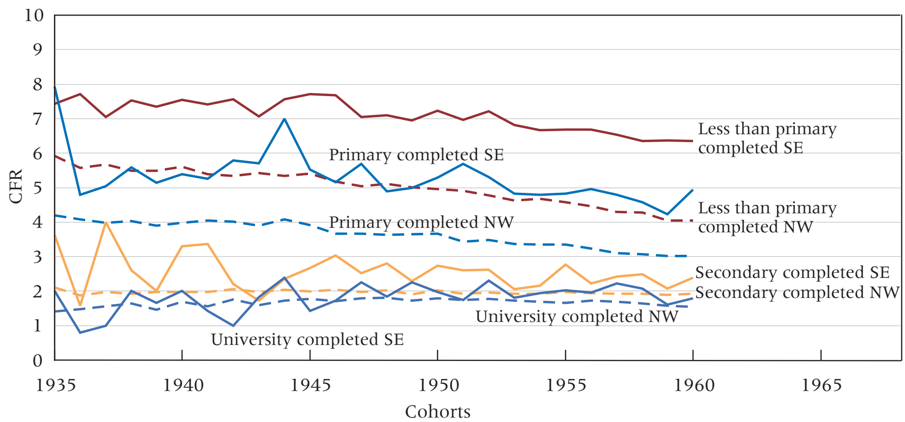
At first sight, these regional differences in fertility might seem to be mainly attributable to different norms, religious beliefs, and ethnic backgrounds. Turkish society is more modernist and Europe-oriented in the west, while traditional norms dominate in the east. The west is also far more economically developed, resulting in regional differences in access to education and employment opportunities. Yavuz (2005) suggests that differences in Turkish fertility by mother tongue are reduced once other characteristics such as literacy and formal employment are considered. When combining region and education in our analysis of fertility differentials, regional differences in fertility almost disappear among highly educated women, which suggests that geographic differences reflect mostly socioeconomic differences rather than ethnic and/or normative differences.[16]

According to Turkish census data, women from the south-east and the north-west follow similar educational trajectories, with increasing proportions of women having completed at least primary education. In all cohorts, however, the proportions of women having completed primary, secondary, and tertiary education are higher in the north-west than in the south-east, and increases in secondary and university education are much higher in the north-west.[17]

Education levels of girls remain lower than those of boys in all regions of the country, but the gender gap is highest for rural regions in the south-east. Official statistics also show that gender differences in school enrollment in Turkey have been decreasing significantly over the last decade, and since 2005, at least for primary education, the school enrollment rates of girls and boys are nearly identical across regions at close to 100 percent. Investments in girls' higher education might still seem less beneficial to some parents in eastern regions, which are dominated by a large agricultural sector. In addition, access to education at secondary and higher levels remains limited in some area of the south-east. Increasing educational attainment of younger cohorts in these regions is likely to lead to migration to urban areas and/or to western Turkey; thus, education levels in rural areas remain low and fertility rates high, while education levels in urban areas increase and fertility decreases.

Figure 5, which combines 2000 census data for region and education, shows a substantial fertility difference of around 2 children between less-educated women in south-eastern and north-western areas. For more educated women (at least secondary completed), this regional difference is reduced to 0.5 children. The fertility differential between the two regions would be reduced by over 50 percent if women in the south-east had the same education levels as women in the north-west. Thus, for the 1960 cohort, more than half of the fertility difference between the two regions can be explained by differences in female education. This observation also suggests that fertility differentials between women in the north-west and

FIGURE 5 Completed fertility by cohort, regional background, and education in Turkey, 1935–1960 cohorts



SOURCE: Census (I-PUMS) 2000.

south-east are likely to be significantly reduced once the majority of women in both regions attain secondary education.

Secondary education is rare for women in the 1960 cohort (5 percent in the south-east, 10 percent in the north-west), but the proportions of women with secondary education are increasing for younger cohorts in both regions. Because these proportions are increasing faster in the north-west than in the south-east for cohorts born after 1960, fertility differentials between regions are widening, even if these differences might be somewhat mitigated by internal migration from rural to urban areas. SILC data for the 1969–1974 cohorts show that regions with high completed fertility rates are those with low average education levels and high proportions of illiterate women (southeast Anatolia: 45 percent illiterate, against 5 percent in Istanbul, West Marmara, and Aegean). Among the 9 percent of university-educated women in these cohorts, 50 percent live in Istanbul and Aegean, while only 2 percent live in southeast Anatolia. Educational differences are thus important for explaining fertility differentials between regions, and a convergence of education levels between regions is likely to result in a convergence of fertility behavior.

The impact of women's activity status on the probability of childbirth

We have seen that the transition from the second to the third child is a key factor for fertility levels in Turkey. It appears that university-educated women, who are becoming more numerous, are the most likely to choose not to have a third child. The following analysis examines the extent to which this decision is linked to women's and their partner's attachment to the labor market.

Data construction

Our regression analysis seeks to identify the characteristics of families that are most likely to decide for or against having a third child. (Results for first and second births are presented in Tables A and B in the Appendix and discussed in detail in Greulich, Dasre, and Inan 2015.) We focus our analysis on women's and their partner's activity status, but also control for other socioeconomic and demographic characteristics.

To estimate women's probability of having a third child as a function of labor market activity status, we use the longitudinal database to observe women's and their partner's activity status during a given period preceding the potential conception of a third child. This allows us to reduce the potential bias caused by inverse causality between labor market participation and fertility decisions (women's degree of labor market attachment might be influenced by larger family size intentions).

To observe women's and their partner's characteristics before potential conception, we use the longitudinal data set of SILC covering the years 2006–2011 for women aged 15–45 (rotational panel with individuals and households observed for a maximum of four years). We focus on women having two children at the beginning of the observed period. A dummy variable indicating the birth of a third child during the observed period serves as an endogenous variable, while we observe women's and their partner's characteristics during a given period before potential conception.

Obtaining the information needed requires that individuals be observed over a period of at least three years. Children born in the third and fourth quarters of each year are generally reported in the interview of the following year, as interviews usually take place during the first half of each year. Births that occur at the end of the year are thus not detectable immediately. Three consecutive years of interviews are thus needed: year t and year $t+1$ to identify all births that occur in year t, and year $t–1$ to observe women's (and their partner's) characteristics over a certain period before potential conception.

We are able to observe activity status for a certain period before potential conception of a third child, as SILC data contain information about labor market status on a monthly basis, as well as about the quarter in which children are born. For women who have a third child in year t (the test group), we observe their activity status during the three months before conception. For women who do not give birth in year t (the control group), we arbitrarily chose a three-month period during year $t–1$.

Around 40 percent of women are observed for four consecutive years. Women observed for four years who have not had a child in year t are included twice in our database, which allows us to increase the number of observations. To avoid estimation bias due to unbalanced panel data (the number of observed years may influence the probability of observed childbirth), we include second-event fixed effects for individuals observed for the second time. The data compilation described above allows us to apply a simple logit estimation model with robust standard errors.

We define an activity status as "stable" if it does not change during the three-month observation period.[18] The following categories are created for women's activity status during the three months before the potential conception of a child: stable employment (self-employed, employed, full-time, part-time); stable unemployment; stable inactivity; and other (student, retirement, military service, any change in the activity status over the three-month period).[19]

We include, one-by-one, a series of control variables to isolate other potential determinants from the impact of stable employment on women's decision to have a third child. We control for the activity status of a woman's partner by distinguishing between men who are in stable employment and those who are not. We also control for women's education (using the UNESCO ISCED classification to distinguish between graduate (with at least primary completed education) and non-graduate (illiterate and primary not completed) women and type of employment (family worker, agricultural work, registered vs. non-registered). We also test for household labor income, which includes the woman's and her partner's gross employment income, as well as their income from self-employment (observed for the whole year before the potential birth of a second child). Four categories are created for household labor income: zero, low, middle, and high—with the last three representing income terciles.

Besides these potential economic determinants, we control for demographic characteristics such as woman's age, age of the second child, and the age difference between the first two children. Finally, we include information about the sex of the first two children, as third births are more likely among parents who have two first children of the same sex (Friedman, Freedman, and Whelpton 1960). We do not control for region, as our descriptive analysis suggests that fertility differences between graduate and non-graduate women are highly correlated with fertility differences between regions. Rural/urban differences are taken into account by distinguishing between employment in and outside agriculture.

Table 1 gives a descriptive overview of the exogenous variables. The proportion of women having two children who are in stable employment (full-time and part-time, including self-employed) is 28 percent. The proportion in stable full-time employment is significantly lower for those women who are predicted to have a third child compared to those who stop at two. Part-time work as an employee is not common for Turkish women who may have a third child, but self-employment (either full-time

TABLE 1 Exogenous variables (proportions) as determinants of the birth of a third child in Turkey

	No 3rd child	3rd child	Significance of difference
Woman's stability in the labor market			
Stable full-time employment	0.11	0.02	**
Stable part-time employment	0.01	0.02	
Stable full-time self employment	0.11	0.05	
Stable part-time self employment	0.05	0.05	
Stable unemployment	0.01	0.00	
Stable retirement	0.01	0.00	
Stable student	NA	NA	
Stable inactivity	0.67	0.83	***
Stable military service	NA	NA	
Change in activity status within the observed three-months period)	0.04	0.03	
Partner's status			
Partner in stable employment	0.81	0.79	
Partner not in stable employment	0.13	0.16	
No partner	0.06	0.05	
Partner and married	0.94	0.95	
Partner but not married	NA	NA	
Both in stable employment	0.23	0.11	
Household wage income			
Zero household wage income	0.08	0.07	
Low household wage income	0.30	0.41	*
Medium household wage income	0.31	0.30	
High household wage income	0.30	0.23	
Woman's educational attainment			
Low education (illiterate, prim.not completed)	0.71	0.84	
Medium education (primary and secondary)	0.24	0.14	
High education (tertiary)	0.05	0.02	
Woman's age			
15-24	0.08	0.24	***
25-34	0.42	0.62	***
35-45	0.50	0.14	***
Age of second child			
0	0.09	0.10	
1-2	0.16	0.28	***
3-6	0.23	0.41	***
7+	0.51	0.22	***
Age difference first-second child	4.32	3.09	*
First two children have the same sex	0.46	0.56	*

*Significant at $p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
SOURCE: EU-SILC LT 2006–2011, women aged 15–45 with 2 children.

or part-time) is quite frequent. Women are reported as self-employed in SILC when working as contributing family workers, in subsistence activities in agriculture, and in informal and non-registered work. Most women are observed as inactive, and the proportion is larger for those women who are predicted to have a third child in the next year; 83 percent of these women are reported as inactive during the three months before conception of their third child. Around 80 percent of women's partners are in stable employment.

Estimation results

Table 2 shows regression results for the determinants of the birth of a third child in Turkey. Model 1 shows that being in stable employment is significantly negatively correlated with the probability of having a third child in comparison to all other activity categories. Model 2 distinguishes the other activity categories and shows that women who are inactive have a higher probability of having a third child than do women in stable employment. (Tables A and B in the Appendix show regression results for having a first and second child. The coefficient of employment is actually more negative and more significant for having a third child than for having a first or second child.)

The following three models in Table 2 include categorical variables for partner status, education and household income, as well as their interactions with stable employment to identify marginal effects. Model 3 shows that a woman's stable employment is particularly negatively associated with the birth of a third child if her partner is not in stable employment (estimated coefficient –1.60). The coefficient gets smaller, but the negative impact is significant also for women who have a partner in stable employment (–1.60 + 0.85 = –0.75). This points to the importance of women's contribution to family income, especially for women who already have two children.

The birth of a third child would likely lead to a reduction or cessation in women's employment, at least temporarily. The short follow-up period in SILC does not allow us to observe women's activity status after childbirth. However, our results show that among women with a partner who is not active in the labor market, employed women have a much lower probability of having a third child than do inactive women. This strongly suggests that the birth of a third child would reduce household income for families in which women work and partners do not, as women would have to stop or reduce their working activities, while household income remains unaffected by the birth of a third child for families in which neither partner works. The indirect cost of a third child (women's wage loss) thus seems to affect the decision to have a third child more than the direct costs, which are the same for the two types of families. Consequently, institutional support that allows

TABLE 2 Probability of having a third child in Turkey for married, partnered women aged 18–45 with two children (logit regressions)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Woman's activity status								
Stable employment	–0.85*	Ref.	–1.60	–1.02**	–1.02*	–1.18*	–1.33*	–1.40
Stable unemployment		N/A						
Stable inactivity		0.91**						
Other (unstable, retirement, student …)		–0.03						
Partner information								
Partner in stable employment			–0.30					
Partner not in stable employment			Ref.					
Woman's education								
Non-graduate				0.84***				
Couple's joint labor income								
Zero and lowest tercile					0.09			
Woman's type of employment								
Employed as family worker						–0.62		
Employed in agriculture							–0.56	
Not registered in social security								–0.68*
Interaction terms								
Stable employment and stable employed partner			0.85					
Stable employment and non-graduate				0.57				
Stable employment and low household income					0.38			

Woman's age								
18–24	0.76**	0.76**	0.75**	0.59*	0.72**	0.73**	0.72**	0.73**
25–34	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
35–45	–1.19***	–1.18***	–1.20***	–1.23***	–1.19***	–1.19***	–1.18***	–1.18***
Age of second child								
0	–0.81*	–0.80*	–0.81*	–0.79*	–0.81*	–0.80*	–0.80*	–0.81*
1–2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
3–6	0.40	0.40	0.41	0.46	0.41	0.40	0.40	0.40
7+	–0.27	–0.26	–0.27	–0.22	–0.27	–0.28	–0.29	–0.29
Age difference between first and second child	–0.17**	–0.17**	–0.16**	–0.14**	–0.16**	–0.16**	–0.17**	–0.16**
First two children are the same sex	0.41*	0.42*	0.41*	0.44*	0.40*	0.42*	0.41*	0.42*
Intercept	–2.63***	–3.51***	–2.39***	–2.85***	–2.68***	–2.64***	–2.62***	–2.64***
Number of observations	3,644	3,644	3,644	3,644	3,644	3,644	3,644	3,644
Number of events	109	109	109	109	109	109	109	109
Pseudo R^2	0.11	0.11	0.11	0.12	0.11	0.11	0.11	0.11
Test of joint significance:								
p (employed if partner employed)			0.01					
p (partner employed if employed)			0.59					
p (employed if non-graduate)				0.37				
p (non-graduate if employed)				0.01				
p (employed if low household labor income)					0.12			

*Significant at $p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

women to continue working while raising children is likely to facilitate the decision to have a third child.

Model 4 indicates that stable employment is significantly negatively correlated with the birth of a third child for graduate women (estimated coefficient –1.02), but is insignificant for non-graduate women who represent 10 percent of observed women already having two children (–1.02 + 0.57 = –0.45). The relative difference between non-graduate and graduate women concerning the impact of stable employment on the probability of having a third child is highest for the third child in comparison to first and second children (see Tables A and B). Thus, educated women who are employed face the most significant barrier to fertility, and this barrier is highest for the birth of a third child. As seen in Model 5, employed women also have a significantly lower probability of having a third child compared to women in other activity categories (inactive, unemployed, etc.) when the household is relatively well off (second or third tercile).

For Models 6 to 8, the categorical variable stable employment represents only a certain type of employment, while the other types are included separately. The effect of employment is significantly negative for women working as employees and employers, and still significantly negative, but with a smaller coefficient (–0.62 instead of –1.18) for contributing family workers, representing 43 percent of active women in the sample (Model 6). We find a significantly negative coefficient for women engaged in non-agricultural activities, but the coefficient is less negative and insignificant for those active in agriculture (representing 46 percent of active women in the sample; Model 7). Finally, for women in both registered and non-registered activities, employment significantly decreases their probability of having a third child, but the estimated coefficient for non-registered activities, representing 60 percent of active women, is less negative (–0.68 instead of –1.4; Model 8).

Model 3 in Table 2 suggests that the negative correlation between women's employment and the birth of a third child is likely to be caused by barriers to women combining work and family life. Models 4 to 8 provide further evidence for this suggestion. Barriers to combining work and family are highest for educated women working as salaried employees in the formal sector. Women who live in relatively poor households, who are poorly educated, and who work as family workers and in informal jobs are most likely to be engaged in agricultural activities, which are more compatible with childrearing.

Finally, to test our assumption that childbirth is likely to interrupt women's labor market activities in Turkey, we estimate determinants of the probability of being in stable employment for women having two children (i.e. activity status observed at *t*–1 for all women at risk of having a third child in year *t*). Table 3 shows the results. Controlling for women's age, women's probability of being in stable employment is lower when the

TABLE 3 Probability of stable employment in Turkey for partnered women aged 18–45 with two children (logit regressions)

	Model 1	Model 2	Model 3
Partner			
In stable employment		0.24*	
Not in stable employment		Ref.	
Woman's education			
No graduate			0.10
Primary and secondary			Ref.
University education			2.09***
Woman's age			
18–24	0.12	0.14	0.32
25–34	Ref.	Ref.	Ref.
35–45	0.30**	0.31**	0.13
Age of second child			
0	–0.13	–0.13	–0.23
1–2	Ref.	Ref.	Ref.
3–6	0.49***	0.49***	0.51***
7+	0.48***	0.48***	0.74***
Intercept	–1.52***	–1.74***	–1.73***
Number of observations	3,633	3,633	3,633
Number of events	983	983	983
Pseudo R^2	0.02	0.02	0.06

*p<0.05, **p<0.01, ***p<0.001

second child is still young (aged 1 or 2) (Model 1). Models 2 and 3 confirm this result by controlling for her partner's activity status and women's education. Model 2 shows that women with a partner in stable employment have a higher probability of being in stable employment themselves than women whose partner is not in stable employment. Model 3 shows that the probability of being employed for women with two children is highest for those with a university education.

When converting estimation parameters of Model 1 into probabilities, we find that, on average, 18 percent of women aged 25–34 having a second child aged 1 or 2 are employed. A comparison with women who are at risk of having a first and second child (see Greulich, Dasre, and Inan 2015 for the estimation results) reveals that the proportion of women in stable full-time employment decreases with birth order: 48 percent of childless women aged 25–34 are in stable employment, compared to 25 percent of women with one child and 18 percent with two. These results are further indication that childbirth causes a cessation or a reduction in women's working activities and reinforce our assumption that women in Turkey have to choose between larger family size and employment.

Conclusion

Turkey is undergoing rapid demographic and socioeconomic changes, and increases in female education and labor market participation are an important aspect of the country's social and economic trajectory (Cagatay and Özler 1995; Klasen 1999, 2002; Luci 2009; World Bank 2012). In parallel, Turkish fertility rates have been decreasing rapidly over the last several decades. On average, women still have slightly more than two children, but a continuation of current trends would cause fertility to fall below replacement level in the near future.

Fertility may well drop further if parents increasingly decide against having a third child. Educated women in the formal labor market are the most likely to decide not to have a third child, while activities in agriculture are found to be less in conflict with larger family size. In addition, women's employment is not conducive to having a third child in particular if their partner is not in stable employment. These findings point to the essential role of women as contributors to household income.

Public discourse in Turkey concerning the role of women remains largely traditional. Women are reminded that their principal role is motherhood, which is why part-time work is privileged over full-time work. Denying women with children full economic participation illustrates that promoting gender equality is still not one of Turkey's political objectives. The Erdogan government apparently wishes to benefit from women's contribution to economic activity while maintaining traditional gender roles. Evidence from elsewhere in Europe shows that this approach leads to low fertility, as women are constrained to decide between children and economic gain. Gender equality thus emerges as a necessary condition for preventing Turkey's fertility from declining to levels below replacement.

Notes

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1 *Financial Times*, September 30, 2013.

2 *The Guardian*, November 24, 2014.

3 *Anadoly Agency*, January 15, 2015.

4 Turkey's Demographic and Health Surveys for 2008 and 2013 (Hacettepe University Institute of Population Studies, Ankara). Sobotka and Beaujouan (2014) and Testa (2012) find, similarly for other European countries, that fertility levels below replacement reflect barriers to realizing fertility intentions rather than low fertility intentions.

5 Turkey lags behind in the average enrollment rate of children aged 3–5 years in pre-school education (31 percent in Turkey vs. 82 percent on average in Europe) (OECD Family Database 2012). Along with Switzerland, Turkey is last on the list when focusing on children of age 3 only (4.6 percent in Turkey vs. 73 percent on average in Europe); for children aged 0–2, formal child care

is practically non-existent in Turkey (vs. 32 percent on average in Europe). In addition, most public child care facilities and public elementary schools have only reduced hours of operation. Parents who work full-time thus rely mostly on private institutions when seeking all-day child care (Turkish Ministry of National Education 2014).

6 Both formal and informal employment is taken into account in the Labour Force Survey.

7 In this article, the EU average refers to the arithmetic mean of 26 European countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

8 General Population Census (5 percent sampling) for 1980, 1985, and 2000 provided by the Turkish Statistical Institute; census data also provided by IPUMS-I.

9 The solid line shows specific peaks for every "round" generation (born in a year ending in 00 or 05), given that their exact age is unknown, especially for older cohorts, and hence women report "round" birth years as proxies.

10 To identify which birth order is most responsible for the fertility gap between Turkey and the EU average, we proceed in two steps. First, we calculate the proportions of women having at least *n* children ("cumulated frequencies") for Turkey and the EU. The sum of these cumulated frequencies yields the country's approximate completed fertility. Second, we calculate the differences between the countries' cumulated frequencies. By definition, these differences sum to the gap in completed fertility between Turkey and the EU (0.6 children).

11 Appendix is available at the supporting information tab at wileyonlinelibrary.com/journal/pdr.

12 For the youngest observed cohort (1977, aged 23 in 2000), some 60 percent of women had completed primary education. The proportion of women with completed secondary education rose sharply between the 1960 and 1977 cohorts, and particularly for the latest observed cohorts. Education rates are not presented here for cohorts later than 1977, as our intention is to focus on completed education and completed fertility.

13 According to census data, the average number of children observed at the end of mothers' childbearing years decreased from 5.7 in the 1930 cohort to 3.2 children in the 1960 cohort. If the number of children per woman had been stable within each education group, while only the distribution of women among education groups had changed, then fertility would have decreased by only 1.5 children instead of 2.5 (structural effect). If the distribution of women among education groups had been stable and only the number of children in each education group had been decreasing, then fertility would also have decreased by 1.5 children. The cumulated effect is a decrease of 2.5 in the average number of children.

14 The reported region in SILC is the place of residence, not the province of birth as in the census data.

15 Comparing approximate completed fertility rates by region reported by SILC with those reported by the Turkish Demographic and Health Survey (2008, women aged 40–49) results in the same ranking of regions and suggests that SILC data underestimate fertility rates especially for the southeast, where fertility is highest and mothers have their children relatively early.

16 Information about fertility behavior of internal migrants reinforces this finding. Turkey is characterized by large flows of internal migration. Most of the time individuals and/or families migrate from east to west, from rural to urban areas, and from eastern Anatolian regions to coastal regions. In most cases, migration is motivated by economic factors and related to education and employment opportunities, and migrants who migrate from east to west tend to adopt Western fertility behavior (Gökhan and Filiztekin 2008).

17 Proportions of women in the 1975 cohort by education category in the southeast: less than primary 45 percent; primary completed 45 percent, secondary completed 8 percent, university completed 2 percent. In the north-west: less than primary 5 percent;

primary completed 65 percent, secondary completed 20 percent, university completed 10 percent (Population Census 2000).

18 The three-month period is not long enough to measure employment "stability," but nevertheless provides more information than labor market status reported at the time of the survey. Because individuals are only followed up for a relatively short period, the SILC database does not allow us to analyze the impact of labor market stability on childbirth.

19 Change in activity status is not reported in further sub-categories, as only a very small minority of women is represented by this group—see Table 1.

References

Aran, M.A. and C. Ridao-Cano. 2013. "Early childhood health and education outcomes and children's exposure to multiple risks in Turkey," *Development Analytics Research Paper Series* 1305. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2333443

Cagatay, N. and S. Özler. 1995. "Feminization of the labor force: The effects of long term development and structural adjustment," *World Development* 23: 1889–1894.

Çarkoğlu, A., N. Kafescioğlu, and A. Mitrani. 2012. "Review of explicit family policies in Turkey from a systemic perspective," *Journal of Child and Family Studies* 21(1): 42–52.

Council of Europe. 2009. "Family Policy in Council of Europe Member States," Two expert reports commissioned by the Committee of Experts on Social Policy for Families and Children. Strasbourg.

Dayıoğlu M. and M.G. Kırdar. 2010. "*Determinants of and trends in labor force participation of women in Turkey*," State Planning Organisation and World Bank, Working Paper No. 5, March 2010. http://siteresources.worldbank.org/INTTURKEY/147254-1268836253913/22540873/DeterminantsOfAndTrendsInLaborForceParticipationOfWomenInTurkey.pdf.

European Survey of Income and Living Conditions (EU-SILC). 2011.

Freedman, D., R. Freedman, and P. Whelpton. 1960. "Size of family and preference for children of each sex," *American Journal of Sociology* 66(2): 141–146

Greulich, A., A. Dasre, and C. Inan. 2015. *"Fertility transition in Turkey—who is most at risk of deciding against child arrival?,"* World Bank Policy Research Working Paper WPS7310, June.

Greulich, A., O. Thévenon, and M. Guergoat-Larivière. 2016 "Securing women's employment: a fertility booster in European countries?" Centre d'Economie de la Sorbonne Working paper 2016-24.

Güneş, P.M. 2013. "The impact of female education on fertility: Evidence from Turkey," GCC Working Paper Series, GCC 13-01.

Hacettepe University Institute of Population Studies (HIPS). 1979. "*1978 Turkish Fertility Survey. First Report. Volume I: Methodology and Findings,"* Ankara: Turkish Historical Society Press.

———. 2009. *"2008 Turkey Demographic and Health Survey."* Ankara.

———. 2014. *"2013 Turkey Demographic and Health Survey,"* Ankara.

Inan, C. 2007. "La population de la Turquie: évolutions démographiques depuis 1927," *Cahiers Démographie des Balkans* 9, Volos.

Ince, M. 2010. "How the education affects female labor force? Empirical evidence from Turkey," *Procedia-Social and Behavioral Sciences* 2(2), 634–639.

Kılıç, A., A. Yazıcı, and Ç. Yoltar. 2009: "Türkiye'de Çocuk Bakım Hizmetlerinin Yaygınlaştırılmasına Yönelik Bir Öneri: Mahalle Kreşleri." Boğaziçi Universitesi Sosyal Politika Forumu Araştırma Raporu.

Kırdar, M.G., M.D. Tayfur, and İ;. Koç. 2011. "The effect of compulsory schooling laws on teenage marriage and births in Turkey," IZA Discussion Paper no. 5887, July.

Klasen, S. 1999. "Does gender equality reduce growth and development?," World Bank Policy Research Report Working Paper No. 7, The World Bank, Washington, DC.

Klasen, S. 2002. "Low schooling for girls, slower growth for all?," *World Bank Economic Review* 16: 345–373.

Koç, İ., M.A. Eryurt, T. Adalı, and P. Seçkiner. 2010. "*Türkiye'nin Demografik Dönüşümü.*" Ankara: Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü.

Koç, I., A. Hanciogly, and A. Cavlin. 2008. "Demographic differentials and demographic integration of Turkish and Kurdish populations in Turkey," *Population Research and Policy Review* 27: 447–457.

Luci, A. 2009. "Female labour market participation and economic growth," *International Journal of Sustainable Development* 4(2/3).

Luci-Greulich, A. and O. Thévenon. 2013. "The impact of family policies on fertility trends in developed countries," *European Journal of Population* 29(4): 387–416. (doi: 10.1007/s10680-013-9295-4).

Luci-Greulich, A. and O. Thévenon. 2014. "Does economic advancement 'cause' a re-increase in fertility? An empirical analysis for OECD countries (1960–2007)," *European Journal of Population* 30: 187–221 (doi: 10.1007/s10680-013-9309-2).

OECD Family Database. 2012.

Sobotka, T. and E. Beaujouan. 2014. "Two is best? The persistence of a two-child family ideal in Europe," *Population and Development Review* 40(3): 391–419.

Testa, Maria Rita. 2012. "Family sizes in Europe: Evidence from the 2011 Eurobarometer survey," European Demographic Research Papers 2012, No. 2, Vienna Institute of Demography, Austrian Academy of Sciences.

Turkish Ministry of National Education. 2014. *National Education Statistics. Formal Education 2014–2015*.

Turkstat Labour Force Survey. 1992, 1997, 2002, 2007, 2012.

Uraz, A. et al., 2010. "Recent trends in female labor force participation in Turkey," State Planning Organization of the Republic of Turkey And World Bank Welfare and Social Policy Analytical Work Program Working Paper (2).

World Bank. 2009. *Female Labor Force Participation in Turkey: Trends, Determinants and Policy Framework*. Washington.

———. 2012. "Gender equality and development," *World Development Report*.

———. *World Development Indicators 2014*.

———. *World Development Indicators 2015*.

Yavuz, S. 2005. "Fertility transition and the progression to third birth in Turkey," MPIDR Working Paper WP 2005-028.

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Research Article

The quality of periodic fertility measures in EU-SILC

Angela Greulich

Aurélien Dasré

Contents

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Research Article

The quality of periodic fertility measures in EU-SILC

Angela Greulich[1]

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Abstract

BACKGROUND
The European Union Statistics on Income and Living Conditions (EU-SILC) are increasingly used in demographic analysis, due to their large country coverage, the availability of harmonized socioeconomic measures, and the possibility to merge partners. However, so far there exists no comprehensive analysis of the representativeness of the fertility behavior reported by EU-SILC.

OBJECTIVE
This paper quantifies the quality of periodic fertility measures in EU-SILC.

METHODS
We compare periodic fertility measures obtained with EU-SILC to unbiased measures from the Human Fertility Database (HFD) for several European countries, by applying a cross-sectional perspective.

RESULTS
We show that EU-SILC measures of periodic fertility are biased downward, mainly due to attrition, while births of order one for ages 20–29 are particularly underreported. However, we find no evidence of socioeconomic differentials in attrition.

CONCLUSION AND CONTRIBUTION
Our results suggest that for the majority of European countries, EU-SILC can be used for the analysis of childbearing behavior when respecting the measures of precaution mentioned in this article. These contain, for example, applying a retrospective approach and differentiating by rotation groups when calculating aggregate measures of periodic fertility.

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1. Introduction

The European Union Statistics on Income and Living Conditions (EU-SILC) are becoming increasingly popular in socioeconomic and demographic analysis.[3] The main advantage of EU-SILC is its large country coverage, with a provision of harmonized socioeconomic measures for both individuals and households.

EU-SILC is mainly used for economic analysis, with the demographic information (such as the number of children present in the household) used as controls. However, EU-SILC is also increasingly used for demographic analysis, particularly in fertility research, as the large international sample allows both marginal effects to be modeled and institutional determinants to be taken into account.

EU-SILC provides not only cross-sectional data but also a follow-up of individuals and households, albeit for only a relatively short period (see the schematic for more detailed information about the database). Therefore, EU-SILC is used not only for measuring household size but also for modeling determinants (and/or consequences) of childbearing behavior. The follow-up helps limit the risk of endogeneity, as individual and household characteristics can be observed during a certain period before the potential conception of a child when the purpose is to investigate determinants of childbirth.

EU-SILC-based studies on socioeconomic determinants of timing and intensity of childbirth, differentiated by birth order, have been conducted, for example, by d'Albis, Gobbi, and Greulich (forthcoming), d'Albis, Greulich, and Ponthière (2015), Greulich and Rendall (2016), Greulich, Thévenon, and Guergoat-Larivière (2016), Nitsche et al. (2015), Matysiak, Sobotka, and Vignoli (2016), Klesment et al. (2014), Rendall et al. (2014) and De Santis, Drefahl, and Vignoli (2014).

However, EU-SILC has not been designed to directly measure fertility indicators. Those indicators have to be compiled indirectly by using the 'own children method.' [4] Moreover, the sampling and the weighting procedures are not directly designed to ensure non-biased fertility measures. Thus, measures of periodic fertility are likely to be biased due to sample selection (underrepresentation of childless individuals who are 'at risk of having', i.e., likely to have, a child) and attrition. It is possible that attrition is directly linked to fertility, as childbirth (be it planned, expected, or just completed) might cause the individual or household to move, which implies a risk of losing

[3] http://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions

[4] This method consists of calculating fertility rates by age for a certain year by considering children who are living in the observed household at the time of the survey and who are born in the particular year of interest (Grabill and Cho 1965; Desplanques 1993).

respondents. This phenomenon potentially creates a systematic underestimation of periodic fertility measures (in the following called ‘measurement bias’).

This measurement bias causes problems if the individuals for whom childbirths are underreported have particular socioeconomic characteristics. In that case, not only descriptive but also econometric analyses will suffer from distortion.

While systematic work has been done to evaluate the quality of fertility measures in other important data sets such as the Gender and Generations Survey (Vergauwen et al. 2015),[5] few studies have addressed the issue of measurement bias of fertility in EU-SILC. The quantifications of the bias are not systematic and the available studies only focus on one country (De Santis, Drefahl, and Vignoli 2014, for example, for Italy). Other studies, for example, Iacovou, Kaminska, and Levy (2012), discuss the quality of EU-SILC data in general but do not provide a detailed analysis of the quality of fertility measures. They find, however, that the percentage of individuals followed on leaving their family home (young adults, separating couples) in EU-SILC is very low, which suggests that for at least some groups of individuals, fertility behavior is underreported.

This article systematically evaluates the quality of periodic fertility measures in the European Union Statistics on Income and Living Conditions (EU-SILC) for a large set of countries. We proceed in the following way. We first compare each country’s aggregate measure of periodic fertility (total fertility rates) obtained with EU-SILC to unbiased measures of total fertility rates and discuss potential reasons for the identified biases (section 2). We then focus on the problem of attrition in order to evaluate the risk that the measurement bias in periodic fertility is linked to socioeconomic characteristics (section 3). In section 4 we propose a retrospective approach which allows circumventing the measurement bias for most countries. For those countries with a remaining bias, we quantify the bias by age and birth order. In section 5 we evaluate how far the measurement bias in periodic fertility can be circumvented by differentiating between rotational groups. Section 6 concludes.

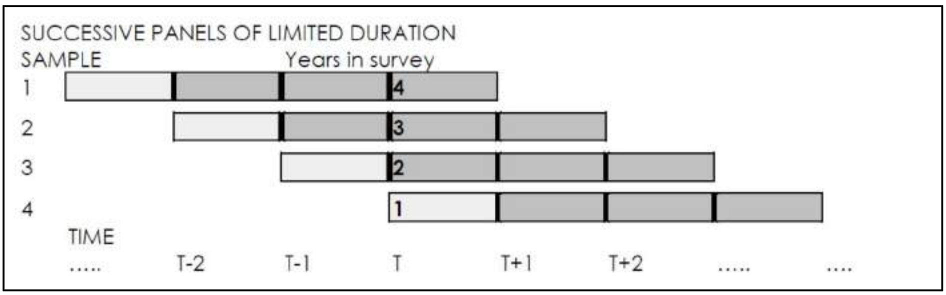
2. Description of the database

The European Union Statistics on Income and Living Conditions (EU-SILC) is a European survey provided by Eurostat. This survey was created in 2003 to replace the European Community Household Panel (ECHP) and now includes 31 European countries. Since then, Eurostat has released a new wave every year. The survey gathers harmonized and comparable data at the individual and the household level on income

[5] Vergauwen et al. (2015) compare indicators of first marriage and fertility estimated retrospectively from GGS to population statistics.

and living conditions, as well as on adults' demographic and socioeconomic characteristics (sex, age, education, labor market position, parenthood etc.).

EU-SILC is composed of two datasets, one cross-sectional and one longitudinal. The annual cross-sectional data is produced from the longitudinal panel (integrated design). The longitudinal dataset of EU-SILC is a rotational panel of four years, which means that for the majority of countries, individuals are observed for a maximum period of four years. The integrated design allows for a large number of observations for the cross-sectional database. In the cross-sectional database a quarter of individuals are observed for the first time, a quarter for the second time, a quarter for the third time, and a quarter for the fourth time (as shown by 'Time = T' in the schematic below). This integrated design reduces measurement bias due to cumulated respondent burden and sample attrition.



Source: Eurostat Guidelines for EU-SILC, 2012

Some countries provide a follow-up of longer than four years (nine years in France, five or more years in some Eastern European countries). By contrast, there is no longitudinal database for Germany. The majority of countries joined the survey in 2004 and 2005, while several Eastern European and Mediterranean countries joined in later (Malta, Croatia, Romania, etc.).

The survey contains information on both individuals and households. It is possible to identify adult women, their partner if they have one, and any children who live in the same household. EU-SILC does not report information on the number of children directly. However, children are observed with a proper identification number when living in their parents' households. For individuals aged 15+, EU-SILC provides both a register file and a personal file. The register file contains basic demographic information (age, sex, residential status, etc.). The personal file contains information about education, labor market participation, and income. For children aged 0 to 14, EU-SILC provides only a register file. Besides an individual registration number, the register files contain IDs for the household, father, mother, and spouse/partner, which enables users to merge household members. However, no distinction is made between biological parents, adoptive parents, foster parents, and step-parents.

Households are generally followed when moving as a whole. However, individuals who leave their original household are hard to follow, and this leads to problems of attrition.

EU-SILC provides detailed measures of individuals' labor market status (reported on a monthly basis and distinguishing between full-time and part-time employment, employment and self-employment, type of contract, hierarchy and sector, etc.). This information is rarely available in other, more 'demographic' surveys. One exception is the Gender and Generations Surveys, but this survey has more limited country and time coverage (just three waves, and only the first wave is nationally representative). Also, in the GGS, information on socioeconomic characteristics of the partner is not available, and employment measures are less detailed than in the EU-SILC. Other surveys, such as the European Labor Force survey, contain information on labor supply but not on income. Some surveys exist that contain both demographic and economic variables, with individuals being tracked for more than only four years. But the limitation of these datasets is their national focus, since these long-run surveys generally cover only one given country (the German Socioeconomic Panel or the American Panel Study of Income Dynamics, for example).

3. Quantification of the measurement bias in total fertility rates

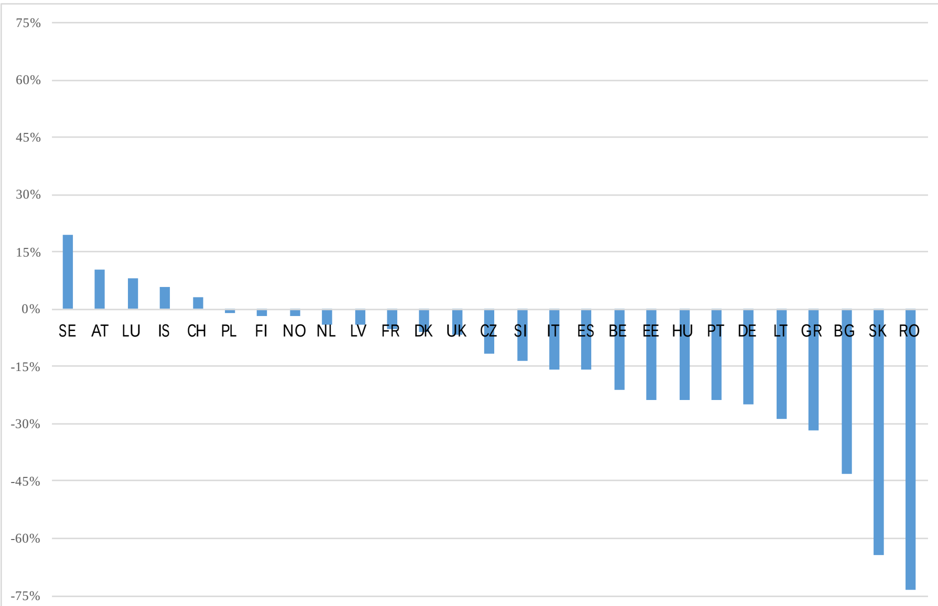
To get a first idea of the extent to which measures of periodic fertility are biased in EU-SILC, we use EU-SILC to construct total fertility rates (TFR) for each country. The cross-sectional samples of EU-SILC can theoretically be used to calculate aggregates, as the country samples are designed to be nationally representative probability samples of the population residing in private households within the country, irrespective of language or nationality. For each country, a minimum effective sample size is respected, and the personal cross-sectional weights of observed individuals (children included) sum to the real population size of each country.

To quantify the measurement bias, we compare the weighted fertility measures obtained from EU-SILC with the unbiased measure from the World Bank World Development Indicators (WB WDI) for 27 European countries. We use the WB WDI rather than the Human Fertility Database (HFD) in this section in order to obtain the largest possible country coverage. The HFD is then used in our later analysis, as it provides information on age-specific fertility by birth order, but only for a subgroup of European countries.

The WDI measures seem relatively unbiased, as they are limited to populations where the registration of births by official statistical agencies is virtually complete and where population estimates over the range of reproductive ages are reliable.

To measure total fertility rates with EU-SILC, we observe children born in 2010 in the cross-sectional database of 2011, for women aged 15+. To obtain the TFR, we calculate the sum of age-specific fertility rates for each country. We compare this measure to the total fertility rates for 2010, given in the World Bank's World Development Indicators.

Figure 1: Relative measurement bias in total fertility rates in EU-SILC



Sources: TFR: EU-SILC CS 2011 - children born in 2010, against WB WDI 2010

Figure 1 illustrates the relative measurement bias in total fertility rates for each country. EU-SILC underestimates total fertility rates in most European countries except Switzerland, Iceland, Luxembourg, Austria, and Sweden. The downward bias is highest in Romania, Slovakia, Bulgaria, Greece, Lithuania, and Germany. The arithmetic mean of the relative difference between the EU-SILC-derived TFR and the unbiased TFR is 15%.

The biases are quite heterogeneous between countries and fertility measures. Countries with high fertility rates are not automatically those with the highest biases in EU-SILC. The country classification in high- and low-fertility countries remains the same for the large majority of countries when using the EU-SILC measures or the unbiased fertility measures. Exceptions occur only for those countries with fertility measures around the European mean. EU-SILC identifies the same highest-high and lowest-low-fertility countries as in the HFD and the WB WDI. Figure A-1 in the Appendix compares EU-SILC-derived TFRs with the unbiased TFR measures and, besides an underestimation, also illustrates a high consistency between the series. There are larger discrepancies in total fertility rates for only a few countries. Without Slovakia and Romania, the correlation coefficient (R^2) between the two series is 0.72.

It should be noted that our method for calculating total fertility rates, also called the ‘own children method’ (as defined in section 1), is known to underestimate total fertility rates because between the date of birth and the time of the survey some children may die and some children may no longer live with their mother. Omissions of newborn children by respondents can also lead to understating this measure. However, the underestimation caused by these factors is known to be very low in European countries (5% of children in France, for example: see Desplanques 1993). Given the relatively large extent of the downward bias in total fertility rates in EU-SILC, it is likely that the bias is caused by other factors.

There are three possible main explanations of the downward bias in TFR in EU-SILC.

- First, it is possible that in the questionnaire some parents do not declare having a new child shortly after childbirth, but provide information about their children with a certain time delay.
- Second, it is possible that parents who have just had a child, who are about to have children, or who are at least likely to have children, are underrepresented in the sample (sampling selection bias). This is potentially linked to attrition.
- Third, attrition is potentially linked to childbirth. Parents who are planning to have a child, who are about to have a child, or who have just had a child might move due to this event, which would increase the risk of dropping out of the survey (sampling attrition bias). Attrition affects not only the longitudinal database but also the cross-sectional EU-SILC samples, due to its integrated design (see the schematic in the introduction for more information about the integrated design in EU-SILC).

In theory, as both the cross-sectional and the longitudinal data are based on nationally representative probability samples (see, for example, Eurostat, 2013, p. 20), the weighting procedure in EU-SILC should compensate for these losses. For each country Eurostat defines the minimum number of individuals and households required for sample sizes, and the database provides a series of weights (household design and cross-sectional weights, individual base weights, individual cross-sectional and longitudinal weights). According to the Commission Regulation on sampling and tracing rules (EC No 1982/2003, §7.4), "weighting factors shall be calculated as required to take into account the units' probability of selection, non-response and, as appropriate, to adjust the sample to external data relating to the distribution of households and persons in the target population, such as by sex, age (five-year age groups), household size and composition and region (NUTS II level), or relating to income data from other national sources where the Member States concerned consider such external data to be sufficiently reliable" (Eurostat, 2013, p. 30). Hence, for each country, weights are supposed to be adjusted to external sources (like censuses, population registers, labor force surveys etc.). In theory, by using weights, researchers should be able to reproduce the population structure of each country; in terms of composition by age and sex, for example, but also in terms of socioeconomic characteristics. However, the documentation provided by Eurostat about how weights are constructed is unclear (see also Iacovou, Kaminska, and Levy 2012), and Eurostat gives no precise information about the effectiveness of the weighting procedure conducted in each country. Consequently, the degree to which the weighted data is really representative of each country is unknown, both in terms of particular demographic characteristics such as fertility and in terms of particular socioeconomic characteristics. The fact that we identify a downward bias in total fertility rates suggests that the weighting process is inefficient in compensating for the underrepresentation of childbirths/ newborn children in EU-SILC.

4. Attrition

Among the three potential causes mentioned above, attrition merits particular attention due to its causal link with fertility.

In general, efforts are made by the interviewers to follow up households for the foreseen time period, even when the household moves or splits. In the longitudinal survey, Household ID and Personal ID never change, not even when the person moves to another household (Eurostat 2013). Information on household and individual movements is included separately in the longitudinal database (coded as "household status" and "membership status" in EU-SILC). However, tracing individuals and households who move between waves is not always successful. In the French SRCV, for example, only 65% – 70% of individuals who have moved in one year are followed up in the next year. The likelihood of being followed up when moving is highest for the principal respondent, and much lower for the other household members. Longitudinal weights provided in EU-SILC are supposed to take into account the phenomenon of non-response, but they are constructed based on the implicit hypothesis that individuals who moved but could have been followed up have the same characteristics as those who moved but could not have been followed up (Burricand and Lorgnet 2014).

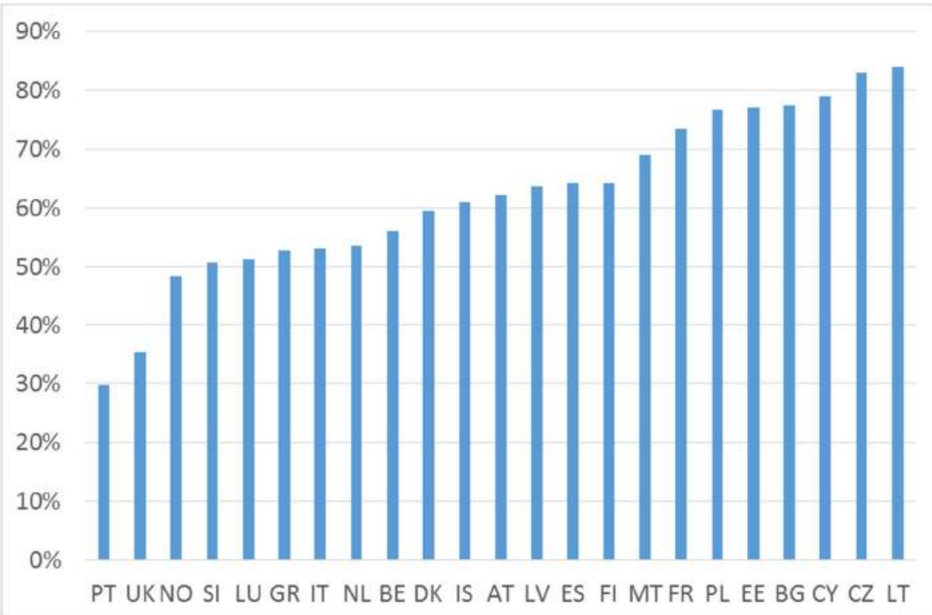
When comparing the events of childbirth reported by the longitudinal database to the ones reported by the cross-sectional EU-SILC database, we find that the longitudinal weights are calibrated to represent the cross-sectional population (for more detailed information, see Figures A-2 and A-3 and their interpretation in the Appendix). This reduces the bias caused by attrition to some extent, as the cross-sectional database is less affected by attrition. However, due to its integrated design, not only the longitudinal but also the cross-sectional databases are affected by attrition in EU-SILC.

Attrition is potentially linked to fertility, as starting or enlarging a family might incite parents to move, which increases the risk of not being followed up in EU-SILC. This risk is even higher in case of household splits. If a member of the household leaves the household to live elsewhere, the chances are high that he/she is no longer followed up, especially if the person is not the principal respondent. Adult children who leave the parental home are thus potential candidates for having relatively low follow-up rates. These are in general likely to have a first child, which might explain why EU-SILC especially underestimates childbirth of order one for young women below the age 30. Following this logic, first childbirth will be particularly underestimated for those adult children who leave the parental home because they start their own families. While in some European countries it is relatively common to live alone or to share a flat or live with a partner for a certain time before having children (Nordic countries, Continental countries), in other countries, especially Mediterranean ones, it is usual to leave the parental household only just before having one's own children (Eurostat 2015, Prioux 2006, Macura and Beets 2002, Kiernan 2002). These childbirths are particularly at risk of not being observed in the longitudinal EU-SILC database. Another group of individuals that might be particularly affected by attrition is people who divorce and separate (Iacovou, Kaminska, and Levy 2012). Births for those who found a new family shortly after separation also risk being under-reported in EU-SILC.

In order to gain more insight into the question of who is particularly concerned by attrition, we now analyze follow-up rates for women aged 15 to 55 who entered the EU-SILC in 2009 and who are supposed to be followed up for four years until wave 2012 (women are in the same rotation group, in each country). EU-SILC does not provide longitudinal data for Ireland, Switzerland, Germany, and Croatia. Sweden, Slovakia, and Romania are missing in Figure 2, as for these three countries longitudinal data was only available until 2011 at the time we conducted the analysis.

On average, for the 23 European countries 61% of women are followed up for four years. Figure 7 illustrates that the follow-up rates are very heterogeneous among European countries in EU-SILC. The countries with the lowest follow-ups are Portugal, the United Kingdom, and Norway, while follow-up rates are highest in Lithuania, the Czech Republic, and Cyprus.

Figure 2: Proportion of women being followed up for 4 years



EU-SILC LT 2009-2012, women aged 15 to 55

The heterogeneity in follow-up is potentially linked to a variety of factors, such as age structure and fertility behavior, but also data collection methods. In France, where a subgroup of individuals is supposed to be followed up for nine years, follow-up rates for the first four years were relatively good. However, Norway, Portugal, Slovakia, and Luxembourg also provide follow-up periods of more than four years for at least one-third of the sample for more recent periods, but the follow-up rates for the first four years for the period 2009–2012 are low in Norway, Portugal, and Luxembourg. In general, we observe that besides Norway, follow-up rates are also relatively low in Denmark and Iceland. This might also be linked to the fact that the in the Nordic countries (as in the Netherlands and Slovenia), data collection is based on administrative registers (they use registers to collect several variables) and other information is obtained via interviews with a ‘representative’ person in the household (Iacovou, Kaminska, and Levy 2012).[6]

Those countries presented in Figure 2 that have the highest follow-up rates are not necessarily those countries with the lowest bias in TFR. Lithuania, Bulgaria, Estonia, and France, for example, have relatively high follow-up rates but also high downward biases in TFR. Thus, a good follow-up does not necessarily lead to less-biased periodic fertility measures. Even if 80% or more individuals of a population are followed up, fertility will be downward-biased due to attrition if the individuals who are most ‘at risk’ of childbirth are the ones that are most likely to drop out of the database.

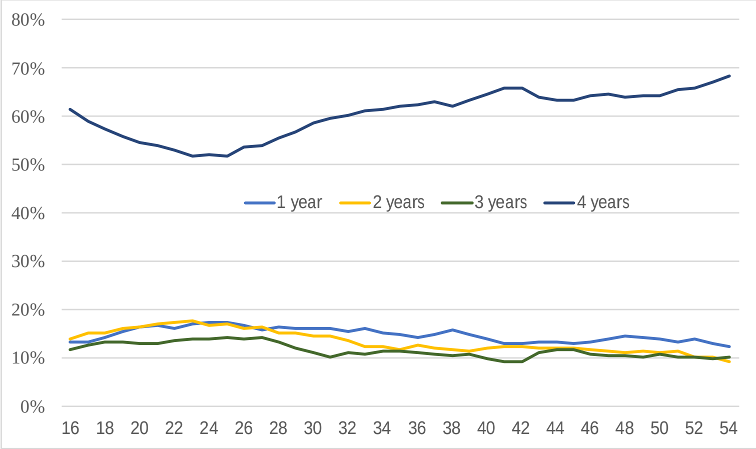
To understand which categories of women are most affected by attrition, we now calculate follow-up rates by age and number of children.

Figure 3 shows that, on average, in the 23 countries follow-up rates drop between age 15 and age 25 and then increase until age 30. Thus, follow-up rates are lower for women aged 20 to 30 than for women aged 30+.

Figure 4 shows that between ages 25 to 35 the proportion of childless women being followed up for four years is much lower than the proportion of women with at least one child. It is only from age 45 onwards that differences between women without and with children are no longer significant. Differences between mothers having one, two, and three or more children are never significant. Figures 3 and 4 suggest that once women have their own household with children they are quite well followed up, at least from age 25 onwards. Childless women seem to be difficult to follow, especially between the ages of 25 and 35. Follow-up rates are better for childless women at younger ages, probably because a significant proportion of these women still live with their parents. Follow-up rates are also better for childless women at later ages, probably because an significant proportion of these women are settled and no longer move home so much.

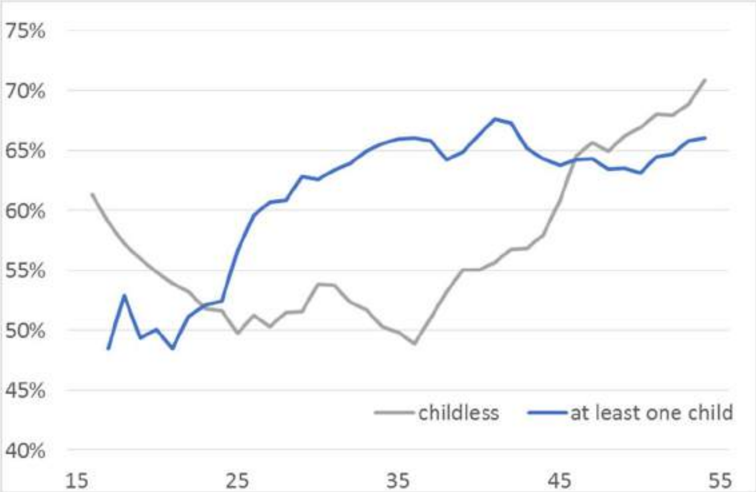
[6] The register countries are also problematic when it comes to observing the personal information of several household members at the same time in EU-SILC (for example, when the objective is to simultaneously observe a woman’s and her partner’s characteristics in terms of education, activity status, income, etc.). While the register files give complete information on the basic demographic characteristics of each household member, in many cases the personal file containing information about socioeconomic characteristics is only complete for the respondent. For about 50% of partners, some information, such as monthly activity status, is missing.

Figure 3: Proportion of women being followed up for *n* years, by age



EU-SILC LT 2009-2012, women aged 15 to 55, 3-year moving average
Weighted average of 23 European countries

Figure 4: Proportion of women followed up for 4 years, by age and number of children



EU-SILC LT 2009-2012, women aged 15 to 55, 3-year moving average
Weighted average of 23 European countries

We now further differentiate by a number of individual and household characteristics. Table 5 shows estimations of women's probability of being followed up for four years, without and with country-fixed effects (logit regression with robust standard errors). Characteristics are observed in the first observed year, i.e., 2009.

The regression confirms that demographic characteristics linked to fertility are highly related to attrition once socioeconomic characteristics and other side effects are controlled for. Childless women aged 20–30 (who are thus likely to have a first child) have the highest dropout rates.

Table 1 shows that couples with children have the highest follow-up probability, followed by couples without children. Lone mothers and, above all, single women (we observe here childless women who are not living with their partner) have a lower follow-up probability. Age has a convex impact, with the 22–25 age group having the lowest follow-up probability.

Those households that own the house or apartment they live in are better followed-up than those who rent. Women living in rural areas appear to be easier to follow up than those living in urban areas. All these characteristics are likely to be proxies for women's probability of staying in the same place of residence during the survey period.

When it comes to activity status, we do not find significant differences between employed, inactive, and unemployed women. The only status that is followed up significantly better in comparison to the other statuses is students, most probably because a significant proportion of students are still registered at their parents' home and the parents continue to answer the survey for them. However, the mother being present in the household of the woman is not significant once age, activity status, etc. are controlled for. Finally, once controlled for age and all other potential side effects including country-fixed effects, we find no significant differences between education groups in the probability of being followed up for four years.

Country-by-country regressions are presented in Table A-1 in the Appendix, available as additional material from the website. Apart from the fact that coefficients might not be significant due to low sample size, Table A-1 confirms that in general, in most European countries, the follow-up rate in EU-SILC does not depend on socioeconomic characteristics such as education or labor market status. Table A-1 also shows clearly that women in their twenties are harder to follow than women aged 30+ in almost all countries. Couples with children have the highest follow-up rates, in particular compared to childless women who are not living with a partner.

Table 1: Estimated coefficients for women being followed-up for four years, EU (23) (logit regression with robust standard errors)

		Without country fixed effects	With country fixed effects
Household type			
	Single	–0.328***	–0.273***
	Lone parent	–0.179***	–0.192***
	Couple with children	Ref.	Ref.
	Couple without children	–0.111**	–0.119**
Age			
	15–17	–0.130	–0.255**
	18–21	–0.275***	–0.374***
	22–25	–0.391***	–0.422***
	26–29	–0.314***	–0.350***
	30–34	–0.130***	–0.124**
	35+	Ref.	Ref.
Household tenure status			
	Owner	Ref.	Ref.
	Rent in market rate	–0.546***	–0.456***
	Rent-subsidized	–0.189***	–0.163**
	Accommodation free	0.0413	–0.0633
Degree of urbanisation			
	Densely populated area	Ref.	Ref.
	Intermediate area	0.0310	0.166***
	Thinly populated area	0.439***	0.344***
Education			
	Low	–0.166***	–0.0531
	Middle (upper secondary)		
	High (tertiary)	–0.00854	0.0387
Mother present in household			
	No	Ref.	Ref.
	Yes	0.0608	0.0153
Activity status			
	Working	Ref.	Ref.
	Unemployed	–0.0768	–0.0906
	Inactive	–0.0342	–0.0119
	Student	0.176***	0.206***
Country fixed effects		no	yes
Constant		0.753***	0.731***
Pseudo R^2		0.03	0.07
Number of obs.		32108	32108

* p<0.05, **p<0.01, *** p<0.001
EU-SILC LT 2009-2012, women aged 15 to 55.

Besides age and household type, tenure status and degree of urbanization are significantly correlated with women's probability of being followed up for 4 years. Home owners are easier to follow up than those who rent in the private sector, and those who live in rural areas are easier to follow up than those who live in urban areas. Exceptions here are small countries, for which the coefficient is most likely to be insignificant due to small sample size and/or because the country is a register country.

The coefficients of age, household type, tenure status, and urbanity suggest that residential mobility causes attrition in EU-SILC. The fact that single women in their mid-20s are particularly affected by attrition suggests that follow-up rates are particularly low for those who leave the (parental) household. This is in line with Burricand and Lorgnet (2014), who find that in the French SRCV individuals leaving a household are most affected by attrition.[7]

Our finding that socioeconomic characteristics do not play a major role in dropout observation risks suggests that attrition is not a general problem for obtaining consistent estimates when analyzing socioeconomic determinants of childbirth. However, the finding that single women around age 25 are most affected by attrition is rather problematic. This group is not only likely to have a first child but it is also possible that for these women attrition is caused by the fact that they are likely to have a first child. They might leave the parental household because they are pregnant, because they are about to give birth, or because they are planning to start a family in the near future. The closer the two events 'leaving the parental household' and 'starting own family with children,' the more problematic attrition is for demographic analysis (for example, in countries with long cohabitation and/or rather traditional countries).

In general, residential mobility and childbirth appear to be closely related events, not only for but particularly for first childbirth. Fertility-linked attrition leads to a downward bias in aggregate measures of periodic fertility. This is rather problematic for demographic analysis when the objective is to benefit from the richness of EU-SILC in terms of socioeconomic variables and country coverage, and to calculate, for example, TFR by socioeconomic group. As attrition is not much linked to socioeconomic characteristics, the differences in TFR between socioeconomic groups will not necessarily be biased, but the fertility levels will be generally underestimated.

[7] Burricand and Lorgnet (2014) also find some significant differences in attrition between socioeconomic groups, but their analysis is based on a longer follow-up period (2004–2010) for the French data, while we only model the probability of being followed-up for four years, which corresponds to the length of the follow-period that is available for most countries in the international EU-SILC-sample.

5. Applying a retrospective approach

Our TFR measure presented in Figure 1 is based on a cross-sectional database, using individual cross-sectional weights. The fact that we identify a downward bias in total fertility rates suggests that the weighting process in the cross-sectional database is not efficient enough to compensate for the underrepresentation of childbirths/newborn children.

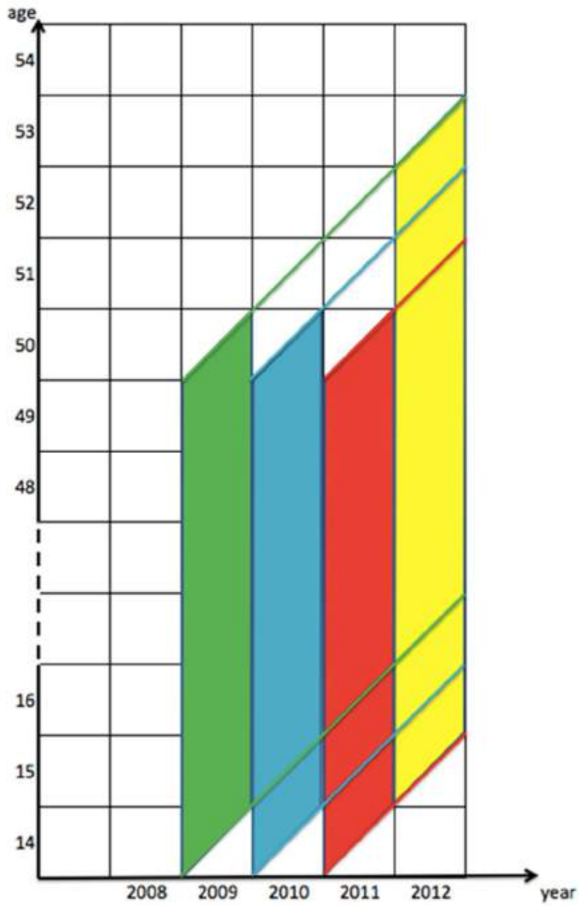
Following our argument that the downward bias in TFR in the cross-sectional database is linked to attrition, children should appear in the survey sometime after their birth. Once parents have moved and are settled with their children they potentially re-enter the survey in a nationally representative probability sample.

Under these circumstances, measures of periodic fertility will be underestimated in EU-SILC for most recent childbirths, but should be less biased for childbirths that occurred slightly longer ago.

To test this hypothesis, we calculate total fertility rates of certain years by using different waves of the cross-sectional EU-SILC database. The total fertility rate of a certain year is the sum of age-specific fertility rates of this year, while we observe childbirths of all birth orders. The cross-sectional database is used because of its larger sample size. Figure 5 illustrates the logic of our retrospective approach with a Lexis-diagram.

For example, we use the cross-sectional wave of 2012 to calculate total fertility rates for 2011, 2010, 2009, and 2008. For the TFR of 2011 we consider all children whose reported year of birth is 2011 by women aged 16 to 50 years old in 2012 (ages calculated by deducting the year of their birth from the survey year). For the TFR of 2010 we consider all children whose reported year of birth is 2010 by women aged 17 to 51 years old in 2012, and so on. We do not use the cross-sectional wave of 2012 to calculate the total fertility rates of 2012, as interviews for the 2012 wave took place throughout 2012: children born after the interview were therefore observed earliest in the interview of the following year.

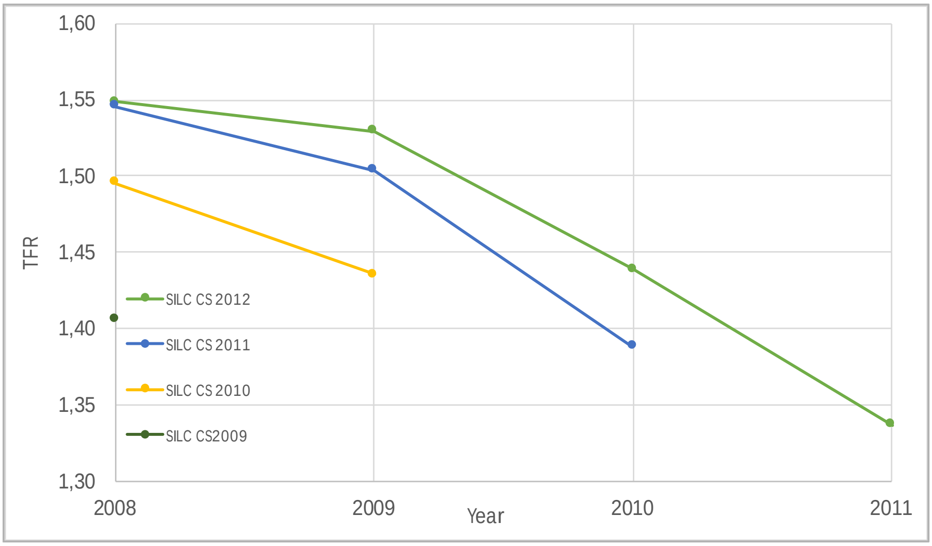
Figure 5: Lexis-diagram: Illustration of the retrospective approach in EU-SILC to calculate TFR



Source: Creation by the authors.

Figure 6 presents the total fertility rates for the years 2008–2011, obtained with the cross-sectional databases of 2009–2012. To facilitate readability without losing representativeness, for the waves concerned we group together all 30 countries for which cross-sectional samples are available. However, the latter analysis contains measures for each country.

Figure 6: Total fertility rates for the years 2008–2011, obtained with the cross-sectional databases of 2009–2012 (EU 30)



EU-SILC CS 2009, 2010, 2011, 2012.

Figure 6 shows that when using the 2012 wave, for example (light-green line), the calculated total fertility rate is the lowest in 2011 and TFR measures are higher in earlier years. For all waves, we observe that the more recent the year, the lower the TFR.

Given the fact that for all years the unbiased weighted TFR measure for this group of countries is higher than 1.55, Figure 11 shows that the downward bias becomes smaller the longer the time delay between the year of childbirth and the interview. The event "childbirth" is thus under-represented in EU-SILC, and children enter the survey during their first years.

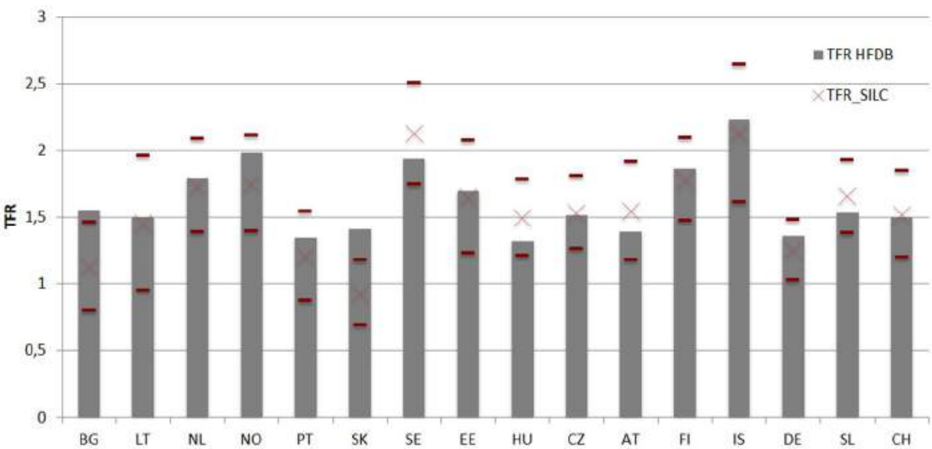
Thus, to limit the downward bias in periodic fertility measures, it seems reasonable to observe childbirth in a retrospective way; i.e., to allow for a certain time delay between the childbirth year and the survey year.

Figure 7 illustrates that applying a retrospective approach limits the downward bias in TFR to a significant extent in all countries. The EU-SILC measures of total fertility rates presented in Figure 12 allow for a time delay of more than one year between the time of the survey and the birth event. We use the cross-sectional database of 2012 to observe births in the years 2008, 2009, and 2010. Grouping together three years obtains a sufficiently large sample size for each country, which also serves for the latter analysis, decomposing TFR by age and birth order. To further reduce random variations we aggregate age-specific fertility rates in five-year age groups. With this procedure we observe a minimum of 30 births for each age group and birth order.

We compare these TFR measures to the unbiased measures of total fertility rates for the year 2009, which are calculated by using age-specific fertility rates from the Human Fertility Database. We also use the HFD measures for decomposition analysis by age and birth order, which is presented later in this article. Data on age-specific fertility rates by birth order is only available for 16 countries in the HFD. To ensure comparability, the HFD measures are also aggregated in five-year age groups.

Figure 7 illustrates that with the retrospective approach, the EU-SILC measures of TFR are not significantly different from the HFD for 14 out of 16 countries. In some countries, EU-SILC measures of TFR are even higher than HFD measures, but the difference is not significant. Children seem to be systematically underrepresented (in EU-SILC) in Bulgaria and Slovakia only.

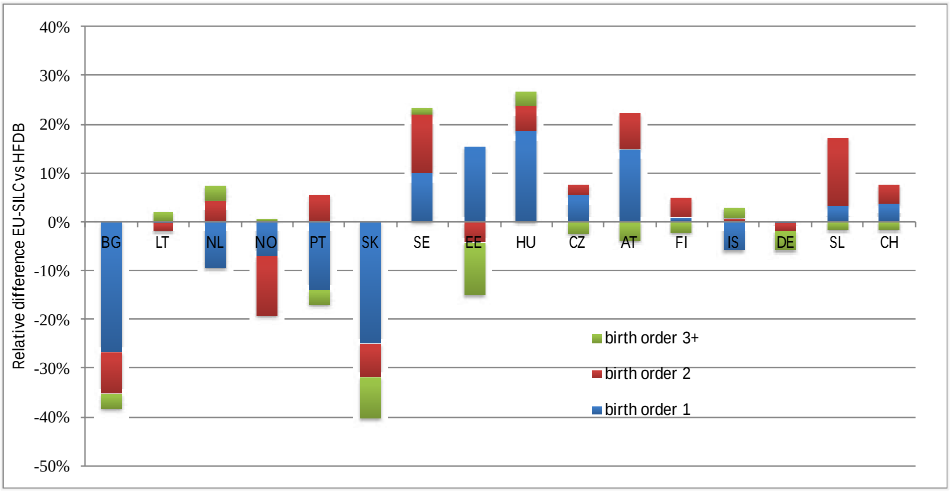
Figure 7: Comparison of EU-SILC retrospective measure and HFD measure of total fertility rates



HFD 2009.
EU-SILC CS 2012, TFR average for years 2008, 2009, and 2010.

We now use the same EU-SILC and HFD measures as in Figure 7 to calculate the measurement bias in TFR by birth order, as illustrated in Figure 8.

Figure 8: Measurement bias in TFR by birth order (EU-SILC retrospective measure vs. HFD measure)



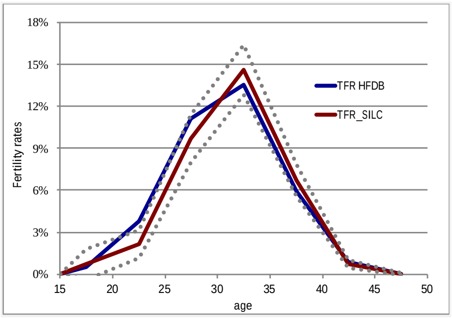
HFD 2009.
EU-SILC CS 2012, TFR average for years 2008, 2009, and 2010.

In most countries the remaining measurement bias is caused by children of birth order 1. The fact that total fertility rates are below two children per woman in most countries certainly contributes to the importance of birth order 1 for the measurement bias in TFR. However, the measurement biases are very heterogeneous in European countries and do not seem to be directly correlated with fertility levels.

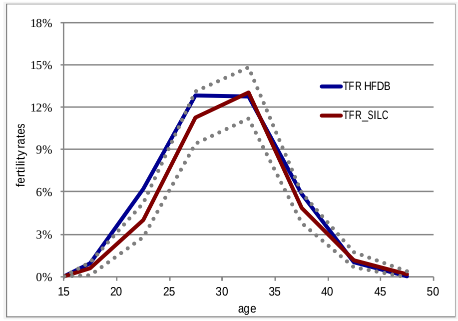
For those five countries with the highest remaining downward bias in total fertility rates (Bulgaria, Netherlands, Norway, Portugal, and Slovakia), we now analyze which ages are particularly affected. Figure 9 compares EU-SILC and HFD measures of the age-specific fertility rates, and shows that childbirth is significantly underestimated for ages 20 to 30 but not for higher ages.

Figure 9: Age-specific fertility rates by age (EU-SILC retrospective measure vs. HFD measure)

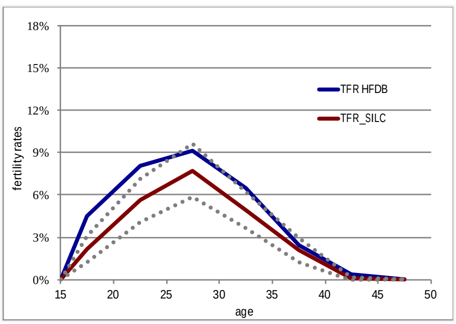
Netherlands



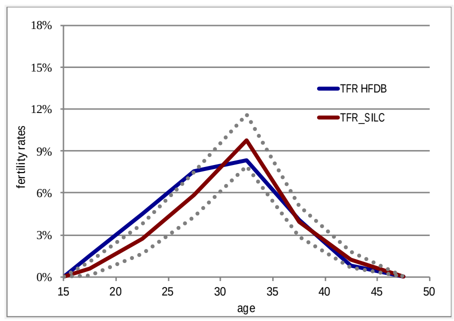
Norway



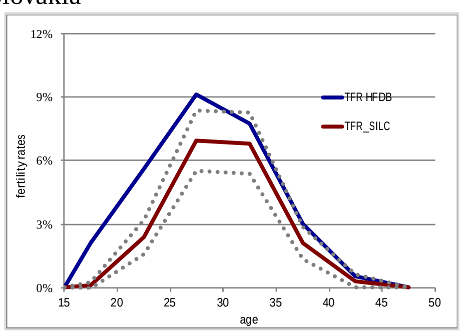
Bulgaria



Portugal



Slovakia

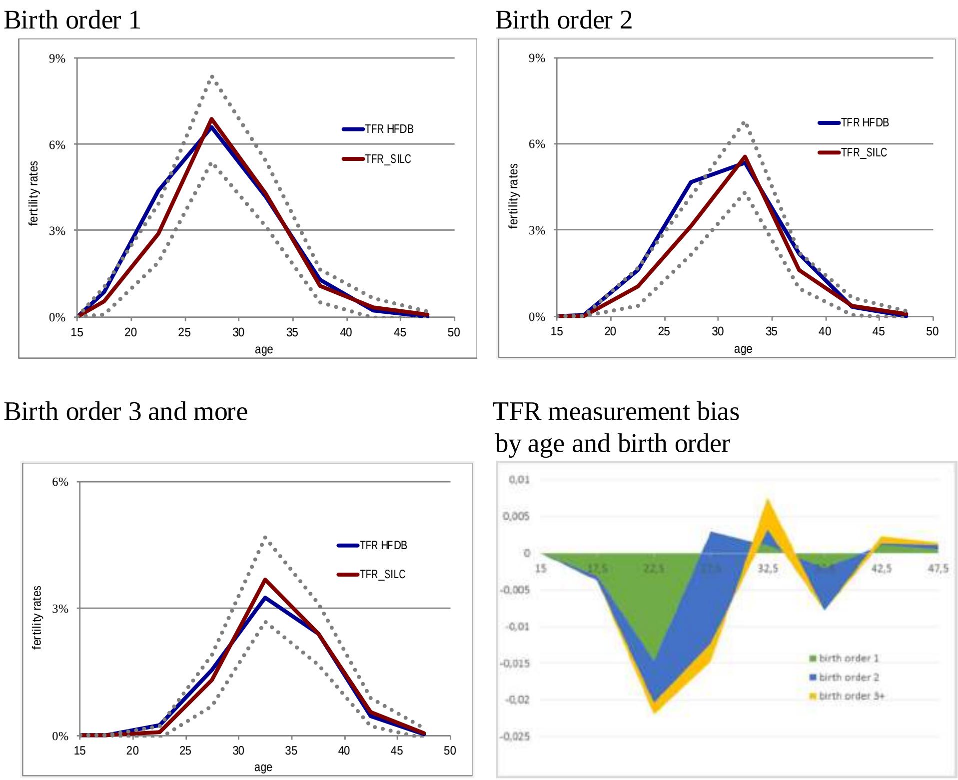


HFD 2009.

EU-SILC CS 2012, TFR average for years 2008, 2009, and 2010. Fertility rates aggregated in five-year age groups (15–19, 20–24, 25–29, etc.); group-averages presented at the mean age of each age group (17.5, 22.5, 27.5, etc.)

Finally, we combine the information on age and birth order. Figure 10 illustrates, exemplarily for Norway, the measurement bias in childbirths by age and rank (figures for the other 15 countries available on request).

Figure 10: Measurement bias in childbirths by age and birth order, Norway



HFD 2009.
EU-SILC CS 2012, TFR average for years 2008, 2009, and 2010.
Fertility rates aggregated in five-year age groups (15–19, 20–24, 25–29, etc.); group averages presented at the mean age of each age group (17.5, 22.5, 27.5, etc.)

Apart from Norway, we find that the rate of childbirths of birth order 1 is significantly underestimated for women aged 20 to 25/30 in Bulgaria, the Netherlands, Portugal, and Slovakia, but not in the other 11 countries.

For children of birth order 2 we find significant differences for women aged 20 to 25/30 in Bulgaria, Norway, Portugal, and Slovakia, but not for the other countries. With this retrospective approach, childbirths of birth order 2 are very clearly observable in EU-SILC for the majority of European countries, independent of woman's age. The blue and red lines are almost identical for most countries.

For children of birth order 3 there are no longer significant differences for any countries and any ages. Note, however, that from birth order 3 on, in many countries the confidence intervals become very large. Nevertheless, almost parallel red and blue lines can be found in the high-fertility countries like Norway, Sweden, Finland, and Iceland, as well as in the Czech Republic, Austria, and Slovenia. Unfortunately, the HFD does not provide data by birth order for France.

Note that these results were obtained by measuring fertility in EU-SILC with a retrospective approach, which limits the bias caused by attrition. Despite this approach, childbirths of birth order 1 and, to a smaller extent, also of birth order 2 are missing in some countries for women aged 20 to 30. This suggests that besides attrition there is a selection bias in these countries; i.e., not only childless women but also women aged 20 to 30 with young children are generally underrepresented in the sample in Norway, the Netherlands, Portugal, Bulgaria, and Slovakia, and cross-sectional weights do not sufficiently compensate for this fact.

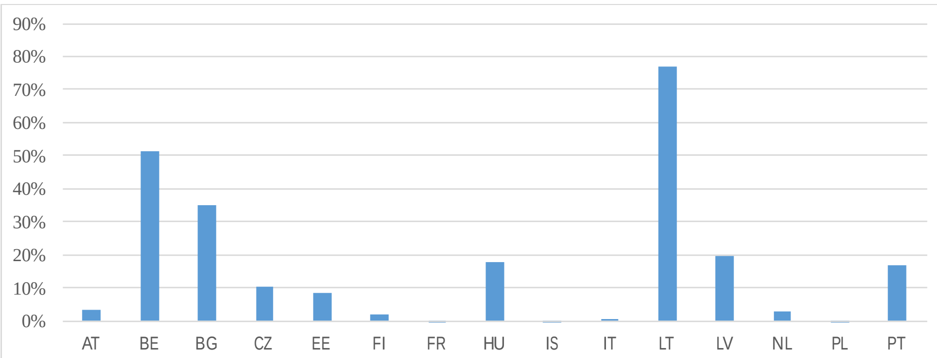
6. Differentiation by rotational groups

In the cross-sectional database, around a quarter of individuals are observed for the first time, around a quarter for the second time, around a quarter for the third time, and around a quarter for the fourth time (as illustrated in the schematic in the introduction). The cross-sectional dataset is thus composed of individuals/households of four different rotation groups. Following the logic that childbirth causes attrition, total fertility rates should be lower for those rotation groups in the cross-sectional SEU-ILC sample that contain individuals who have been observed for more than one wave.

To test this hypothesis, we calculate total fertility rates (retrospectively for the period 2008 to 2010, as in the previous section) based on the cross-section database of 2012, and differentiated by rotation group. We take into account individual cross-sectional weights. Due to attrition, the proportion of women who had just entered the survey (in 2012) is somewhat higher than the proportion of women who had been in the survey since 2009, 2010, and 2011. The Austrian cross-sectional sample for 2012, for example, contains 29% of women who entered the survey in 2012, 25% who entered in 2011, 24% who entered in 2010, and 22% who entered in 2009.

Figure 11 illustrates the relative difference in TFR for women who had just entered in 2012 and women observed since 2009, for each country. In the majority of countries, total fertility rates are higher for women who had just entered in 2012 than for women who had entered in 2009. This strongly indicates that childbirth causes attrition. Those women who entered the sample in 2009, and did not drop out until 2012, could have been followed up over the whole period of four years because they did not give birth to a child during that period and thus did not move. The group of women that has just entered the database is therefore more randomly selected than the other groups, as this group is not yet affected by selective attrition – which is why total fertility rates are higher for this group.

Figure 11: Relative difference in TFR for women who had just entered in 2012 and women observed since 2009, for each country



EU-SILC CS 2012, TFR 2008–2010.

7. Conclusion

The European Union Statistics on Income and Living Condition (EU-SILC) are increasingly used not only in economic but also in demographic analysis. Researchers benefit from the large country coverage and the availability of several harmonized socioeconomic measures. These variables are observed on an individual basis, and household members can be merged. The fact that women’s and their partners’ characteristics can be observed simultaneously represents a major advantage in comparison to other more demographic surveys such as the GGS. However, as a non-demographic survey, birth events risk being underreported in EU-SILC.

This paper sheds light on the quality of periodic fertility measures in EU-SILC. We find that attrition in the longitudinal database is linked to fertility behavior. Childbirth and residential mobility are correlated events. Consequently, individuals who are likely to have children have a higher probability of not being followed up. This particularly concerns childless women in their twenties. However, follow-up probabilities do not differ significantly between socioeconomic groups in EU-SILC. Thus, attrition is not a general problem in obtaining consistent estimates when analyzing socioeconomic determinants and consequences of childbirth. Yet childbirths, and in particular first childbirths of women under 30, are underrepresented in EU-SILC.

Longitudinal weights reduce the downward bias caused by attrition, as EU-SILC provides longitudinal weights such that the longitudinal population represents the cross-sectional population. However, childbirths are also underrepresented in the cross-sectional sample, as the annual cross-sectional data are produced from the longitudinal panel (integrated design). This leads to a downward bias in aggregate measures of periodic fertility. Differences in TFR between socioeconomic groups will not necessarily be biased, but the fertility levels will be generally underestimated. Due to fertility-linked attrition, total fertility rates are higher for those individuals who have just entered the sample in comparison to those who have been observed for consecutive waves.

Thus, one solution for obtaining less-biased measures is to calculate total fertility rates by only observing those individuals who have just entered the survey.[8] However, limiting the analysis to one particular rotation group significantly reduces sample size. This is rather problematic for certain analyses of demographic interest, such as calculating TFRs differentiated by socioeconomic characteristics, by country.

In order to maintain a sufficiently large sample size, we therefore suggest applying a retrospective approach when calculating total fertility rates with EU-SILC. Childbirth should not be observed for the calendar year previous to the cross-sectional wave, but with a more important time lag. Applying a retrospective approach limits the downward bias in TFR to a great extent. We find that with a three-year lag, total fertility rates are no longer significantly biased downwards in most European countries. In some countries, however, a downward bias persists despite the retrospective approach, which points to sample selection problems, which, besides attrition, distort measures of periodic fertility.

[8] EU-SILC makes it possible to distinguish between rotation groups in the cross-sectional sample. Attention has to be paid, however, as the rotation groups are numbered differently in the various countries (i.e., the numbers of the rotation groups do not identify the same entry years in all countries, as EU-SILC did not start in all countries in the same year).

Overall, our results suggest that for the majority of European countries, EU-SILC can be used for modeling fertility behavior when respecting the precautionary measures mentioned in this article. EU-SILC is a unique database which has several advantages: it covers a large set of countries and a relatively long time period, it includes not only cross-sectional but also longitudinal data, and, most importantly, it provides comparable socioeconomic information for all adult household members. EU-SILC thus has a strong potential for enriching not only economic but also demographic analyses.

In order to improve the quality of measures of periodic fertility behavior, and to allow EU-SILC users to infer information about national populations, a possible direction for future research is to derive weights that can be used to correct estimates of fertility.

8. Acknowledgments

The data used in this study are from the European Commission, Eurostat, the European Union Statistics on Income and Living Conditions (EU-SILC), the Human Fertility Database (HFD), and the World Bank World Development Indicators (WB WDI). The providers have no responsibility for the results and conclusions of the authors.

References

Burricand, C. and Lorgnet, J.P. (2014). L'attrition dans l'enquête SRCV: Déterminants et effets sur la mesure des variables monétaires. *Economie et statistique* 469(1): 19–35. doi:10.3406/estat.2014.10422.

D'Albis, H., Gobbi, P., and Greulich, A. (forthcoming). Having a second child and access to childcare: Evidence from European countries. *Journal of Demographic Economics.*

D'Albis, H., Greulich, A., and Ponthière, G. (2015). Avoir un enfant plus tard: Enjeux sociodémographiques du report des naissances. Paris: Rue d'Ulm (Collection du CEPREMAP n° 39).

De Santis, G., Drefahl, S., and Vignoli, D. (2014). Un indice synthétique de fécondité enrichi à partir des données de panel. *Population* 69(3): 463–476. doi:10.3917/popu.1403.0463.

Desplanques, G. (1993). Mesurer les disparités de fécondité à l'aide du seul recensement. *Population* 48(6): 2011–2023. doi:10.2307/1534171.

Eurostat (2013). Description of target variables: Cross-sectional and longitudinal, 2012 operation (version May 2013). Luxembourg: European Commission, Eurostat Directorate F (EU-SILC 065 [2012 operation]).

Eurostat (2015). Being young in Europe today [electronic resource]. Luxembourg: Eurostat Statistics Explained. doi:10.2785/59267.

Grabill, W.H. and Cho, L.J. (1965). Methodology for the measurement of current fertility from population data on young children. *Demography* 2(1): 50–73. doi:10.2307/2060106.

Greulich, A. and Rendall, M. (2016). Multiple imputation for demographic hazard models with left-censored predictor variables. *Demographic Research* 35(38): 1135–1148. doi:10.4054/DemRes.2016.35.38.

Greulich, A., Thévenon, O., and Guergoat-Larivière, M. (2016). Securing women's employment: A fertility booster in European countries? Paris: Centre d'Economie de la Sorbonne (CES working paper 2016–24). ftp://mse.univ-paris1.fr/pub/mse/CES2016/16024.pdf

Human Fertility Database [electronic resource]. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). www.humanfertility.org (data accessed on 01/03/2015).

Iacovou, M., Kaminska, O., and Levy, H. (2012). Using EU-SILC data for cross-national analysis: Strengths, problems and recommendations. Colchester: Essex University (Institute for Social and Economic Research Working Paper Series No. 2012–03).

Kiernan, K. (2002). Cohabitation in Western Europe: Trends, issues and implications. In: Booth, A. and Crouter, A.C. (eds.). *Just living together: Implications of cohabitation on families, children and social policy*. Mahwah: Lawrence Erlbaum: 3–32.

Klesment, M., Puur, A., Rahnu, L., and Sakkeus, L. (2014). Varying association between education and second births in Europe: Comparative analysis based on the EU-SILC data. *Demographic Research* 31(27): 813–860. doi:10.4054/DemRes.2014.31.27.

Macura, M. and Beets, G. (eds.) (2002). Dynamics of fertility and partnership in Europe: Insights and Lesson from Comparative Research (Vol. 1). New York: United Nations Economic Commission.

Matysiak, A., Sobotka, T., and Vignoli, D. (2016). *The impact of the great recession on fertility in Europe*. Paper presented at PAA 2016 Annual Meeting, Washington, 31 March–2 April.

Nitsche, N., Matysiak, A., van Bavel, J., and Vignoli, D. (2015). Partners' educational pairings and fertility across Europe. Stockholm University: Families and Societies (Working Paper Series 38/2015).

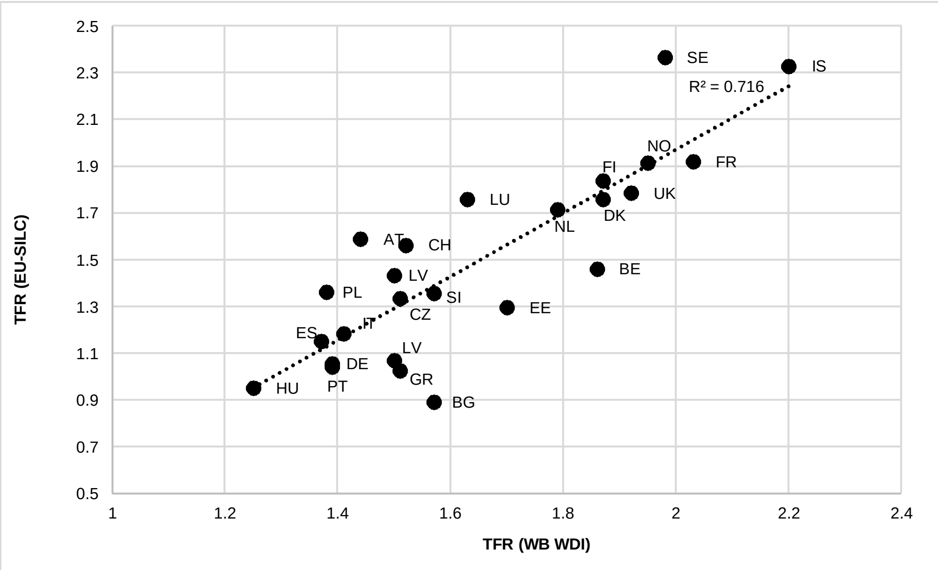
Prioux, F. (2006). Vivre en couple, se marier, se séparer: Contrastes européens. Paris: INED (Population et Société 422).

Rendall, M., DeRose, A., Evans, A., Gray, E., Hanappi, D., Kreuter, F., Lappegard, T., Reeder, L., Rønsen, M., and Toulemon, L. (2014). Employment impacts on partnership and parenthood entry in different family-policy regimes. Paper presented at European Population Conference, Budapest, June 27.

Vergauwen, J., Wood, J., De Watcher, D., and Neels, K. (2015). Quality of demographic data in GGS Wave 1. *Demographic Research* 32(24): 723–774. doi:10.4054/DemRes.2015.32.24.

Appendix

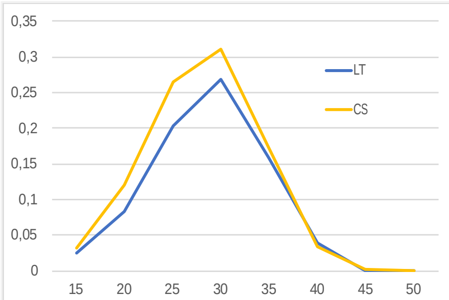
Figure A-1: Comparison of EU-SILC-derived TFR with unbiased TFR from the WB WDI



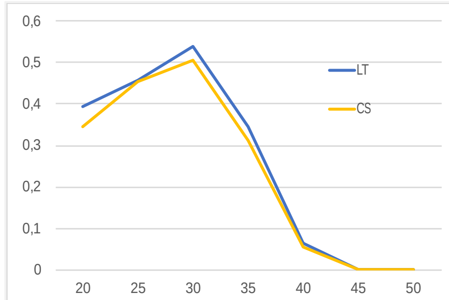
TFR: EU-SILC CS 2011 – children born in 2010, against WB WDI 2010.

Figure A-2: Probabilities of first childbirth by age – comparison of cross-sectional and longitudinal samples in EU-SILC, without weights

All women aged 15 to 50



Partnered women aged 15 to 50



EU-SILC LT 2009–2012, EU-SILC CS 2012, women aged 15 to 50.
Average 23 European countries

Control for attrition in EU-SILC by longitudinal weighting

Longitudinal weights provided in EU-SILC are supposed to take into account the phenomenon of non-response. To identify how far these longitudinal weights control for attrition linked to fertility within the EU-SILC databases, we compare fertility measures obtained with the cross-sectional and the longitudinal databases, with and without the respective weights.

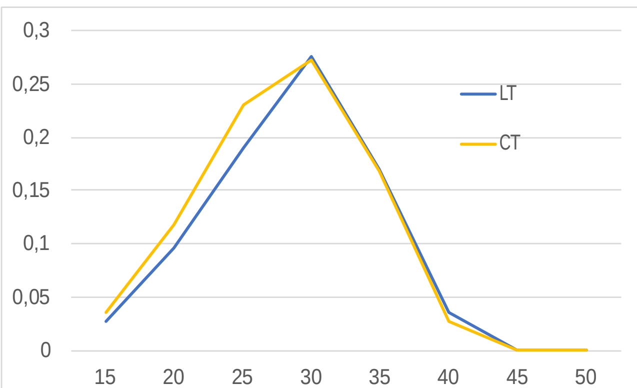
More precisely, we calculate age-specific fertility rates by birth order for women aged 15 to 50 in 2009. First, in the longitudinal database, we concentrate on women who are observed for the full period of four years, from 2009 to 2012, and we observe their childbirths during this period. Second, we use the cross-sectional database of 2012 to observe childbirths for the years 2009 to 2012. In each dataset we group together all countries that are available in the two datasets. We expect fertility to be lower in the longitudinal database, as here we selected only women who are observed for the entire four years, while the cross-sectional database contains four rotation groups.

Figure A-2 illustrates our findings for first childbirth.

Without taking into account the cross-sectional and longitudinal weights, we find that the phenomenon of first childbirth is underrepresented in the longitudinal database compared to the cross-sectional database, while the difference is significant for ages 20 to 30 (left panel). For second and third childbirths there is no significant difference between the two datasets (results are available on request). This again indicates that attrition is linked to first childbirth of young women. The right panel in Figure A-2 shows that once we focus on partnered women, the difference disappears. In the cross-sectional database we do not know if women were already partnered in 2009 (beginning of the observed period in the longitudinal database). In order to obtain the best comparability between the two datasets we select in both the longitudinal and the cross-sectional dataset women who were partnered in 2012. In line with the previous section, this suggests that being partnered is a good proxy for having founded one's own household, which increases the chance of being followed up in EU-SILC, even when the household as a whole moves. It seems that women who do not live with their parents until shortly before or after first childbirth are particularly affected by attrition. A country-by-country analysis (available on request) shows that the difference in first childbirth for ages 20 to 30 between the cross-sectional and the longitudinal database is particularly pronounced in Mediterranean countries, where late cohabitation with parents is quite common, while the differences are not significant in the Nordic countries, France, and other Continental countries, even for young ages.

Finally, taking into account the cross-sectional and longitudinal weights leads to the fact that the differences between the two datasets are no longer significant for all ages (all women, not only the partnered ones), as Figure A-3 illustrates.

Figure A-3: Probabilities of first childbirth by age – comparison of cross-sectional and longitudinal samples in EU-SILC, with individual weights



EU-SILC LT 2009-2012, EU-SILC CS 2012, women aged 15 to 50.
Average of 23 European countries

It seems thus that in EU-SILC, the cross-sectional database, which is less affected by attrition, serves to create longitudinal weights that reduce the fertility bias caused by attrition in the longitudinal database. However, attrition also affects the cross-sectional

EU-SILC samples to a significant extent, as the annual cross-sectional data is produced from the longitudinal panel (integrated design: see section 2, Description of the database).

Table A-1: Probability of women being followed-up for four years, country-by-country

available as additional material from:
http://www.demographic-research.org/volumes/vol36/17/files/36-17_appendix.xlsx.

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Descriptive Finding

Multiple imputation for demographic hazard models with left-censored predictor variables: Application to employment duration and fertility in the EU-SILC

Michael S. Rendall

Angela Greulich

Contents

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Descriptive Finding

Multiple imputation for demographic hazard models with left-censored predictor variables: Application to employment duration and fertility in the EU-SILC

Michael S. Rendall[1]

Angela Greulich[2]

Abstract

OBJECTIVE
A common problem when using panel data is that individuals' histories are incompletely known at the first wave. We demonstrate the use of multiple imputation as a method to handle this partial information, and thereby increase statistical power without compromising the model specification.

METHODS
Using EU-SILC panel data to investigate full-time employment as a predictor of partnered women's risk of first birth in Poland, we first multiply imputed employment status two years earlier to cases for which employment status is observed only in the most recent year. We then derived regression estimates from the full, multiply imputed sample, and compared the coefficient and standard error estimates to those from complete-case estimation with employment status observed both one and two years earlier.

RESULTS
Relative to not being full-time employed, having been full-time employed for two or more years was a positive and statistically significant predictor of childbearing in the multiply imputed sample, but was not significant when using complete-case estimation. The variance about the 'two or more years' coefficient was one third lower in the multiply imputed sample than in the complete-case sample.

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CONTRIBUTION

By using MI for left-censored observations, researchers using panel data may specify a model that includes characteristics of state or event histories without discarding observations for which that information is only partially available. Using conventional methods, either the analysis model must be simplified to ignore potentially important information about the state or event history (risking biased estimation), or cases with partial information must be dropped from the analytical sample (resulting in inefficient estimation).

1. Introduction

A frequently encountered problem when using panel data for demographic applications is that the individual's history is incompletely known at the first wave. It is common practice, but inadvisable (Özcan, Mayer, and Luedicke 2010), to ignore this left censoring. We suggest that multiple imputation (MI), a method typically used to handle non-response (Johnson and Young 2011), can be a general solution to the problem of left censoring in demographic hazard modeling. The Missing at Random (MAR) assumption needed for multiple imputation (Little and Rubin 2002) is sometimes problematic for data that is missing because of non-response (Allison 2001). The MAR assumption is much less likely to be problematic in the case of left censoring, however, as the missingness occurs "by design" (Raghunathan and Grizzle 1995). The 'design' in the case of panel surveys refers to the start date of the panel.

In a previous treatment of this problem in the US Panel Study of Income Dynamics, Moffitt and Rendall (1995) used a maximum likelihood approach to combine left-censored and non-left-censored spells of single motherhood in separate components of the likelihood. The statistical equivalence of maximum likelihood and multiple-imputation (MI) approaches to handling missing data has been noted (Schafer and Graham 2002; White and Carlin 2010). This equivalence assumes 'congenial' imputation and analysis models in which the variables used in the imputation model are also those used in the analysis model, and that the number of imputations $m \to \infty$ (Meng 1994: 543–544). Moreover, m need not be very large (Schafer and Graham 2002). Our choice of $m = 20$ in the present study reflects the relatively high proportion of person-year cases that are 'incomplete' (almost 50%).

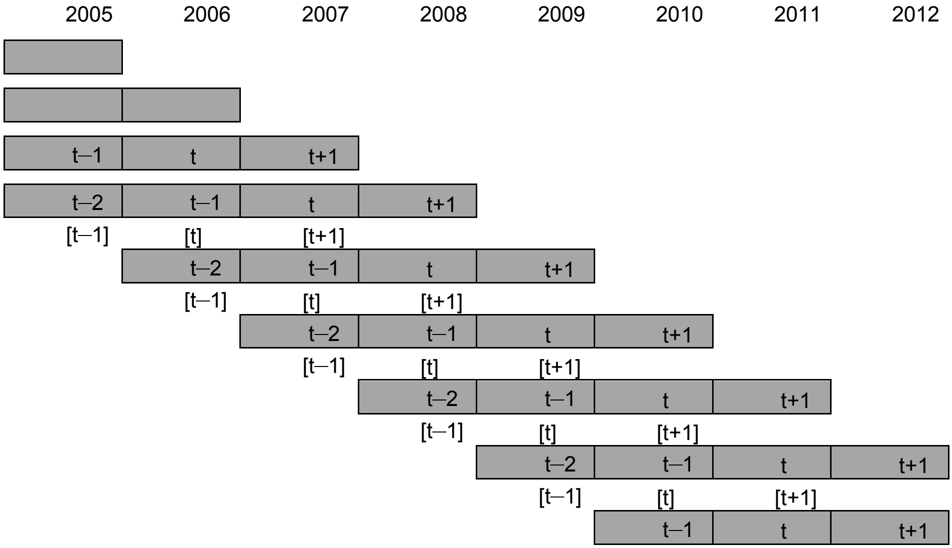
Separating the imputation step from the analysis step, however, has the major advantage of allowing the analysis step to use software designed for rectangular data structures. To our knowledge, MI has not previously been used to address the left-censoring problem. We evaluate gains to using MI this way in a simple example in which women in a panel survey contribute either one or two waves of employment status as a predictor of partnered first birth.

2. Data and method

We use the Poland country sample of the European Union Survey of Income and Living Conditions (EU-SILC), a group of more than 30 comparable country surveys (Eurostat 2011). The standard longitudinal implementation of the EU-SILC consists of a rotational panel in which individuals are observed annually for a period of four years, with four rotation groups present in each year. Poland's SILC follows this design. Selection into the sample occurs annually, beginning in 2005, and each new sample after 2005 is followed for four waves (see Figure 1). We choose Poland due to its relatively large number of observations, reflecting its larger population size than most EU-SILC countries, and because its wave-to-wave retention rate of approximately 90% is among the highest of the EU-SILC countries (Iacovou, Kaminska, and Levy 2012).

We limit our analyses to partnered women aged 18 to 39 who were observed for either three or four consecutive waves between the years 2005 and 2012 and who were childless when entering the survey. The upper age restriction is needed so that we may reasonably approximate a woman's being of parity 0 from a household variable of her having no co-resident children. The restriction to individuals observed for a minimum of three waves is necessary since interviews usually take place during the first half of each year and children born in the second half of each year are then reported at the interview of the year after the birth. Two consecutive years of interviews are therefore needed to identify all births that occur in one calendar year, and at least one more preceding wave is needed to observe the woman's employment status before exposure to conception and birth. For those individuals who are observed for three waves, the latter two waves are designated t and $t + 1$ and serve to identify a first birth interval in the calendar year of wave t. Wave $t - 1$ is used to observe the woman's employment status and that of her partner. For those individuals who are observed for four waves and for whom no birth occurs in the calendar years of the first two waves, the woman's employment status before birth exposure in year t is observed in both waves $t - 2$ and $t - 1$.

Figure 1: ‘Complete’ and ‘incomplete’ person-year sequences in the Poland country sample of the European Union Survey of Income and Living Conditions, 2005 to 2012



Note: ‘Complete’ person-year sequences include observation at t–2; ‘incomplete’ sequences do not.

2.1 Multiple Imputation (MI) for left-censored observations

We specify a model with outcome variable Y_t for a birth in calendar year t as a function of predictor variables observed at times $t-2$ and $t-1$. We allow woman’s full-time employment status E to have an effect on Y_t based on its values at both times $t-2$ and $t-1$, E_{t-2} and E_{t-1}. The other predictor variables, denoted by Z and consisting of age (operationalized as ‘age – 18’) and partner’s employment status, have effects on Y_t only from their values at time $t-1$. We delete observations with item non-response, which is anyway very low for our variables of interest in the Poland EU-SILC. That is, no imputation is attempted for missingness due to non-response, which we have noted above is more problematic with respect to the MAR assumption. This leaves us with N_1 ‘complete’ person-year observations $\{Y_t, E_{t-2}, E_{t-1}, Z_{t-1}\}_{i=1}^{N_1}$, omitting person-year subscripts throughout, and N_2 'incomplete' observations $\{Y_t, E_{t-1}, Z_{t-1}\}_{j=1}^{N_2}$. Figure 1 illustrates the five types of complete observations and the seven types of incomplete observations in our data. Whether a woman's birth-exposure year is preceded by one or two years of observed employment status depends on when she was sampled into the panel. Therefore employment status two years before birth exposure is reasonably treated as missing at random (MAR).

We first use the set of complete observations to estimate an imputation equation for E_{t-2}. We use sequential MI (Raghunathan et al. 2001) that allows for the imputation of binary, count, or continuous variables. In our case, the imputed variable is binary, and therefore logistic regression is appropriate:

$$LOGIT[\Pr\{E_{t-2} = 1 | E_{t-1}, Z_{t-1}, Y_t\}] = \gamma_0 + \gamma_1 E_{t-1} + \gamma_2 Z_{t-1} + \gamma_3 Y_t \tag{1}$$

We then apply random draws from the posterior distribution of parameter estimates $\hat{\gamma}_0, \hat{\gamma}_1, \hat{\gamma}_2, \hat{\gamma}_3$ to the incomplete data $\{E_{t-1}, Z_{t-1}, Y_t\}_{j=1}^{N_2}$ to derive an arbitrarily large number of values m of E_{t-2} (we set $m = 20$) to produce completed data $\{\{Y_t(k), E_{t-2}(k), E_{t-1}(k), Z_{t-1}(k)\}_{j=1}^{N_2}\}_{k=1}^{m}$. Following that, we concatenate the complete data $\{Y_t, E_{t-2}, E_{t-1}, Z_{t-1}\}_{i=1}^{N_1}$ to each instance of completed data and estimate the analysis equation m times. These m estimates are combined using standard multiple-imputation algorithms, or "combining rules" (Little and Rubin 2002), to produce a set of parameters with standard errors that adjust for the uncertainty introduced by imputation of E_{t-2} to the incomplete person-year observations. These combining rules account for the additional uncertainty due to imputation by adding 'between imputation' variance to 'within imputation' variance, thereby avoiding the underestimation of variance of single-imputation analysis (Zhang 2003: 584). This sequence of procedures is performed with standard package software SAS PROC MI and PROC MIANALYZE (SAS Institute 2008a, 2008b; code to replicate the analysis using STATA's *mi* procedure is provided online). This software uses unweighted data in the imputation equation. Consistent with common econometric practice for complete-data analysis, and to avoid issues of 'uncongeniality' between imputation and analysis models, our analysis equation is also unweighted.

Our analysis equation uses composites of E_{t-2} and E_{t-1}. We consider three durations l of full-time employment spells in progress at the time of birth exposure D_l: 0, 1, and 2+ years. The reference category is $D_0 \equiv \{1 \; if \; E_{t-1} = 0 \; and \; 0 \; if \; E_{t-1} = 1\}$ and therefore requires only information from $t-1$. To code the alternate categories of duration of exactly 1 year, D_1, and duration of two or more years, D_2, information at both times $t-2$ and $t-1$ is required, since $D_1 \equiv \{1\ if\ E_{t-1} = 1\ and\ E_{t-2} = 0\}$ and $D_2 \equiv \{1\ if\ E_{t-1} = 1\ and\ E_{t-2} = 1\}$. The analysis model we estimate is then:

$$LOGIT[\Pr\{Y_t = 1|D_2, D_1, Z_{t-1}\}] = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 Z_{t-1} \quad (2)$$

The expected efficiency gain in the estimation of β_3 when multiply imputing employment status at $t-2$, relative to estimation with the complete data only, is approximately equal to the fraction of observations with missing imputing employment status at $t-2$ (Little 1992, White and Carlin 2010, and see discussion in Rendall and Greulich 2014). The expected efficiency gains in the estimation of β_1 and β_2 are a priori unknown, but are of particular interest here. Because durations D_1 and D_2 are composites of employment status in times $t-2$ and $t-1$, they are constructed partially from observed data and partially from multiply imputed data. Therefore the reductions in $Var(\hat{\beta}_1)$ and $Var(\hat{\beta}_2)$ may be substantial, even though less than the reductions in $Var(\hat{\beta}_3)$. For $Var(\hat{\beta}_3)$, the corresponding variable vector Z is entirely constructed from observed data, and therefore the reduction in variance is expected to approximate the fraction missing.

3. Results

The sample consists of person-years exposed to a first birth among partnered, parity-0 women (see Table 1). For only 200 person-years do we observe the woman's employment status two years before her calendar year of exposure to first birth. Of a total of 671 person-year observations, 323 were full-time employed in the year before birth exposure $(t-1)$ and did not have employment status observed in the year before that $(t-2)$ because they had not yet entered the panel. These are the left-censored spells. The 'fraction missing' is then 0.481 (323/671). Across all person-years, a weighted 74.5% of women were full-time employed the year immediately preceding exposure to first birth, and 70.8% were full-time employed two years before exposure.

Table 1: Descriptive statistics and numbers of observations, partnered parity-0 Polish women ages 18–39, 2005–2012

Descriptive statistics (person-years, weighted)			
	Mean	Standard deviation	Sample size
woman's age	28.7	4.4	671
woman's full-time employment in t–1 (proportion)	0.745	0.436	671
woman's full-time employment in t–2 (proportion)	0.708	0.456	200
partner's full-time employment in t–1 (proportion)	0.859	0.349	671
Number of observations (unweighted person-years)			
Left censored observations: full-time employed at t–1, not observed at t–2			323
Non-left-censored observations			348
All observations			671
Fraction missing full-time employment duration (left-censored)			0.481

Note: all observations have valid values of age and partner's employment status at t-1 and of birth between t and t+1. All statistics are weighted.
Source: European Union Survey of Income and Living Conditions, Poland 2005–2012

Table 2: Logistic regressions of birth in year t, before and after imputing full-time employment status in t–2, partnered parity–0 Polish women ages 18 to 39, 2005–2012

	Model 1				Model 2			
	complete data, reduced specification[a]				complete data, full specification[b]			
	Estimate	Odds Ratio	Stand-ard Error	p-value	Estimate	Odds Ratio	Stand-ard Error	p-value
Intercept	–1.433		0.38	< 0.001	–1.413		0.48	0.003
Full-time-employed at t–1	0.658	1.93	0.26	0.011				
Full-time employed at t–1 and t–2 ("duration 2+ years")					0.675	1.96	0.35	0.056
Full-time employed at t–1 but not t–2 ("duration 1 year")					–0.112	0.89	0.67	0.867
age – 18	–0.102		0.03	< 0.001	–0.111		0.04	0.006
partner full-time employed at t–1	0.555		0.34	0.103	0.617		0.459	0.179
Sample	671				348			

a. Excludes employment status at time t–2.
b. Includes regressors constructed from employment status at time t–2.
c. Calculated by squaring the standard errors and taking the proportionate reduction in these variances about the parameter estimate from Model 2 to Model 3.
All regressions are unweighted.
Source: European Union Survey of Income and Living Conditions, Poland 2005–2012

Table 2: (Continued)

	Model 3				
	complete and multiply-imputed data, full specification[b]				
	Estimate	Odds Ratio	Standard Error	p-value	Reduction in variance, Model 2 to Model 3[c]
Intercept	–1.407		0.38	< 0.001	0.365
Full-time-employed at t–1					
Full-time employed at t–1 and t–2	0.724	2.06	0.29	0.012	0.342
("duration 2+ years")					
Full-time employed at t–1 but not t–2	0.365	1.44	0.59	0.539	0.220
("duration 1 year")					
age – 18	–0.106		0.03	< 0.001	0.536
partner full-time employed at t–1	0.559		0.34	0.104	0.440
sample n	671				

a. Excludes employment status at time t–2.
b. Includes regressors constructed from employment status at time t–2.
c. Calculated by squaring the standard errors and taking the proportionate reduction in these variances about the parameter estimate from Model 2 to Model 3.
All regressions are unweighted.
Source: European Union Survey of Income and Living Conditions, Poland 2005–2012

Regression results are presented in Table 2. In Model 1, in which all 671 person-years are used, but for which the specification of employment status is reduced to one prior year, being full-time employed at $t - 1$ is associated with a 1.93 greater odds of giving birth. This result is consistent with Matysiak's (2009) finding using retrospective data, in which she also used employment status only in the year immediately before exposure. She estimated the model without partner's employment status among her predictors, explaining (p. 260) that partner data was missing for more than half the female sample. Our specification instead takes advantage of the partner employment-status variable, which is both better obtained from a panel survey than a retrospective survey and has strong justification in the theory and evidence on couple fertility (e.g., Vignoli, Drefahl, and De Santis 2012).

Model 2 distinguishes between 1 year only and 2+ years of full-time employment, and is estimated with the 348 person-years for which these durations are observed in the complete data. Having been full-time employed 2 or more years ('duration 2+') is associated with a 1.96 greater odds of giving birth compared to not having been full-time employed in the prior year ('duration 0'). This is statistically significant, however, only at the 0.10 level (p = 0.06). Having become full-time employed only in the most recent year ('duration 1') is not a statistically significant predictor of giving birth. These results are suggestive of duration of full-time employment being a critical factor in predicting a partnered woman's first birth. When restricted to using complete data, however, we are only able to include employment duration in the model at the cost of eliminating almost half of an already small sample, thereby rendering both employment-duration coefficients non-significant at conventional thresholds.

Our preferred model is Model 3, in which all 671 person-year observations are used, and with a specification of full-time employment that distinguishes 0, 1, and 2+ years' duration. This is the model made possible by multiply imputing values of the full-time-employed variable for the 323 person-years in which the woman was observed as full-time employed at time $t - 1$ and was not observed at time $t - 2$. Being full-time employed for 2 or more years is associated with a 2.06 greater odds of giving birth compared to not having been full-time employed in the prior year ('duration 0'), and the coefficient is now significant at the 0.05 level (p = .01). Being full-time employed only in the most recent year ('duration 1') is again not statistically significant. The proportionate reductions in variances about the coefficients for age (0.536) and partner's employment status (0.440) approximate the fraction missing (0.481). The proportionate reductions in variances are respectively 0.342 and 0.220 for the coefficients for full-time employed two or more years and for full-time employed only one year. These reductions are substantially less than the fraction missing, as expected, but are nevertheless quite large.

4. Conclusion

In short panels and in panels that sample from populations rather than from cohorts, such as the EU-SILC of the present study and the U.S. Survey of Income and Program Participation (SIPP, US Census Bureau 2014), left censoring is present for almost every individual. Supplementary histories collected retrospectively may be much less accurate than panel collection (Jacobs 2002; Kyyra and Wilke 2014), and not all characteristics of state or event histories will be covered; for example, parent-child co-residence. We proposed MI as a general solution to the problem of left censoring in demographic hazard modeling. As an example, we examined the gains that may be realized by multiply imputing a single additional year of employment status before the first wave of the panel. This was the maximum possible amount of imputation in the four-wave EU-SILC. Nevertheless, it allowed us to conduct more effectively a simple test of the hypothesis that women are more likely to begin childbearing after first obtaining stable employment (Santarelli 2011). Using conventional methods to conduct this test would have required using only half the number of person-year observations that we were able to use in our multiply imputed data analysis.

Substantively, we found that being full-time employed for two or more years was strongly predictive of a birth. Only in the analysis with the multiply imputed data, however, was the coefficient statistically significant at conventional levels ($p < .05$). The magnitude of variance reduction about this coefficient in the multiply imputed data was around one-third. To have obtained a variance reduction of this size represents a substantial payoff to having multiply imputed the source variable (employment status at $t-2$) for a large fraction of the person-year sample. We attribute the large variance reduction to the fact that for every observation at least some information was available on the length of the employment spell. Future work, however, might profitably investigate the different amounts of variance reduction that may be realized under different types and magnitudes of missing versus non-missing information in left-censored histories.

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References

Allison, P.D. (2001). *Missing Data*. Thousand Oaks: Sage Publications.

Eurostat (2011). 2008 Comparative EU final quality report. Version 3, July 2011.

Iacovou, M., Kaminska, O., and Levy, H. (2012). Using EU-SILC data for cross-national analysis: Strengths, problems and recommendations. Institute for Social and Economic Research Working Paper Series No. 2012-03, Essex University.

Jacobs, S.C. (2002). Reliability of recall and unemployment events using retrospective data. *Work, Employment, and Society* 16(3): 537–548. doi:10.1177/095001702762217489.

Johnson, D.R. and Young, R. (2011). Toward best practices in analyzing datasets with missing data: Comparisons and recommendations. *Journal of Marriage and Family* 73(5): 926–945. doi:10.1111/j.1741-3737.2011.00861.x.

Kyyra, T. and Wilke, R.A. (2014). On the reliability of retrospective employment information in European Household Panel data. *Empirical Economics* 46(4): 1473–1493. doi:10.1007/s00181-013-0718-1.

Little, R.J.A. (1992). Regression with missing X's: A review. *Journal of the American Statistical Association* 87(420): 1227–1237. doi:10.2307/2290664.

Little, R.J.A., and Rubin, D.B. (2002). *Statistical analysis with missing data* (2nd Edition). Hoboken: Wiley. doi:10.1002/9781119013563.

Matysiak, A. (2009). Employment first, then childbearing: Women's strategy in post-socialist Poland. *Population Studies* 63(3): 253–276. doi:10.1080/00324720903151100.

Meng, X-L. (1994). Multiple-imputation inferences with uncongenial sources of input. *Statistical Science* 9(4): 538–573.

Moffitt, R.A. and Rendall, M.S. (1995). Cohort trends in the lifetime distribution of female family headship in the U.S., 1968–85. *Demography* 32(3): 407–424.

Özcan, B., Mayer, K.U., and Luedicke, J. (2010). The impact of unemployment on the transition to parenthood. *Demographic Research* 23(29): 807–846. doi:10.4054/DemRes.2010.23.29.

Raghunathan, T.E. and Grizzle, J.E. (1995). A split questionnaire survey design. *Journal of the American Statistical Association* 90(429): 54–63. doi:10.1080/01621459.1995.10476488.

Raghunathan, T.E., Lepkowski, J.M., van Hoewyk, J., and Solenberger, P. (2001). A multivariate technique for multiply imputing missing values using a sequence of regression models. *Survey Methodology* 27(1): 85–95.

Rendall, M.S. and Greulich, A. (2014). Multiple imputation for demographic hazard models with left-censored predictor variables. Maryland Population Research Center Working Paper PWP-MPRC-2014-011.

Santarelli, E. (2011). Economic resources and the first child in Italy: A focus on income and job stability. *Demographic Research* 25(9): 311–336. doi:10.4054/DemRes.2011.25.9.

SAS Institute (2008a). The MI Procedure. Chapter 54 SAS/STAT 9.2 User Guide, 2nd Ed.

SAS Institute (2008b). The MIANALYZE Procedure. Chapter 55 SAS/STAT 9.2 User Guide, 2nd Ed.

Schafer, J.L. and Graham, J.W. (2002). Missing data: Our view of the state of the art. *Psychological Methods* 7(2): 147–177. doi:10.1037/1082-989X.7.2.147.

US Census Bureau (2014). SIPP Introduction and History. http://www.census.gov/programs-surveys/sipp/about/sipp-introduction-history.html#. [Accessed October 13, 2014]

Vignoli, D., Drefahl, S., and De Santis, G. (2012). Whose job instability affects the likelihood of becoming a parent in Italy? A tale of two partners. *Demographic Research* 26(2): 41–62. doi:10.4054/DemRes.2012.26.2.

White, I.R. and Carlin, J.B. (2010). Bias and efficiency of multiple imputation compared with complete-case analysis for missing covariate values. *Statistics in Medicine* 29(28): 2920–2931. doi:10.1002/sim.3944.

Zhang, P. (2003). Multiple imputation: Theory and method. *International Statistical Review* 71(3): 581–592. doi:10.1111/j.1751-5823.2003.tb00213.x.