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Pre-school attendance and the labor supply of women in Italy

Evidence from an Instrumental Variable approach

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Abstract

Among European Union countries, Italy distinguishes itself for its dramatically low female participation rate in the labor market and fertility rate. This analysis investigates the effect of the provision of childcare through pre-primary education on the labor supply of Italian mothers, through the development of an instrumental variable approach based on the quarter of birth of their children. In accordance with the literature on this matter, the results highlight a strong and significant impact of enrollment in pre-school on the mothers' participation rate in the labor force and their employment rate. Moreover, said effects appear to be stronger for non-married mothers and for mothers living in southern regions. These results point towards a strengthening of childcare provision through an extension of mandatory education to pre-primary levels and to an increase in the coverage of nurseries. Finally, these findings are especially crucial in the current context as they highlight a priority for policymakers that are trying to understand what services' reopening should be prioritized following the lockdown for the COVID-19 pandemic.

Key words

Female participation to the labor market, childcare, family policy.

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1 Why should we read this research?

This research inquires a question that is crucial to developed nations, that is whether the provision of childcare supports women's participation to the labor market. Although the economic literature is very rich on this topic (Ferragina, 2020), there are no precise estimates regarding the relevance of childcare to female employment in Italy, with the exception of Brilli et al. (2016) which however focuses on childcare coverage rather than actual enrollment.

By contrast, this analysis provides causal estimates of such relationship, adapting the analysis conducted by Goux and Maurin (2010) in an original way and taking advantage of the European Union Statistics on Income and Living Conditions (EU-SILC) survey. In fact, by exploiting the quasi-random distribution of births between two consecutive quarters, this analysis develops an instrumental variable approach that provides causal and robust evidence of a strong effect of the provision of childcare, in the form of pre-primary education, on the labor outcomes of Italian mothers. Moreover, the results uncover a previously unobserved interaction between the geographical area of residence, the period under consideration (pre- and post- 2008 crisis) and the relationship that is being studied.

In conclusion, this analysis provides a good starting point for further research in this field, with a particular attention to geographical and time-related variations, as well as important results that argue in favor of an extension of childcare provision with the aim of balancing the participation to the labor market of males and females. Furthermore, the results provided are more relevant than ever as they suggest an important priority for governments that need to know what services to prioritize in the attempt of moving past the lockdown policies that have been in place during the months of March and April 2020, due to the current global pandemic.

2 Introduction

In the last 40 years, Western countries have witnessed a radical change in the social and economic role of women in society, that can be measured through the increase of their participation to the labor market and to the decrease in the fertility rate across these countries (Goldin, 2006).

However, this change did not affect all the developed countries in the same manner, as some of them still lag behind in terms of a balanced participation of men and women in the job market. Among these countries, there is Italy. Italian women display the lowest female labor force participation rate (computed for the population aged 15-64 years old) among EU Member States (Eurostat, 2020), as well as one of the lowest fertility rates (Eurostat, 2020). By contrast, France, a country that could be regarded as sharing many similarities with Italy, displays radically different outcomes in this respect, as it has an above average female labor force participation and one of the highest fertility rates in the EU.

The source of these differences, or at least part of the explanation, is likely to reside in the different approach to family policies that these two countries have taken. In fact, Ferragina's (2020) review of more than 200 studies on family policy and mother's employment outcomes provides multiple pieces of evidence that argue that these types of social welfare policies indeed have important and causal effects on the labor outcomes of women. More precisely, the main types of explicit family policy in which countries generally engage are parental work leaves, child benefits (both in the form of allowances and tax benefits), and the provision of childcare.

This paper focuses on the latter and answers to the research question of whether childcare provision for children aged 3 years old can improve the labor outcomes of their mothers in Italy. The research is conducted employing the data from the European Union Statistics on Income and Living Conditions (EU-SILC) from the year 2006 to the year 2015. The methodology employed in order to produce causal inferences is inspired from the work of Goux and Maurin (2010), who take advantage of the day of birth of children to employ a Regression Discontinuity Design. However, as the structure of the data used would not have allowed to apply the same approach, this research introduces an original methodology which consists in an instrumental variable model that employs the quarter of birth of children as an instrument for the probability of being enrolled at pre-school.

Hence, the analysis follows a main hypothesis and two secondary ones. The main hypothesis concerns the presence of a positive causal relationship between the children's pre-school attendance rate (and of the weekly hours of childcare received by pre-primary establishments, in the second specification of the model) and their mothers' labor outcomes, i.e. the employment rate (computed out of the total population) and their labor force participation rate. Then, the first sub-hypothesis focuses on non-married mothers, and maintains that the coefficients estimated previously would be stronger for this sub-sample. Finally, the second sub-hypothesis argues in favor of a geographical divide in the results and expects coefficients to be stronger in the northern part of the country, rather than in the South.

We find that the main hypothesis is confirmed, as pre-school attendance increases, on average, the employment rate of mothers by 23.5% and their labor force participation rate by 19.9% with a 99% significance level. Moreover, when focusing on non-married mothers, we are able to confirm again our hypothesis as the coefficients for the main regressor increases to 45.5% and 37.8% respectively. Finally, the second sub-hypothesis is not confirmed in the data, though an interesting pattern is observed by splitting the analysis between the years from 2006 to 2009 and from 2010 to 2015.

In conclusion, this analysis is consistent with the broader literature on this topic and provides causal estimates of the impact of the provision of childcare on the labor supply of mothers. On the basis of these results, it is possible to argue in favor of an extension of such services, in order to increase female participation to the job market in Italy. Finally, these results are particularly relevant in this historical period as governments struggle to understand which services to prioritize in the attempt to move past the lockdown they have undertaken due to the current Coronavirus Disease 2019 (COVID-19) pandemic. In fact, this analysis highlights the importance of guaranteeing the provision of childcare in order not to penalize women's ability to return to work.

3 State of the literature

The topic of family policies and their effects on female employment is a central one in the field of economics, as well as other ones such as sociology. Starting from the 1980s, the economic literature has shown a growing interest towards the policy drivers of female employment, in the face of an increasing participation of women to the labor market (Ferragina, 2020).

This increased attention towards women's employment coincides with the beginning of a phenomenon that Goldin (2006) calls the "quiet revolution". The author refers in these terms to the fourth phase of the development of women's modern economic roles. While she defines the

first three phases as "evolutionary", the last one, starting in the last years of the '70s, is considered "revolutionary" in relation to three aspects of women's choices and decisions. These are: horizons, meaning whether a woman perceives her lifetime labor force involvement as long or brief at the time of human capital investment decisions; identity, which is whether a woman "finds individuality in her job, occupation, profession or career"; and, finally, decision making, which refers to whether labor force decisions in a household with a couple are made fully jointly between the man and the woman, or whether the woman is considered as a "secondary worker" that optimizes her behavior according to that of her spouse/companion. Goldin argues that the shift from a static decision making with limited horizons to a dynamic decision making with long-term horizons marked the passage from the evolutionary phases to the revolutionary one. Parallel to this phenomenon, the labor force participation rates have kept growing, sometimes even sharply, as in the case of the participation rate for married women (aged 20 to 44 years old) with a child under the age of one in the United States, that passed from 0.2 in 1973 to 0.62 in 2000.

Interestingly, Goldin argues that the phenomenon she describes is not limited to women belonging to higher socio-economic groups, nor to women located solely in the US, but that it has characterized women of different extractions from all around the world, although the revolutionary changes listed above are mainly concentrated in developed countries. As a matter of fact, among high-income countries, female labor force participation rates increased from 50% in the 1970s to around 70% in recent years (Ferragina, 2020). However, Esping-Andersen (2009) is less optimistic about the "general" character of such a change in society. In fact, he famously argues that the revolution in women's work roles is "incomplete" as it only concerned well-educated, middle-class women. According to the author, the sole approach to "complete" the revolution, and to address the increase in social inequality that is generated by it, are the welfare state and social policies.

3.1 The relationship between fertility and employment

Participation to the labor force and fertility are two fundamental elements for the economic development of countries. In fact, the former concurs to define the production capacity of a country, by establishing how many workers will be active in an economy, while the latter determines the future size of the labor force itself. Thus, it is important to highlight how family policy interacts with both fertility and female labor force outcomes.

Family policy, as a specific dimension of the broader welfare policy, can and has been considered as the main instrument to address the changing economic role of women in society (Ferragina, 2019). In fact, these policies usually affect either fertility decisions (through the provision of fiscal benefits for mothers of young children or of public childcare) or employment decision (with active labor market policies aimed at boosting the full-time employment of women), or both. Moreover, employment and fertility decisions appear to be related among themselves. For instance, the linkage between female participation in the labor market and fertility has been studied by Aaronson et al. (2018), who analyzed more than 400 censuses from 103 countries between 1787 and 2015. The authors argued that there is no significant effect of fertility on labor supply for low levels of development, while there exists a negative effect, that is large and significant, for countries with a higher level of development. In addition to this, they claim that their results are consistent with standard labor-leisure models, and thus that the effect is mainly to be attributed to the increasing cost of not working as wages increase over

time. These results appear to be in line with the ones highlighted by Angrist and Evans (1998). The two authors exploited twin births and sibling-sex composition to instrument exogenous variations in the number of children of a family and derive their effect on the parents' labor supply. They find that an increase in the number of children is indeed linked to a decrease in the mother's labor supply, while the participation rate of the father usually remains unchanged. Their IV estimates for the effect on mothers' participation rate are smaller than regular OLS ones and are weaker for college-educated mothers, while rather consistent for fathers. Hence, when approaching the design of family policies, this link between fertility and labor outcomes should be considered carefully in order to avoid unexpected byproducts of the policies enacted.

3.2 Family Policy

These last 4 decades have been particularly prolific in terms of family policies (Ferragina, 2019). However, as specified by Zimmerman (1995), the terminology of "family policy" encompasses a number of different policies. In fact, the author argues that "family policy constitutes a collection of separate but interrelated policy choices that aim to address problems that families are perceived as experiencing in society". In line with what argued by Ferragina (2019), who defines family policy as an umbrella term, Zimmerman differentiates among "implicit" and "explicit" policies. Implicit policies are those that are not explicitly aimed to families but that nevertheless affect them and their choices (for example health-care policies and educational ones are forms of implicit family policy). By contrast, explicit family policies directly, and admittedly, target families with their action and goals (Zimmerman, 1995). More precisely, explicit family policies can be defined as supporting families with young children through children-related income support, employment leave and the provision of childcare (Kamernian & Kahn, 1994).

Accordingly, Thévenon (2011) defines six main objectives for family policy. First, poverty reduction and income maintenance, which are primarily addressed through financial benefits and allowances targeting low income families with children. Second, direct compensation for the cost of children, carried out especially through cash benefits and fiscal incentives that are not necessarily means-tested or only aimed at poorer families. Third, fostering employment, especially for women, in order to promote their participation to the labor force and economic growth, mainly through parental leaves, fiscal incentives to work and the provision of childcare. Fourth, improving gender equality, with the aim of achieving a more balanced share of paid and unpaid work among the couple, usually through the use of tax benefits and incentives. Fifth, support for early childhood development, that is mainly influenced by the time and attention that the parents can devote to the children in their early stages of life and by the provision of formal childcare by the state. Finally, increasing birth rates, which, according to the author, has been a growing concern for policymakers in developed countries, not only due to ageing population combined with usually low (especially in the EU) fertility rates, but also due to the mismatch present between the desired number of children recorded in surveys and the actual households' fertility decisions. Thus, family policy mainly consists of parental leaves, transfers (both in forms of cash allowances and fiscal benefits), and the provision of affordable childcare.

The mix of all these different policies defines the various welfare approaches adopted by countries. One of the most well-known taxonomy of the different types of welfare states is the one elaborated by Esping-Andersen (1990), who argues about the existence of three main models of welfare state: the liberal, the conservative-corporativist and the social democratic

ones. However, such a characterization has been widely described as lacking the dimension of gender. In fact, Orloff (1993) argues that a gendered version of the schemes employed by analysts to assess social policy regimes would improve the research on this matter. In accordance with this conceptualization, Misra et al. (2007) provide a more elaborate description of welfare models (that is also widely consistent with the one provided by Thévenon, 2011) based mainly on family policy. According to the authors it is possible to differentiate among four main strategies adopted by countries in relation to family policy and welfare state. First, the "primary caregiver/secondary earner strategy" mostly focuses on compensating women for the effort they put in the care of children, rather than promoting their employment and it is characterized by generous family allowances and parental leaves (mainly in countries defined by them as conservative, exemplified by Germany, Austria, Luxembourg and the Netherlands). By contrast, the "primary earner/secondary caregiver strategy" aims at engaging women in the labor force, focusing on giving them opportunities to be employed full-time, rather than providing support for care, for which families need to rely on market provision (mainly in liberal countries, exemplified by Canada, the United States, the United Kingdom). Third, the "choice strategy" allow women to choose whether they prefer to be caregivers, providing them with generous parental leaves and allowances, or whether they want to commit to full-time employment, supporting them with policies such as high-quality public childcare (exemplified by France and Belgium). Finally, the "earner-carer" strategy consist in a model that aims at balancing men's and women's participation to care and employment, by encouraging men's participation to caregiving and women's participation in the labor market (exemplified by Sweden). In addition to these four main models, many authors recognize the existence of a fifth one: the Mediterranean model, which is characterized by a strategy similar to the "primary caregiver" one, although providing less services and support to carers (exemplified by Greece, Italy, Portugal and Spain) (Ferragina, 2019).

These different approaches have been linked with different, and sometimes contrasting, socio-economic outcomes. The primary caregiver model, again according to Misra et al. (2007), appears to be linked with the biggest gap in employment between males and females, and with single mothers facing higher poverty rates in countries adopting this strategy. On the contrary, the primary earner model tends to be more successful in terms of women's employment, although it is also linked to poverty rates for single mothers. Then, the choice model seems to support effectively earnings although motherhood decreases the likelihood of full-time employment in those countries. Finally, the earner-carer one is linked to the highest levels of equality in terms of employment and wages.

However, the literature also presents some puzzling findings. For example, the earner-carer system appears to negatively affect gender balance in top managerial positions (Datta Gupta et al., 2008). By contrast, the primary earner strategy, that displays less equitable outcomes in terms of wage inequalities and employment gap, is linked with a higher share of women in important managerial jobs (Ferragina, 2019). Thus, it is important to consider the interactions between the various family policy systems and the socio-cultural characteristic of each country, in order to better understand the specific effect of a policy in a particular setting. It is also worth noticing that, according to Ferragina (2019), who focuses on 23 OECD countries, there exists a common trend of expansion and convergence in explicit family policy among developed countries, although in a general environment of austerity regarding their welfare states.

After having provided some contextualization regarding the definition of family policies and how they are usually categorized, the next sections will focus more on the analysis of the three main instruments that have been highlighted: work leaves, financial and fiscal benefits, and childcare provision.

3.2.1 Work leaves

First, work leaves linked to children have traditionally been present in various countries in the form of maternity leaves, i.e. mainly focused on mothers rather than fathers. However, while the maternity leaves have been fairly stable for the last three decades, there has been an increase in parental leaves aimed at both the father and the mother (Ferragina, 2019). Waldfogel et al. (1999) argue that, if on the one hand having a young child has a negative effect on the employment rate of mothers in the US, Britain and Japan, on the other one, maternity leave coverage has a strong effect on young women's job retention after childbirth. However, the effect of parental leave does not appear to increase linearly with its duration. In fact, the effectiveness of the leave is widely recognized to be stronger for a period of 20-30 weeks, while longer arrangements actually display negative effects on women's employment outcomes (Akgunduz & Plantenga, 2013; Del Boca, Pasqua, & Pronzato, 2009). In other words, the relationship between the length of the leave and women's employment outcomes seems to be inversely U-shaped (Ferragina, 2019), with the threshold for the change in the direction of the relationship after 30 weeks of leave. The explanation for such a relationship might reside in the fact that a prolonged leave could result in a deterioration of labor market skills, hindering future career development (Jaumotte, 2003).

3.2.2 Fiscal & Financial incentives

Child income support to families with young children mainly consists in cash allowances and fiscal incentives aimed at compensating households that decide to have children rather than being childless. Interestingly, these types of benefit have been converging across the various family policy regimes (Ferragina, 2019), although with some important differences in the mechanisms adopted, whether it is a tax incentive or a cash allowance.

For what concerns the effects of such policies, the literature indicates that unconditional and overly generous benefits are linked with a reduction in women's employment (Jaumotte, 2003). However, it is important to highlight that the evidence on this relationship is strongly dependent on the family policy system in place in a country. For example, Stadelmann-Steffen (2011) argues that, in Switzerland, high direct and indirect cash benefits negatively affect the likelihood of being employed for women with a low to medium educational level. On the other hand, Sànchez-Mangas and Sànchez-Marcos (2008) analyzed a monthly cash benefit program introduced in Spain in 2003 and found that eligible women displayed a small but significant positive effect on their labor market participation, an effect primarily focused on high-school educated mothers. Similarly, Givord and Marbot (2015) analyze an important reform in France that significantly increased childbearing and childcare subsidies (the PAJE[1] reform of 2004) and evaluate its effect on the use of paid childcare services and on mother' labor supply. In accordance with the findings of other authors, they find that the increase in childcare subsidies following the reform increased mothers' labor force participation by two percentage points in 2006, with a stronger effect for households with more children.

[1] *Prestation d'accueil du Jeune Enfant*, which means: "benefit for the care of young children".

By contrast, tax benefits show more consistent results, as they appear to generally support female participation to the labor market. In fact, the economic literature recognizes a positive effect of equalizing tax rates between the first and second earner in the household on women's employment (Ferragina, 2019). Moreover, Shirley (2020) provides interesting evidence on the Earned Income Tax Credit, one of the largest anti-poverty programs in the United States. By exploiting the month of birth of women's first child as running variable for a regression discontinuity approach, the author is able to estimate a strong and significant positive effect of the benefit on unmarried women's employment (with a coefficient around 14-15%), with smaller effect for the ones with an educational attainment limited to a high-school degree or lower, while no significant effect is detected for married women.

3.2.3 Childcare provision

Childcare provision is the most common type of family policy, as all developed countries offer some level of childcare, either through public establishments or by subsidizing private ones. The main idea is that by offering a service that takes care of young children during the day, their parents - and especially the mothers - can enjoy more free time that they might invest by entering the job market. In general, the economic literature tends to recognize positive effects of the provision of childcare on women's labor force participation (Ferragina, 2019), although with varying intensity depending on national characteristics (Del Boca, 2015). For example, Goux and Maurin (2010) analyze the case of France through a regression discontinuity approach, using the day of birth as running variable, to derive the effects of early school availability on mothers' employment outcomes. Interestingly, they find no significant effect for the sample of all mothers, though they show a positive and significant effect on the labor outcomes of lone mothers. This paper is of great interest for this analysis as it takes advantage of the timeliness of the childbirth to control for endogenous factors, which is an approach very similar to the one hereby adopted, although with the difference that the precise date of birth of children was not available in the dataset used and thus the quarter of birth has been employed. Moreover, Goux and Maurin's (2010) results provide an interesting baseline for the comparison of the results of this analysis, as they study a country, France, that shares many characteristics with Italy but that has a more developed family policy strategy and thus displays completely different outcomes in terms of fertility and female employment (for more details see section 5.1).

3.3 Family policy in Italy and the focus of this research

Interestingly, Italy appears quite often in comparative studies on family policy, qualifying itself as an interesting case study for researchers (Ferragina, 2020). According to the categorization provided by Misra et al. (2007) (mentioned in section 3.2) and by Thévenon (2011), Italy is characterized by a system of family policies that provides limited support to caregivers, while also failing to support actively the participation of women in the labor market. Coincidentally, Italy displays historically lower rates of female labor force participation, that have been justified by Chiuri (2000) with the fact that the Italian legislation used to incentivize full-time employment rather than part-time one, negatively affecting women's capability to work while also being the primary caregiver. She argued that an improvement in the quality of formal childcare provision, intended as nursery for children below the age of 3, could encourage female labor market participation. This conclusion appears to be reflected also in the analysis of Del Boca (2002), who argued that the rigidities of the Italian labor market, at the time, as well as the limited availability of affordable childcare services especially for children below the age of

3 determined the particularly low participation rate to the labor market and fertility rate of Italian women, with respect to other EU countries. Hence, the author claimed that an increase in childcare provision funded by a rise in payroll taxes could be welfare-enhancing, as it would positively impact both the labor participation rate and the fertility of Italian women. Again, this conclusion appears to be consistent with successive analyses, such as Del Boca and Yuri (2007) who argued that an expansion in childcare would promote women's participation to the labor force. Furthermore, Cipollone and D'Ippoliti (2011) considered the role of gender-based discrimination and norms of progressive social policies and their interaction with women's housework. They suggest that macro and individual factors are both important in predicting the employment of Italian women, and that they interact with each other in a significant manner. Brilli et al. (2016) confirmed the relationship between childcare provision and mothers' employment in more recent data (more specifically, for the years 2009-2010) by estimating that a percentage point increase in public childcare coverage was linked with a 1.3% increase in mothers' probability to work, as well as a significant increase in the children's standardized test scores in Language. Interestingly, the authors also noted that when the childcare availability is particularly low, the observed relationships are stronger for both outcomes.

This empirical evidence appears to suggest that more investments in family policy, whatever the form, might be needed. However, Kazepov and Ranci (2017) argue in favor of a more cautious approach. In fact, the two authors maintain that social investments, intended as a specific approach to welfare aimed at achieving three main functions (human capital development, activation of potential labor force, and social inclusion), might not always help governments to achieve the results desired. Instead, social investments might have unexpected and even negative impacts on socio-economic outcomes if some contextual conditions are not present. Interestingly, the two authors focus on the case of Italy as the example of a country that is particularly adverse for social investment, and that displays lower expenditures on family policy, education and active labor market policies than other OECD countries. Thus, a more holistic approach, that affects both the supply of labor of the population under consideration (namely, mothers) and the incentives of the labor market itself, in order to stimulate the demand for this labor force, is advisable when approaching policy advice, which will be addressed in section 6.2.

In conclusion, after having reviewed some of the literature available on family policy in general and on Italy, it appears that there is a broad consensus for an expansion of family policies. If we focus on childcare, the consensus is that an expansion of early childcare for children aged 2 or less would be beneficial for mothers' employment rate. However, a clear estimation of the effect of pre-primary childcare (targeted at children from 3 to 5 years old) on the labor supply of mothers in Italy appears to be lacking. This analysis takes advantage of the quarter of birth of children to address the research questions of whether enrollment in pre-primary education for children aged 3 years old increases their mothers' participation to the labor market and employment rate. This question will be addressed through the testing of three hypothesis, a main one and two secondary ones.

The first hypothesis is that the mothers whose children are attending pre-school are more likely to be in employment, computed as a share of total population, and to have a higher activity rate more in general. Then, the first sub-hypothesis is that non-married women will show stronger results than married ones, similarly to what was highlighted by Goux and Maurin (2010). Finally, the second sub-hypothesis is that results will be stronger for the households located in

the northern regions of Italy, as they display a more dynamic job market and are therefore able to accommodate the increased demand for occupation that follows the availability of childcare by pre-primary institutions.

The next section will briefly describe the Italian pre-school system and then the following one will introduce the description of the data employed.

3.4 Introduction to the Italian pre-primary childcare system

Pre-primary education concerns children aged between 3 and 5 years old and in Italy, differently from France, it is not mandatory. Nevertheless, the take-up rate is almost universal, as the enrolment rate of children aged from 3 to 5 years is around 94%, above the OECD average of 87% (OECD, 2019). Moreover, pre-school is mainly provided by public establishments, as 72% of children are enrolled in public institutions. On average, there are 12 children per teacher in pre-primary establishments, a figure that is lower than the OECD average of 15 (OECD, 2019). However, Italy appears to spend less per child than the OECD average, with an average expenditure of US $7,400 per capita versus US $8,350 per capita.

Pre-primary schools are monitored by regional branches of the Ministry of Education[2] (*Uffici scolastici regionali*), similarly to what happens for nurseries, which are monitored by regional and local authorities (Adamson, 2017). Nevertheless, Italy lacks both a national body in charge of assessing child development during pre-primary education and standardization across regions, as quality guidelines are defined at the regional level. Although National guidelines on the curriculum were introduced in 2012 (the *Indicazioni Nazionali*), they mainly address "broad learning goals, specific objectives regarding the competencies children should acquire, and a profile of children at the end of preschool in the transition to primary education" (Adamson, 2017).

The aim of pre-primary education is to provide children aged between 3 and 5 with education and social, cognitive, psychomotor, religious, and moral development (Ministry of Education, Ministry of University and Research, 2020). Its goal is to provide effective equality in educational opportunities. The enrolment in pre-primary establishments is available for children who turn 3 years old within the end of the year of enrolment. Moreover, there exists the possibility of an "early enrolment" for children who are 2 years old but who were born before the 30th of April, and thus who would turn 3 years old within the first quarter of the year following the one in which they would enroll. However, such an early procedure is subordinated to several conditions, among which the availability of free seats (meaning that 3 years old have priority for enrolment), the exhaustion of the waiting lists, the availability of services apt at caring for younger children, and a pedagogical evaluation by a teachers' committee (Ministry of Education, Ministry of University and Research, 2020).

The information outlined in this section should help to contextualize the functioning of the pre-primary educational system in Italy and provide the background to understand the analysis conducted in the rest of the paper.

[2] For clarity, it is important to highlight that until the last Government, the Italian Ministry of Education also was also responsible for universities and research, and was called the "Ministry of Education, University and Research". However, since the second Government Conte, that swore-in in September 2019, it has been split between the Ministry of Education and the Ministry of University and Research, although they still share the same website.

4 Data & Methodology

This section will, first, describe in detail the data employed for this analysis and, then, focus on an explanation of the methodology adopted.

4.1 Data

This analysis has been performed using the EU-SILC (European Union Statistics on Income and Living Conditions) data for Italy for the years from 2006 to 2015, made available by the Italian National Institute of Statistics (*Istituto Nazionale di Statistica,* ISTAT) (2019). This survey is conducted each year among almost 30 thousand households and is randomly sampled. It collects essential information on the household's income, the taxes paid, the benefits received and the living conditions (such as the presence of domestic appliances or the capability to pay for holidays) of all the household's members older than 16. This survey, launched in 2003, takes place, with similar parameters, across all EU countries and allows to draw comparison among the different Member States. Microdata for the whole European dataset are stored by Eurostat (2020). The survey is conducted in both a cross-sectional and a longitudinal way for each country. It is worth noticing that the interviews occur with timeframes that vary across the different waves. As a matter of fact, in some years they are concentrated in the same quarter, either at the beginning or at the end of the year, while in other cases they are spread evenly across the four quarters. Although it would have been very interesting to extend the analysis to the most recent years (from 2016 onward), such an option has proved to be unavailable as the most recent waves of the EU-SILC data are available only to researchers and PhD students after submitting a formal research proposal to Eurostat or ISTAT. Nevertheless, the data open to the broader public are sufficient to study the research question under consideration.

The data collected for each wave are organized into four different files, a personal data file, which stores the surveys to the eligible members of the household; a personal register file, which provides baseline information about all the components of the households, including those not eligible to be interviewed; a household data file; and finally a household register file. The presence of the personal register file is key to the analysis that is developed in this paper, as it provides information about the children below the age of 16 present in each household. Among the various variables included in the data, the most important ones for the scope of this analysis are:

i. the type of school attended (*tipscu*),

ii. the number of weekly hours spent at pre-school (*rl010*),

iii. the child's age (*rx020*),

iv. the child's quarter of birth (*rb070***)**, and

v. the identifiers of the child's parents (*rb220* for the father, and *rb230* for the mother).

These variables allow first to identify the main independent variables that will be used for most of the analysis (*tipscu* and *rl010*), then to generate the instrument variable for the IV regression approach, and finally to match each offspring with their mother, in order to use their employment rate and participation rate in the labor market as outcomes of interest.

More specifically, the variables used as main regressors in the analysis that will be presented in the next section are two. First, a variable generated on the basis of the type of school attended by the child (*tipscu)*, which divides the observations among treated, those who are attending

pre-primary education, and controls, those who are not enrolled in this level of education. Second, a variable for the number of weekly hours spent at pre-school, which takes positive values only for the children who are attending pre-schools or nurseries. This allows to account for the variation in effects of different intensity of weekly attendance, rather than assuming that all children enrolled in pre-school are treated in the same way in spite of the hours of attendance.

The variables employed to generate the instrument are the age at the end of the income reference period (*rx020*) and the quarter of birth of the child (*rb070*). The former has been chosen over the actual age of the child as the moment of the year in which the interview had been conducted varies on the basis of the wave of the survey into consideration, and also within the same survey, as mentioned beforehand. For this reason, by using the age at the end of the income reference year, which is the fiscal year ended just before the survey (i.e. 2014 for the wave of 2015, 2013 for the wave of 2014 and so on), it is possible to know the age that the child will have at the end of the year in which the interview takes place just by adding 1 to the value of the variable. This variable has been combined with the one reporting the quarter of birth of the children to isolate those born at the end of the year that allows them to be 3 years old in the year of the interview, from those born in the first quarter of the following year, who are only 2 years old when the survey takes place. This specific cutoff has been chosen due to the structure of the Italian pre-primary educational system (described in section 3.4), which allows children to enroll in pre-primary school from the year in which they turn 3 years old or in the year in which they turn 2 if that happens before the 30th of April. Although such a special provision would make all the children in both quarters eligible to attend pre-primary education, the fact that children who are 3 years old have the precedence to enroll and do not need a further evaluation by the teachers at the establishment (which is required to enroll a younger child), allows to take advantage of the quasi-random allocation of the quarter of birth, and thus of age, within this six months period to predict the probability of being enrolled at pre-school. Thus, it is possible to conceptualize this approach as an "intention to treat". In fact, the children who are in the *treated* group of the instrument (3 years old born in the fourth quarter) have a much higher propensity to receive the treatment with respect to those in the *control* group (2 years old born in the first quarter). More details about the change in the propensity to attend pre-school across the two groups will be provided in section 5.2, after having discussed the specificities of the methodology employed. However, the focus on such a specific subset of the sample has resulted in a drastic reduction of the number of observations. If we take into account the wave of 2015, from a starting sample size of 49,987 observations in the personal register data file, only 190 children were in either category of the instrument variable. Thus, in order to increase the sample size and obtain more precise results, the waves from 2015 to 2006 have been merged together. As a result of this process, the number of children between 2 and 3 years old that fall within the two quarters taken into account are 2,061, of which 995 (48,28%) are 2 years old born in the first quarter and 1,066 (51,72 %) are 3 years old born in the last quarter of the year. As the analysis focuses on the mothers of the children for what concerns the outcomes of interest, the dataset with the children who fall in the two categories of the instrument has been then merged with the personal data-file with the interview of the eligible household members using the mother ID provided in the personal register file. Out of the 2,061 children, 2,026 have been matched, while only 35 were not matched correctly (approximately 1.7% of the sample). Then, the observations who displayed a double personal identifier, namely the mothers of twins, were dropped as they would have been otherwise overrepresented (2 observations for each mother).

However, there are only 38 mothers in the whole sample who were matched to twin children (and thus accounting for 76 observations), resulting in a sample of 1,950 mothers. Of these 1,950 observations, 1,946 do not present any missing value for all the other variables included in the analysis, and hence they constitute the main sample used.

First, the main outcomes of interest are the employment rate, computed out of the total working age population thus including also the individuals not looking for a job in the not employed category, and the labor force participation rate. Both variables are derived from the variable for the self-reported activity status (*pl031* or *pl030*, depending on the wave). Then, the main regressor is whether or not the children attend pre-primary education or, alternatively, the number of weekly hours spent at pre-school (*rl010*).

Moreover, the following variables have been employed as controls[3]:

i. The age of the mother at the end of the reference income period (*px020*), which is equal to the age at the end of the year of the survey minus 1;

ii. The highest ISCED level attained (*pe040*), which ranges from 0 (less than primary education) to 5 (short cycle of tertiary education and above) and it is considered as an ordinal variable;

iii. The number of weekly hours of childcare by a professional child-minder at child's home or at child-minder's home (*rl050*) and by grandparents, other household members (not the parents), other relatives, friends or neighbors (*rl060*). These types of childcare represent a "substitute" to the treatment provided by the pre-school, to be accounted for;

iv. The number of children in the household (computed by counting the multiple matches from the data file with the children to the data file with the mothers);

v. The degree of urbanization (db100), which is an ordinal variable with values "densely-populated area", "intermediate area", and "thinly-populated area";

vi. A categorical variable for whether or not the child goes to nursery. This variable also aims at controlling for a "substitute" treatment;

vii. A categorical variable for child or family allowance received by the household organized as follow: the value of "0" is assigned to all the individuals who are in households that do not perceive any allowance, then the values from 1 to 5 stands for the quintile distribution of the respondents with a strictly positive value for the allowance;

viii. A categorical variable for the quintile distribution of the disposable household income;

ix. Year and region fixed effects. The years are from 2006 to 2015 and the regions comprehend all the 20 Italian administrative units known as "Regioni" with the exception of Trentino-South Tyrol which is further disaggregated into the two provinces of Bolzano and Trento (due to Bolzano being an autonomous province).

[3] For reference, it is possible to access the Guidelines for all the variables from 2006 to 2015 from the Eurostat website (Eurostat, 2020), or from the Gesis website (Leibniz Institute for the Social Sciences, 2020), recognized by the Eurostat.

Furthermore, the analysis will be carried out on different sub-samples in order to allow for the testing of the various hypothesis that stems from the central research question. In fact, as already mentioned in section 3.3, while the main research question regards the effect of child-care at pre-school on the labor supply of mothers, this research also aims at testing whether there are some particular effects on non-married mothers and to whether the effects found in the previous cases for the whole country are consistent throughout both the northern and the southern regions or whether there exists a north-south divide with respect to this phenomenon.

For the first sub-hypothesis, the sample has been restricted to non-married women, in order to isolate the mothers that have less immediate support within their households. The original idea was to focus exclusively on single mothers, in the same way that Goux and Maurin (2010) did in their paper. However, the dataset includes a too small share of mothers living in households without a partner to draw a large enough sample, even by merging together the observations for all 10 years (i.e., from 2006 to 2015). For this reason, the analysis has been extended to non-married women for testing the first sub-hypothesis. These mothers can be single, divorced, widowed or with a non-married partner, and the selection is operated through the variable for the marital status of respondents (*pb190*).

The second sub-hypothesis, instead, has been tested by, first, restricting the sample to the households residing in the northern regions of the country and, then, by restricting to those living in the southern ones. The regions that constitute the North of Italy are Piedmont, Val d'Aosta, Lombardy, Liguria, Veneto, Trentino-South Tyrol, Friuli-Venezia-Giulia, Emilia-Romagna, Tuscany, Marche, and Umbria, while the regions that constitute the South of Italy are Lazio, Campania, Abruzzo, Molise, Basilicata, Apulia, Calabria, Sicily and Sardinia.

The next section will explore more in detail the choice of applying an instrumental variable approach to provide an answer to the research question. Moreover, it will provide more details regarding the model applied and the assumptions needed to make causal inferences.

4.2 Methodology

The relationship between someone's being able to send their child to pre-school and their employment status is a spurious one. In fact, children's enrollment in pre-school is not a characteristic randomly allocated among households, but it is the result of an informed choice by the parents. Moreover, the fact that in Italy pre-primary education is not mandatory adds a further layer of complexity, as self-selection should be more likely, although the very high attendance rate (OECD, 2019) attenuates such an issue. For these reasons, a simple linear regression model between employment outcomes and whether or not the child of the respondent attends pre-primary education would not be able to correctly estimate the causal impact of such regressor. Indeed, for an ordinary least squares estimator to be causal it is necessary to assume that the regressor is uncorrelated with the error term, which would amount to a strong and difficult to justify assumption in this case. In fact, it is not difficult to imagine that there might exist other factors that are linked at the same time to the regressor and the main dependent variable, such as family income or age. Alternatively, it could be that a third factor could explain altogether the presence of the independent variable, and thus being responsible for the relationship with the outcome, rather than the variable itself. Although an easy way to account for such issues consists in controlling for various confounding factors (such as income, age, education of the mother, etc.), the challenge of exhausting the list of possible omitted variables by including all the relevant regressors into the computation would be nearly unattainable.

Moreover, besides the possibility of not being able to control for some factors due to the limitation of the data, including too many variables as controls could result in an issue of overfitting the model. In addition to this, the relationship between pre-school attendance for the children and their mothers' labor outcomes might suffer from a simultaneous causality bias besides a selection one. In fact, it might not only be the case that mothers who have the possibility of accessing child-care have more free time which in turn allows them to enter the labor market, but also that the mechanism is reversed. Hence, it could be that working mothers have the necessity of accessing additional child-care, making them more likely to enroll their children into pre-primary education.

For these reasons, it is argued that there is the necessity to apply a more sophisticated research design in order to obtain more robust results than the one that could be reached through simple linear regressions. With this aim, the age of the child might represent a way through which we have access to a natural experiment since enrollment in pre-school is open to children who are between three and five years old[4]. Thus, the first approach that might come to mind is to compare the mothers of children who have access to pre-primary education to those of children who are too young to be enrolled. However, again, such a comparison would not yield causal results as the two samples compared would be fundamentally different. In fact, the average mother of a one-year old child is likely to be different from the average mother of a four-years old child (for example, the former is likely to be younger than the latter). Thus, the age gap needs to be reduced in order to obtain a quasi-random distribution of age. The optimal approach would be to take advantage of the date of birth and employ a regression discontinuity approach by comparing the mothers of the children born right before and right after the end of the year that would allow them to turn three years old in the year of the survey. In this way, it would be possible to consider the age of the child during the year of the survey as quasi-randomly distributed, as the difference between being born on the 31st of December and the 1st of January is likely not to be correlated with specific characteristics of the mother but to be a matter of casualty. Such an approach is the one adopted by Goux and Maurin (2010) in their paper on France. However, the structure of the EU-SILC data does not allow for a precise identification of the date of birth, but only provides information about the quarter of birth of children. This does not allow to compute the functional forms before and after the cutoff, without including more than one quarter. Nevertheless, by widening the sample in this way, the precision of the estimations declines dramatically, as the mothers on either side of the cut-off are no longer comparable.

Another possible approach would be to take advantage of the panel version of the EU-SILC data to conduct a difference-in-difference analysis. However, the lack of many variables in this other version of the files does not allow to identify the treatment, as there is no information regarding the school level attended by the children of the respondents.

Thus, the Instrumental Variable approach has been privileged as the main methodology of the analysis, as it is both feasible within the framework of the data available and sufficient to establish some degree of robustness in the estimations, granted that the first stage and the exclusive restriction assumptions are respected.

[4] As mentioned in section 3.4, enrollment to pre-school in Italy is also open to children who are 2 years old and who were born before the 30th of April. The limitations to the validity of the results obtained implied by this approach will be explored in section 4.2.2.

The next sections will develop more in detail the model employed and discuss the validity of the assumptions as well as the limitations of this approach.

4.2.1 The Model

The research design adopted is an instrumental variable one, using the quarter of birth as instrument. The main idea behind such an approach is to adopt a variable, the instrument, that is correlated with the main independent variable and that only affects the outcome through that variable in order to obtain unbiased linear estimators. A very famous example for such an approach in the economic literature can be found in Angrist and Krueger (1991), who adopt quarter of birth as an instrument to study the effects of schooling on future earnings. This seminal paper opened the doors to a multitude of studies with that structure, although Barua and Lang (2016) have argued in favor of greater caution in applying that framework (see section 4.2.1.1 for a more detailed explanation).

The instrumental variable approach rests on two main assumptions: the first stage and the exclusive restriction. The first stage assumption maintains that the instrument must be correlated with the regressor that is instrumented. The second concerns the fact that the instrument must be uncorrelated with the error term. If both assumptions are respected, then the results are considered to be unbiased.

In order to clarify the approach that is employed, the OLS and the IV functional forms of the model are here presented.

Equation 1: Ordinary Least Square specification of the model

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 K_i + \varepsilon_i$$

Equation 2: First stage of the IV approach

$$\hat{x}_i = \alpha_0 + \alpha_1 z_i + \alpha_2 K_i + \mu_i$$

Equation 3: Second stage of the IV approach

$$y_i = \tilde{\beta}_0 + \tilde{\beta}_1 \hat{x}_i + \tilde{\beta}_2 K_i + \tilde{\varepsilon}_i$$

where y_i is the outcome of interest, i.e., the mother's employment rate and her labor force participation rate; x_i is the pre-school attendance rate of children and, alternatively, the number of weekly hours of childcare in a pre-primary education facility (the latter is used as instrument in order to allow for a robustness check of the results obtained); $\hat{x}_i$ is the predicted value of this variable obtained from the first stage equation; z_i is the instrument used to predict the potentially endogenous regressor, namely the children's quarter of birth; and finally K_i is the vector of controls, as outlined in section 4.1. More specifically, these control variables are: the age of the mother at the end of the reference income period (*px020*); the highest ISCED level attained (*pe040*); the number of weekly hours of childcare by a professional child-minder at child's home or at child-minder's home (*rl050*) and by grandparents, other household members (not the parents), other relatives, friends or neighbors (*rl060*); the number of children within the household; the degree of urbanization (*db100*) where the household lives; whether or not the child attends nursery (based on *tipscu*); the quintile of net children- or family-related allowance received by the household (based on *hy050n*); the quintile of disposable household income (based on *hy020*), and finally year and region fixed effects. These variables have been

added to the model as controls in order to support the exclusive restriction assumption, as explained in greater detail in section 4.2.1.3. Moreover, the year and region fixed effects are aimed at controlling for the bias and loss of precision that derives from extending the sample to 10 different waves of the survey. In fact, during the period chosen, Italy has transitioned from an initial condition of slow economic growth, to the years of the Great Financial Crisis, to the European Sovereign Debt crisis in 2011-2012 and, finally, to a phase of slow recovery in 2014 and 2015.

The next section will focus on the choice of the instrument and on the two assumptions needed to claim unbiased results.

4.2.1.1 Instrument: quarter of birth

The quarter of birth is a well-known instrument in the economic literature. One of the most famous pieces of research linked to this instrument, is the article published by Angrist and Krueger in 1991. In said paper, the authors employed the quarter of birth of individuals to instrument their educational attainment and thus obtain unbiased estimates of the wage returns from education and arrived at the conclusion that a longer educational attendance increases earnings later in life. Noticeably, the quarter of birth under consideration within this thesis is not the one of the units of observations themselves (i.e., the mothers) but that of their children, who determine with their attendance of pre-primary education whether their mother can be considered as treated or not. Following their seminal paper, this instrument has been widely used in the literature. However, in recent years it has come under increasing scrutiny by scholars who have argued that it should be employed with more caution. This is for example the case of Barua and Lang (2016) who emphasize the possible bias displayed by the quarter of birth in studying the effects of increases in the minimum school entry age on children's educational attainment. In fact, they maintain that using quarter of age as instrument gives an inconsistent estimate of LATE, as it violates the monotonicity assumption. However, the instrument employed in this analysis does not consist exactly in the one taken into consideration by Barua and Lang (2016), neither in the one of Angrist's and Krueger's (1991) famous paper. In fact, instead of looking at the quarter of birth of the observations, the instrument in this analysis consists in a subdivision among the children who were born at the end of the year that allows them to be 3 years old in the year of the survey and those born at the beginning of the year right after (meaning that they are only 2 years old when the survey takes place).

Moreover, it is important to underline that the instrument employed does not display a perfect degree of compliance, as there are children who are not enrolled in pre-school although they are already 3 years old, as well as children who are enrolled in such level of education already at the age of 2. Hence, the analysis conducted displays a setting similar to the one of an "Intention-To-Treat" (ITT) approach. However, it would impossible to precisely estimate the share of compliers in order to estimate the Local Average Treatment Effect. In fact, it might be that some of the mothers would like to send their children at pre-school, but they cannot due to the lack of available seats. This hinders our capacity of correctly estimating the share of compliers, as it would be necessary to make some important assumptions which would not be realistic, ultimately limiting the possibility to proceed further in obtaining more precise results.

The validity of the instrument rests on two main assumptions, namely the first stage and the exclusive restriction ones. These two assumptions will be discussed in detail in the following sub-sections.

4.2.1.2 First stage

As mentioned in section 4.2.1, the first stage assumption stipulates that the instrument is strongly correlated with the independent variable that is instrumented. In this case, it means that the quarter of birth should be correlated with the probability that the respondent's child attends pre-primary education. In order to ensure the unbiasedness of the estimation, the first stage regression should include all the controls present in the main regression. Table 1 displays in the first column the coefficients for the first stage regression between the share of children attending pre-school and the instrument, while in the second one it shows the first stage regression between the weekly hours of education at a pre-school facility and the instrument.

Table 1: First stage regressions

	Share of children attending pre-primary education	Weekly hours spent at pre-school
Quarter of birth	0.328***	9.310***
	(16.70)	(13.58)
Highest ISCED level attained	0.0208*	0.748*
	(2.16)	(2.15)
Age at the end of the reference income period	0.00233	0.0760
	(1.02)	(1.01)
Weekly hours of childcare by a professional childminder	-0.00543	-0.202*
	(-1.79)	(-2.03)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	-0.00483***	-0.156***
	(-6.81)	(-6.19)
Number of children	-0.00649	0.254
	(-0.46)	(0.53)
Degree of urbanization	0.0195	0.0621
	(1.14)	(0.11)
Attending nursery school	-0.376***	17.34***
	(-21.32)	(23.31)
Quintile of child- or family-related allowances	-0.00414	-0.0778
	(-0.82)	(-0.44)
Quintile of disposable household income	0.0237**	0.845**
	(2.58)	(2.63)
2007 fixed effect	0.0241	0.140
	(0.53)	(0.08)
2008 fixed effect	0.0394	-16.45***
	(0.92)	(-13.27)
2009 fixed effect	0.0386	0.626
	(0.86)	(0.40)
2010 fixed effect	-0.195***	-4.186**
	(-4.37)	(-2.68)
2011 fixed effect	0.0617	1.899
	(1.41)	(1.27)

2012 fixed effect	-0.146***	-4.566**
	(-3.34)	(-3.07)
2013 fixed effect	-0.153**	-4.423**
	(-3.17)	(-2.69)
2014 fixed effect	-0.347***	-10.70***
	(-8.87)	(-8.00)
2015 fixed effect	0.0179	0.367
	(0.36)	(0.21)
Aosta Valley fixed effect	-0.0551	-1.604
	(-0.84)	(-0.72)
Lombardy fixed effect	0.0725	0.680
	(1.54)	(0.39)
Bolzano fixed effect	-0.0271	-0.277
	(-0.35)	(-0.10)
Trento fixed effect	0.0903	3.105
	(0.89)	(0.94)
Veneto fixed effect	0.0739	1.066
	(1.58)	(0.60)
Friuli-Venezia Giulia fixed effect	0.103*	2.071
	(1.99)	(1.04)
Liguria fixed effect	-0.0242	-0.00901
	(-0.37)	(-0.00)
Emilia-Romagna fixed effect	0.0923*	4.114*
	(1.97)	(2.21)
Tuscany fixed effect	0.0113	-1.475
	(0.23)	(-0.84)
Umbria fixed effect	0.0598	-1.064
	(1.01)	(-0.58)
Marche fixed effect	0.106*	0.594
	(2.03)	(0.33)
Lazio fixed effect	0.0469	2.048
	(0.95)	(1.12)
Abruzzo fixed effect	-0.0470	-3.004
	(-0.71)	(-1.35)
Molise fixed effect	0.00385	-1.024
	(0.04)	(-0.37)
Campania fixed effect	-0.00109	-0.946
	(-0.02)	(-0.50)
Apulia fixed effect	0.0467	0.204
	(0.83)	(0.11)
Basilicata fixed effect	-0.0451	-1.911
	(-0.51)	(-0.69)
Calabria fixed effect	0.0110	-2.792
	(0.19)	(-1.32)
Sicily fixed effect	-0.0686	-2.672
	(-1.17)	(-1.32)
Sardinia fixed effect	0.0239	1.133
	(0.28)	(0.39)
Constant	0.0691	3.583
	(0.76)	(1.15)
N	1946	1946
R_2	0.404	0.442

t statistics in parentheses

** p < 0.05, ** p < 0.01, *** p < 0.001*

Note: the reference year and region for the fixed effects are the year 2006 and Piedmont.

Looking at Table 1, it is possible to deduce that the first stage relationship is positive and

significant for both independent variables. In fact, in the case of the share of children attending pre-school, the coefficient for being born in the last quarter of the year that allows the child to be 3 years old when the survey takes place (contrary to being born the quarter right after, that is at the beginning of the following year) points toward a significant increase in the probability of being enrolled at pre-school of about 33% at the 99,9% confidence interval. Interestingly, the 95% confidence interval for this coefficient is closely centered around the estimate, meaning that there is a good degree of confidence in recognizing that this relationship is strong and of an economically important magnitude. Accordingly, in the case of the weekly hours of pre-primary education, being three years old by a one quarter difference increases the average number of hours by 9 in a significant manner.

Other variables that appear to have a significant effect in both regressions are the mother's ISCED level attained, which however has only a marginal effect in terms of magnitude; the household disposable income; and, most importantly the three potential substitute treatments, childcare by a professional childminder, childcare by a relative or a friend and whether or not the child attends nursery. All of these variables have negative and significant relationships with both outcomes (with the exception of the one between the hours of weekly childcare by a professional childminder and the share of children enrolled in pre-primary education which is marginally insignificant with a *p*-value of 0.076). However, although in the cases of childcare provided by either a professional or another person outside of the household the coefficients are fairly small in magnitude, the variable for nursery attendance displays an expected strongly negative relationship. Controlling for these variables is crucial as they represent some other types of treatment that resembles the one provided by pre-school and that might bias the results. This is especially the case for nursery attendance as many 3 years old might still be attending this level of education instead of being enrolled in pre-primary school. Such a phenomenon is likely to be linked to the fact that nursery and pre-primary education are not mandatory in Italy, and thus have more blurred thresholds for attendance.

In conclusion, it is notice worthy that the R_2 scores for both regressions are respectively 40% and 44%, meaning that the models chosen to describe the first stage relationship are able to explain slightly less than half of the total variation in the pre-school attendance rate and in the average of weekly hours of pre-primary education.

The next section will discuss the exclusive restriction assumption.

4.2.1.3 Exclusive restriction assumption

As aforementioned, this assumption requires that the instrument is uncorrelated with the error term of the second stage regression, or, in other words, that the instrument only affects the outcome through the independent variable and in no other way. Unfortunately, a formal process to test such an assumption does not exist, and its validity usually rests on qualitative explanations and previous studies.

In this case, it is argued that the mothers of the children born in the last quarter of a year (treated) and those with children born in the first quarter of the following year (control) should be, on average, quite similar. Table 2 displays the coefficients for the regression between some variables describing basic information about the mothers in the sample and the variable for the instrument. The coefficients for the regressor can be interpreted as the difference in the average values of the outcome of interest between the treated group and the control one, while the constant can be interpreted as the average value of the outcome for the mothers in the control

group. These results have been provided in the form of a regression table rather than through the Stata command *ttest* due to the impossibility to include weights in such command, which would have biased the estimates. From the table, it is clear that there is no significant difference among the group of women in the treatment group of the instrument (those with a child who is three years old and was born in the last quarter of the year) and the women in the control group (those with a child who is two years old and was born in the first quarter of the year). In other words, the women belonging to either group, based on the instrument, could be considered as comparable, as they do not display any significant difference in the variables considered.

Table 2: Comparison between the mothers of children in the treated category of the instrument and of those in the control one

	Age	Household disposable income (in €)	Child- or family-related allowance (in €)	Highest ISCED level obtained	Number of children	Share married	Share living in the North of the country
Being treated	-0.0986	-2075.3	22.82	-0.0328	0.0326	0.0117	-0.0491
	(-0.32)	(-1.86)	(0.22)	(-0.49)	(0.77)	(0.57)	(-1.74)
Constant	33.58***	33982.0***	980.4***	3.190***	1.715***	0.828***	0.583***
	(159.16)	(42.96)	(14.52)	(67.88)	(58.32)	(55.11)	(28.92)
N	1950	1950	1950	1946	1950	1950	1950

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the estimates are presented through a regression between the outcome of interest (at the top of each column) and a nominal variable for whether or not the mother belong to the treatment or control group, as observations needed to be weighted (which cannot be done with a simple t-test in Stata). The coefficient of the main regressor can be interpreted as the difference between the average outcome in the treatment group and the average outcome in the control one. The constant can be interpreted as the average value of the outcome for the mothers in the control group.

Such evidence would support the idea that belonging to either side of the cutoff is almost random, and thus uncorrelated with the residual factor. As a matter of fact, quarter of birth is, in general, a widely accepted instrument in the economic literature. However, many authors, among which Barua & Lang (2016) have argued in favor of more caution than the one set forth when employing such an instrument. For example, Buckles and Hungerman (2008) provide evidence that children who are born in different seasons are conceived by women with different socioeconomic backgrounds. In fact, they show that the mothers who give birth during winter are disproportionately more likely to be teenagers, and less likely to be married or have a high school degree. A similar finding is highlighted by Bound and Jaeger (1996) which maintain that the quarter of birth might be correlated with unobserved differences in ability.

4.2.2 Theoretical limitations of the approach

The approach adopted in this analysis suffers from some weaknesses, which are important to explore in order to better interpret the final results. First, there is an overarching issue regarding the sample size. In fact, although the sample sizes of the personal surveys range from more than 46,000 individuals in 2006 to almost 37,000 in 2015, for a total of 416,636 observations, the children who are born in either category of the instrument are only around 200 for each wave of the survey. Moreover, the loss of some data due to the impossibility of correctly matching some children to their mothers and to the deletion of twins resulted in a further reduction in the sample size. However, during the discussion of the results obtained, in section 5.3, the model

has been tested on the wider sample with also the mothers of twins as a form of robustness check. The distribution of observations for each year is provided in Table 3.

Table 3: Distribution of the observations collected in the instrumental variable for each year

	Year										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
2 years old born in the first quarter	125	89	111	109	85	92	91	86	74	77	939
3 years older born in the last quarter	103	104	96	117	118	99	95	90	84	105	1,011
Total	228	193	207	226	203	191	186	176	158	182	1,950

As it is possible to understand from the table, focusing on specific years would severely hinder the robustness of the results, due to the very limited sample size. This is the reason for which the different waves of the survey, from 2006 to 2015, have been merged together: to have a higher number of observations. However, as the final dataset covers a period of 10 years, this operation comes at the expense of the internal validity as well as of the external validity of the results. On the one hand, the internal validity would be jeopardized by the fact that different observations from different waves of the survey would hardly be comparable, and, on the other one, it would be even more difficult to assert the external validity of the results as the overall sample of the analysis is not representative of the Italian population today. By focusing on the extreme example, the individuals surveyed in 2006 are likely to experience a much different context than those surveyed in 2015, after the Great Financial Crisis and the European Sovereign Debt crisis, as well as many years of economic stagnation. As a matter of fact, as shown in section 5.3, there exists an important difference in the results if the analysis is conducted only for the surveys taken before the Great Financial Crisis compared to whether it is conducted for the following waves. This shows that the year-fixed effects are not enough to account for the changes in the context, and that the further steps of splitting the analysis into different sub-samples of the waves of the survey is necessary to obtain clearer results.

Second, another threat to the external validity comes from the fact that although the most recent year of the survey taken into account is 2015, there have been some reforms concerning child- and family-allowances in the following years, which could have changed the dynamics of the phenomenon described in this analysis. For example, in 2015 the "newborn bonus" has been announced by the then Renzi government, introducing an additional measure, in the form of a refundable tax credit, aimed at households with children aged from 0 to 3 years old (INPS, 2019). It is recognized that the inability to access the official EU-SILC data for the most recent years limits the validity of the results obtained. Nevertheless, the lack of fundamental reforms to the school curriculum and of changes in the labor market trends regarding women's participation rate allow to still consider as relevant the main findings highlighted.

Then, another issue is linked to the fact that the enrollment in pre-primary education in Italy, as already mentioned, is also open to children who are 2 years old and who are born before the 30th of April. Given that the instrument considers children who are 2 years old and are born in the first quarter of the year for the control group and those who are 3 years old and are born in the last quarter of the year for the treatment one, there could be an issue as both groups can, potentially, receive the treatment. However, as explained in section 3.4, the "early" enrollment

in pre-primary education is subject to a list of conditions, most importantly the availability of seats after giving the priority to children who are at least 3 years old. This factor could explain why there still exist a strong correlation between the instrumental variable and the main regressor. Indeed, across all years taken into account, only 13% of the 2 years old children born in the first quarter of the year are enrolled in pre-primary education (121 out of the total 939), while 50.5% of 3 years old born in the last quarter of the year are enrolled (511 out of the total 1,011). Thus, it is possible to consider this setting as an ITT instrumental variable approach, as there is no sharp compliance with the instrument but we have some never-treated (the children who are already 3 years old but not yet enrolled in pre-school) and some always-treated (the children who are still 2 years old but are already enrolled in pre-school).

Finally, the timeliness of the survey along the year in the different waves might have some consequences on the share of children who result as enrolled in pre-primary education. In fact, if a household were to be surveyed at the beginning of the year, the chance of the child of being already enrolled in the first year of pre-school would be very small, as the beginning of activities for all educational establishments in Italy is in September. This is reflected in the fact that the waves of the survey that had most of the interviews at the beginning of the year displays a remarkably low share of 3 years old children born in the last quarter of the year enrolled in pre-primary education (for example, for 2014, there are no observations for this sub-sample). Such an issue is likely to weaken the robustness of the analysis that is hereby conducted, however we are limited in the possibility of predicting clearly how much results will be impacted, if at all, and in what direction. Nonetheless, it is important to underline this characteristic of the data employed in order to provide the best possible understanding of the approach adopted, of its limitations, and of its strengths.

The following section presents the analysis and comments upon the results obtained.

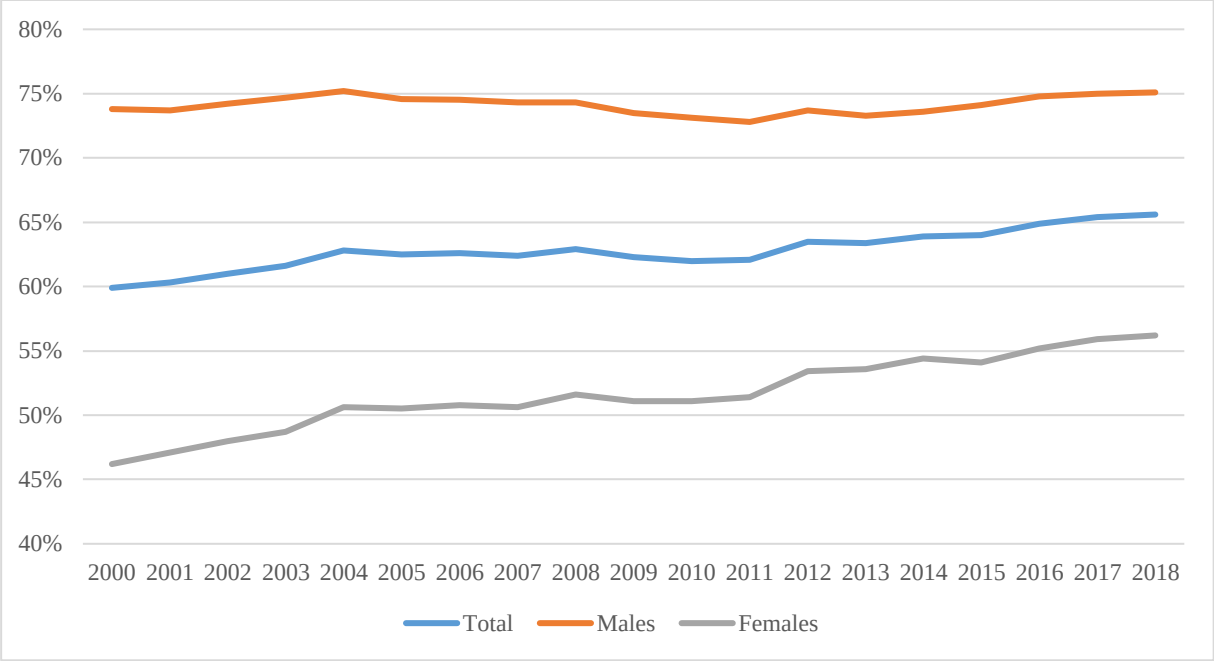
5 Analysis & Results

As mentioned in section 3.3, the main hypothesis of this thesis is that the childcare provided by pre-primary schools increases the availability of mothers to participate in the labor market, and thus is reflected in their labor supply. However, before focusing on the actual instrumental variable model, it is necessary to better understand the dynamics of women's labor market participation in Italy and other European countries, as to grasp how Italy is faring with respect to comparable countries, as well as analyzing the differences among the mothers who are able to enroll their child to pre-primary education and those who are not.

5.1 Employment outcomes and fertility rate in the EU and in Italy

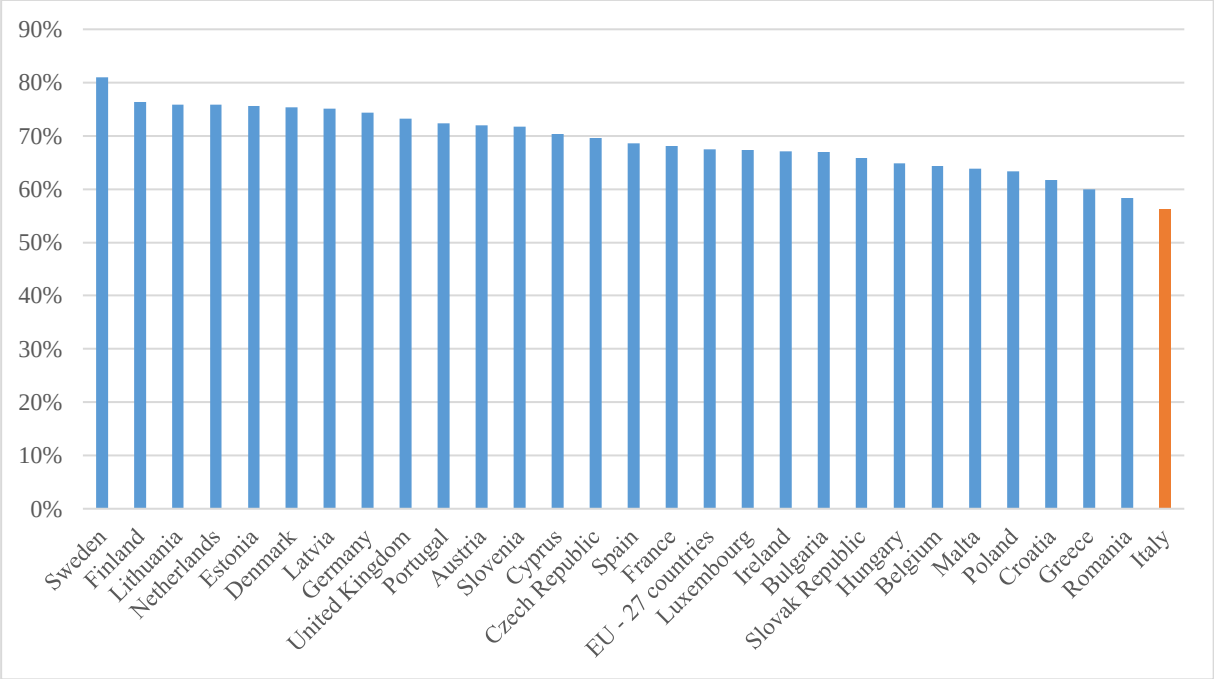
The participation of women to the labor market constitutes a long-standing issue in Italy. In fact, according to the *European Labour Force Survey* data, the participation rate of Italian women to the labor force has consistently remained below that of males for the last 20 years, as shown in Figure 1. Although the gap has been closing down since the year 2000, with an overall increase for women over the period of about 10%, the difference between men and women in terms of participation to the labor market was just short of 20 percentage points in 2018.

Figure 1: Labor force participation rate in Italy, 15-65 years old



Source: Labour Force Survey (Eurostat, 2020).

Figure 2: Female labor force participation rate (15-64 years old) for the European Union countries in 2018



Source: Labour Force Survey (Eurostat, 2020).

Furthermore, Figure 2 shows that the Italian female participation rate in the labor market is the lowest across all European countries. As a matter of fact, as shown in Table 4, the gender gap in the activity rate (computed by taking the difference between the males' rate and the females') for Italy was the second-highest in the EU both in 2000 and 2018 (after Malta's). These statistics highlight a structural problem of the Italian labor market, which appears to be still dominated by males, although there has been an improvement across the period taken into account.

Table 4: Gender gap in the activity rate across EU countries.

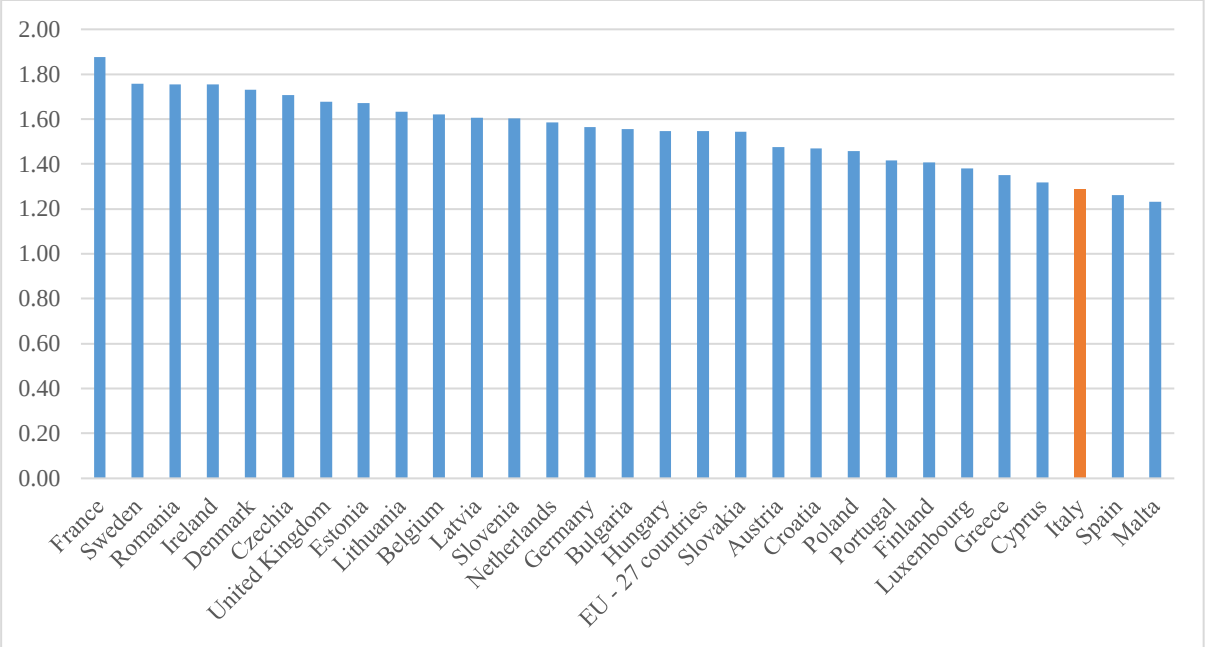
Gender gap (males - females) in the labor force participation rate per year, in percentage points

Country	Year 2000	Year 2018
Austria	17.6%	9.6%
Belgium	17.2%	8.5%
Bulgaria	11.3%	8.9%
Cyprus	24%	9.5%
Czechia	15.5%	13.7%
Denmark	8.1%	5.8%
Estonia	9%	7%
Finland	5.3%	3.2%
France	12.7%	7.6%
Germany	15.8%	8.6%
Greece	27%	16.7%
Hungary	15.1%	14.2%
Ireland	23.7%	11.7%
Italy	27.6%	18.9%
Latvia	11.3%	5.4%
Lithuania	7.2%	3.1%
Luxembourg	24.7%	7.3%
Malta	44.5%	21%
Netherlands	18.2%	8.9%
Poland	11.3%	13.7%
Portugal	15.1%	5.7%
Romania	12.1%	18.6%
Slovakia	13.7%	12.8%
Slovenia	8.6%	6.5%
Spain	26.7%	10.2%
Sweden	3.8%	3.4%
United Kingdom	15%	9.4%

Note: Croatia has been removed from the list due to missing values for the year 2000.
Source: Labour Force Survey (Eurostat, 2020)

Given such an underrepresentation of women in the labor market, relative to their European peers, it could be expected that the fertility rate in Italy would be higher. In fact, a negative link between fertility and women's labor supply is accounted by Angrist and Evans (1998), as already mentioned in section 3.1, which exploit preferences in the gender composition of a family's children to instrument the estimates for such a relationship. Nevertheless, Italy places itself towards the end of the ranking also for what concerns women's fertility rate, as shown in Figure 3.

Figure 3: Women's fertility rates across European countries in 2018



Source: Eurostat (2020).

Thus, it can be highlighted that Italy displays (comparatively) low levels of both female labor force participation rate and fertility rate, while France, a comparable country according to socio-economic characteristics, displays the highest fertility rate and a female activity rate higher than the EU average. This difference is likely to be due to a number of different reasons, that range from social to economic ones. However, among these, the more structured system of childcare in place in France is likely to play an important role. In fact, as described in section 3.2, France belongs to the group of countries that adopts a "choice strategy", which should allow women to make an active choice between being caregivers, in this case providing them with generous parental leaves and allowances, and committing to full-time employment, supporting them with policies such as public childcare. On the contrary, Italy has failed to provide as generous policies as the French one, while it has historically preferred to protect and incentivize full employment, which is generally less accessible to women (Chiuri, 2000).

5.2 Description of social characteristics of mothers that have access to pre-school

Before proceeding with the analysis of the method applied for this research, it could be interesting to focus on the characteristics of mothers who send their children to primary school and those who do not. Table 5 displays the odds ratios for the logit regression of pre-school attendance rate on the vector of controls plus a categorical variable for the mother's marital status (for which the omitted value is "never married"), in order to understand how the different variables affect the likelihood of enrolling children to pre-primary education. The four columns contain the results for four different samples, with the aim of testing this analysis on slightly different populations and provide a robustness check. Noticeably, all the four displayed logit regressions exclude observations for the year 2014 (164 observations) as none of the children born in the periods of interest were enrolled in pre-primary education at the time of the interview. Thus, we cannot estimate the relationship between the probability of this outcome and other variables for these individuals. The first column shows the odds ratios for the sample without mothers of twins (the one employed in the main analysis). The second one also excludes the mothers of the children attending nursery (456 observations) in addition to twins' mothers.

The third column focuses on the sample that also includes twins' mothers. Finally, the fourth one has the same sample of the third one but also excludes the mothers of children attending nursery.

According to the table's results, the only variable that significantly affects the outcome's odds ratios in the four samples is the weekly hours of childcare by a relative, friend or neighbor (excluding the parents), which appears to be a consistent substitute for formal childcare provided by educational establishments. The negative relationship with the outcome probability ranges from a factor of 0.03 to one of 0.04 per hour of weekly childcare provided in this manner, depending on the sample. Moreover, the mother's educational level only significantly increases the odds having their children attending pre-school for the sample that excludes the mothers of twins and the mothers of the children enrolled in nursery, with a significant increase in the odds ratio with a factor of 0.15. Then, the only other variables that have a significant impact are the quintile of household income, which increases the mothers' odds of sending their child to pre-school in the two samples that exclude the mothers of children who are enrolled in nursery, and the indicator variable for being widowed, that decreases odds for both samples that include twins' mothers. In general, results appear to be more precise, i.e. closer to significance or with a larger odds ratio if already significant, for the samples excluding the mothers of children attending nursery.

Table 5: Odds ratio from the logit regressions of pre-school attendance rate on the vector of controls

	Pre-school attendance rate Odds Ratio Excluding twins' mothers and 2014 observations	Pre-school attendance rate Odds Ratio Excluding twins' mothers, 2014 observations and the mothers of children attending nursery	Pre-school attendance rate Odds Ratio Excluding 2014 observations	Pre-school attendance rate Odds Ratio Excluding 2014 observations and the mothers of children attending nursery
Highest ISCED level attained	0.0509 (0.86)	0.145* (2.02)	0.0201 (0.34)	0.119 (1.70)
Age at the end of the reference income period	0.0216 (1.50)	0.0239 (1.46)	0.0256 (1.81)	0.0283 (1.75)
Weekly hours of childcare by a professional childminder	-0.0197 (-0.87)	-0.0234 (-1.08)	-0.0286 (-1.26)	-0.0298 (-1.40)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	-0.0298*** (-5.64)	-0.0408*** (-7.08)	-0.0280*** (-5.45)	-0.0394*** (-6.98)
Number of children	-0.0590 (-0.68)	0.0132 (0.13)	-0.0523 (-0.64)	-0.000454 (-0.00)
Degree of urbanization	0.169 (1.59)	0.161 (1.26)	0.136 (1.31)	0.0967 (0.77)

Quintile of child- or family-related allowances	-0.0174 (-0.54)	-0.0492 (-1.29)	-0.0182 (-0.58)	-0.0434 (-1.16)
Quintile of disposable household income	0.00728 (0.12)	0.156* (2.32)	0.0129 (0.23)	0.167* (2.55)
Married	0.213 (1.07)	0.0370 (0.15)	0.187 (0.95)	-0.00900 (-0.04)
Separated	-0.493 (-1.00)	-0.641 (-1.21)	-0.235 (-0.50)	-0.397 (-0.76)
Widowed	-2.075 (-1.70)	-2.397 (-1.79)	-2.374* (-2.01)	-2.799* (-2.22)
Divorced	0.311 (0.66)	0.281 (0.53)	0.345 (0.75)	0.314 (0.61)
2007 fixed effect	0.211 (0.87)	0.310 (1.10)	0.205 (0.87)	0.324 (1.18)
2008 fixed effect	0.104 (0.43)	0.272 (0.99)	0.0670 (0.28)	0.248 (0.91)
2009 fixed effect	0.241 (1.02)	0.301 (1.09)	0.183 (0.78)	0.278 (1.02)
2010 fixed effect	-1.248*** (-4.09)	-1.069** (-3.12)	-1.361*** (-4.48)	-1.214*** (-3.55)
2011 fixed effect	0.111 (0.44)	0.577 (1.86)	0.127 (0.52)	0.614* (2.01)
2012 fixed effect	-1.034*** (-3.51)	-0.707* (-2.07)	-1.108*** (-3.81)	-0.769* (-2.29)
2013 fixed effect	-0.809** (-2.81)	-0.686* (-2.09)	-0.868** (-3.09)	-0.733* (-2.28)
2015 fixed effect	0.268 (1.01)	0.415 (1.32)	0.211 (0.81)	0.346 (1.13)
Aosta Valley fixed effect	-0.183 (-0.37)	0.0260 (0.05)	-0.210 (-0.43)	0.109 (0.21)
Lombardy fixed effect	0.287 (0.97)	0.507 (1.49)	0.202 (0.72)	0.479 (1.48)
Bolzano fixed effect	-0.224 (-0.42)	-0.526 (-0.93)	-0.258 (-0.48)	-0.460 (-0.81)
Trento fixed effect	0.719 (1.54)	0.548 (1.09)	0.697 (1.53)	0.636 (1.30)
Veneto fixed effect	0.366 (1.19)	0.523 (1.48)	0.251 (0.85)	0.489 (1.44)
Friuli-Venezia Giulia fixed effect	0.444 (1.32)	0.567 (1.49)	0.528 (1.66)	0.730* (2.00)
Liguria fixed effect	0.110 (0.29)	-0.267 (-0.66)	0.0273 (0.07)	-0.258 (-0.65)
Emilia-Romagna fixed effect	0.349 (1.10)	0.805* (2.25)	0.295 (0.97)	0.886* (2.55)
Tuscany fixed effect	-0.0519 (-0.16)	0.0635 (0.17)	-0.169 (-0.53)	0.0957 (0.26)
Umbria fixed effect	0.123 (0.32)	0.329 (0.79)	0.116 (0.32)	0.377 (0.96)
Marche fixed effect	0.536 (1.58)	0.669 (1.72)	0.494 (1.49)	0.713 (1.88)

Lazio fixed effect	0.0764	0.307	0.0258	0.329
	(0.24)	(0.81)	(0.08)	(0.90)
Abruzzo fixed effect	-0.546	-0.467	-0.540	-0.245
	(-1.02)	(-0.79)	(-1.09)	(-0.44)
Molise fixed effect	-0.181	-0.0130	-0.185	0.107
	(-0.33)	(-0.02)	(-0.35)	(0.18)
Campania fixed effect	0.150	0.0606	0.0546	0.0501
	(0.45)	(0.17)	(0.17)	(0.14)
Apulia fixed effect	0.193	0.415	0.277	0.584
	(0.51)	(0.97)	(0.77)	(1.43)
Basilicata fixed effect	-0.594	-0.585	-0.594	-0.492
	(-1.09)	(-0.98)	(-1.10)	(-0.83)
Calabria fixed effect	0.00955	0.138	-0.141	0.121
	(0.02)	(0.31)	(-0.36)	(0.27)
Sicily fixed effect	-0.212	-0.114	-0.247	-0.0587
	(-0.60)	(-0.30)	(-0.72)	(-0.15)
Sardinia fixed effect	0.284	0.626	0.459	0.837
	(0.63)	(1.18)	(1.07)	(1.64)
Constant	-1.738**	-2.019**	-1.638**	-1.979**
	(-2.73)	(-2.78)	(-2.64)	(-2.76)
N	1788	1326	1858	1376

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted values are the year 2006, the region of Piedmont, and the "never married" indicator.

Hence, from this piece of evidence, it is possible to deduce that, on average, mothers who belong to more affluent households, are more educated, are not widows, and do not have the possibility to take advantage of childcare provided by their social network, appear to be more likely to enroll their children in pre-school, although the significance of the majority of these factors might depend on the specification of the sample. Furthermore, it is important to highlight that these results do not imply causal patterns but simply constitute some estimations regarding the likelihood of an outcome based on certain characteristics. The next section will present the results of the main analysis and discuss them.

5.3 Results

As already stated in section 4.2.1, the model adopted for the analysis revolves around an IV regression approach. The first hypothesis that is tested is that the mothers of children attending pre-school are more likely to be in employment, computed as a share of total population, and to have a higher activity rate more in general. Then, the first sub-hypothesis is that non-married women will show stronger results than married ones, similarly to what was highlighted by Goux and Maurin (2010). Furthermore, the second sub-hypothesis is that results will be stronger for the northern regions of the country, as they display a more dynamic job market and are therefore able to accommodate the increased demand for occupation that follows the availability of childcare by pre-primary institutions. All the hypotheses are tested on two different specifications of the main regressor, in order to have a robustness check of the results.

First, Table 6 shows the results of a basic OLS regression between the independent variable (for both specifications) and the outcomes of interest. These preliminary results highlight an initial support for the main hypothesis, as the coefficients for both pre-school attendance and weekly hours spent at pre-school are positively and significantly correlated with the two outcomes (employment rate, computed out of the total population, and the labor force

participation rate). More precisely, having the child attend pre-school is linked, on average, with a 17% increase in the mother's probability of being employed, and a 19% increase in the probability of being part of the labor force. Moreover, an additional weekly hour of pre-school attended by the child is linked, on average, with a significant increase of 0.6% in the probability of being employed and of 0.7% in the probability of being part of the labor force. Interestingly, among the control variables included in these regressions, the ones that display a significant relationship with the outcomes of interest are the mothers' education level, their age, the childcare provided by either a professional and/or a relative, the number of children present in the household, and the quintile of disposable household income. All these variables have positive impacts on the outcomes, with the exception of the number of children in the household, that negatively affects the mothers' probability of being employed as well as their activity rate.

Table 6: OLS regression of childcare availability at pre-school on employment outcomes

	Regression of pre-school attendance on employment (out of total population)	Regression of weekly hours of pre-school on employment (out of total population)	Regression of pre-school attendance on labor force participation rate	Regression of weekly hours of pre-school on labor force participation rate
Pre-school attendance	0.173***	-	0.193***	-
	(5.99)		(6.28)	
Weekly hours spent at pre-school	-	0.00632***	-	0.00690***
		(7.14)		(7.73)
Highest ISCED level attained	0.0376***	0.0364***	0.0408***	0.0396***
	(3.41)	(3.36)	(3.61)	(3.58)
Age at the end of the reference income period	0.0105***	0.0104***	0.00770**	0.00763**
	(4.20)	(4.19)	(2.89)	(2.88)
Weekly hours of childcare by a professional childminder	0.0129***	0.0133***	0.0118***	0.0122***
	(5.27)	(5.30)	(6.24)	(6.31)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00949***	0.00964***	0.00797***	0.00811***
	(8.63)	(8.75)	(7.42)	(7.56)
Number of children	-0.0648***	-0.0676***	-0.0869***	-0.0899***
	(-3.95)	(-4.16)	(-5.06)	(-5.29)
Degree of urbanization	-0.0148	-0.0118	-0.0205	-0.0172
	(-0.83)	(-0.68)	(-1.09)	(-0.93)
Attending nursery school	0.200***	0.0261	0.196***	0.00439
	(6.43)	(0.87)	(6.13)	(0.15)
Quintile of child- or family-related allowances	0.00629	0.00608	0.00458	0.00433
	(1.04)	(1.02)	(0.73)	(0.69)
Quintile of disposable	0.116***	0.115***	0.0805***	0.0792***

household income	(10.41)	(10.33)	(7.23)	(7.14)
2007 fixed effect	-0.0572	-0.0541	-0.0520	-0.0484
	(-1.10)	(-1.04)	(-0.99)	(-0.92)
2008 fixed effect	-0.00658	0.104*	0.0431	0.164**
	(-0.15)	(2.19)	(0.90)	(3.28)
2009 fixed effect	0.00697	0.00962	0.0282	0.0313
	(0.14)	(0.20)	(0.58)	(0.66)
2010 fixed effect	0.0141	0.00663	0.0414	0.0326
	(0.28)	(0.13)	(0.81)	(0.64)
2011 fixed effect	-0.0653	-0.0667	-0.0108	-0.0120
	(-1.38)	(-1.40)	(-0.21)	(-0.24)
2012 fixed effect	-0.0357	-0.0322	-0.0275	-0.0241
	(-0.74)	(-0.67)	(-0.53)	(-0.47)
2013 fixed effect	0.00326	0.00463	0.00683	0.00783
	(0.05)	(0.08)	(0.12)	(0.13)
2014 fixed effect	-0.0810	-0.0736	-0.00684	0.0000540
	(-1.54)	(-1.41)	(-0.12)	(0.00)
2015 fixed effect	-0.0769	-0.0764	-0.00383	-0.00305
	(-1.58)	(-1.60)	(-0.07)	(-0.06)
Aosta Valley fixed effect	0.0168	0.0172	-0.0113	-0.0110
	(0.25)	(0.25)	(-0.17)	(-0.16)
Lombardy fixed effect	-0.102	-0.0943	-0.158**	-0.149**
	(-1.86)	(-1.72)	(-2.98)	(-2.82)
Bolzano fixed effect	-0.103	-0.106	-0.181	-0.185*
	(-1.04)	(-1.08)	(-1.94)	(-2.01)
Trento fixed effect	-0.0516	-0.0558	-0.133	-0.137
	(-0.49)	(-0.53)	(-1.25)	(-1.29)
Veneto fixed effect	-0.124*	-0.118*	-0.156**	-0.149**
	(-2.13)	(-2.02)	(-2.77)	(-2.62)
Friuli-Venezia Giulia	-0.0409	-0.0362	-0.0456	-0.0401
fixed effect	(-0.65)	(-0.58)	(-0.79)	(-0.70)
Liguria fixed effect	-0.0479	-0.0521	-0.130*	-0.135*
	(-0.71)	(-0.78)	(-1.97)	(-2.03)
Emilia-Romagna fixed	-0.124*	-0.135*	-0.108	-0.119*
effect	(-2.19)	(-2.37)	(-1.92)	(-2.12)
Tuscany fixed effect	-0.103	-0.0916	-0.0732	-0.0609
	(-1.80)	(-1.61)	(-1.37)	(-1.14)
Umbria fixed effect	-0.107	-0.0894	-0.0986	-0.0796
	(-1.66)	(-1.40)	(-1.53)	(-1.24)
Marche fixed effect	-0.101	-0.0862	-0.0836	-0.0673
	(-1.67)	(-1.43)	(-1.40)	(-1.14)
Lazio fixed effect	-0.0888	-0.0937	-0.0916	-0.0968
	(-1.58)	(-1.66)	(-1.69)	(-1.79)
Abruzzo fixed effect	-0.108	-0.0972	-0.183*	-0.171*
	(-1.42)	(-1.26)	(-2.31)	(-2.13)
Molise fixed effect	-0.198	-0.191	-0.136	-0.128
	(-1.93)	(-1.80)	(-1.43)	(-1.31)
Campania fixed effect	-0.186**	-0.180**	-0.231***	-0.225***
	(-3.20)	(-3.08)	(-3.96)	(-3.85)
Apulia fixed effect	-0.168**	-0.161*	-0.145*	-0.137*
	(-2.60)	(-2.51)	(-2.16)	(-2.08)
Basilicata fixed effect	-0.209*	-0.205*	-0.220*	-0.216*
	(-2.48)	(-2.43)	(-2.29)	(-2.21)
Calabria fixed effect	-0.215**	-0.196**	-0.156*	-0.135
	(-2.99)	(-2.71)	(-2.04)	(-1.75)
Sicily fixed effect	-0.148*	-0.143	-0.206**	-0.201**
	(-2.01)	(-1.96)	(-2.77)	(-2.71)

Sardinia fixed effect	-0.0831 (-0.90)	-0.0865 (-0.93)	-0.142 (-1.57)	-0.146 (-1.60)
Constant	-0.187 (-1.80)	-0.196 (-1.90)	0.144 (1.30)	0.135 (1.23)
N	1946	1946	1946	1946
R_2	0.341	0.350	0.272	0.283

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year is 2006, while the omitted region is Piedmont.

The results for the second stage of the instrumental variable approach are shown in Table 7 (for the first stage, see section 4.2.1.2 and, more specifically, Table 1). In this case, the coefficients for both main regressors are slightly larger than in the OLS approach, especially when tested against the mothers' probability of being employed. In this case, the women in the sample appear to have, on average, a 23.5% higher probability of being employed if their child attends pre-school (predicted through the use of the instrument), and a 0.8% higher probability for every additional hour of childcare in a pre-primary establishment. Thus, from this first comparison, it appears that the OLS results would suffer from a downward bias, which is corrected by the IV approach. It is worth noticing that the relationships among the other control variables and the two outcomes maintain the same direction and have the same significance pattern in both approaches. Moreover, Table 14 in Appendix 1 shows that the results are robust across slightly different samples. In fact, it shows that the same IV regression tested on the sample including the mothers of twins returns very similar results, albeit with slightly smaller coefficients.

Table 7: Second stage of the IV regression of pre-school (in both specifications) on labor outcomes

	Regression of pre-school attendance on employment (out of total population)	Regression of weekly hours of pre-school on employment (out of total population)	Regression of pre-school attendance on labor force participation rate	Regression of weekly hours of pre-school on labor force participation rate
Pre-school attendance	0.235***	-	0.199**	-
	(3.43)		(2.72)	
Weekly hours spent at pre-school	-	0.00829***	-	0.00701**
		(3.47)		(2.76)
Highest ISCED level attained	0.0361**	0.0348**	0.0406***	0.0395***
	(3.27)	(3.18)	(3.61)	(3.55)
Age at the end of the reference income period	0.0104***	0.0103***	0.00769**	0.00762**
	(4.20)	(4.18)	(2.92)	(2.92)
Weekly hours of childcare by a professional childminder	0.0132***	0.0136***	0.0119***	0.0122***
	(5.39)	(5.36)	(6.26)	(6.27)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00986***	0.0100***	0.00800***	0.00813***
	(8.69)	(8.72)	(7.24)	(7.26)

Number of children	-0.0646***	-0.0683***	-0.0869***	-0.0900***
	(-3.98)	(-4.21)	(-5.12)	(-5.31)
Degree of urbanization	-0.0161	-0.0121	-0.0206	-0.0172
	(-0.91)	(-0.70)	(-1.11)	(-0.94)
Attending nursery school	0.227***	-0.00514	0.199***	0.00264
	(5.76)	(-0.11)	(4.73)	(0.05)
Quintile of child- or family-related allowances	0.00664	0.00631	0.00462	0.00434
	(1.11)	(1.07)	(0.74)	(0.70)
Quintile of disposable household income	0.115***	0.114***	0.0804***	0.0791***
	(10.41)	(10.29)	(7.29)	(7.19)
2007 fixed effect	-0.0602	-0.0557	-0.0523	-0.0484
	(-1.17)	(-1.08)	(-1.00)	(-0.94)
2008 fixed effect	-0.00910	0.136*	0.0429	0.166**
	(-0.20)	(2.29)	(0.90)	(2.64)
2009 fixed effect	0.00389	0.00779	0.0279	0.0312
	(0.08)	(0.16)	(0.58)	(0.66)
2010 fixed effect	0.0240	0.0129	0.0424	0.0330
	(0.47)	(0.26)	(0.82)	(0.65)
2011 fixed effect	-0.0697	-0.0709	-0.0112	-0.0123
	(-1.47)	(-1.49)	(-0.22)	(-0.25)
2012 fixed effect	-0.0287	-0.0251	-0.0268	-0.0237
	(-0.59)	(-0.52)	(-0.52)	(-0.46)
2013 fixed effect	0.0108	0.0116	0.00758	0.00822
	(0.18)	(0.19)	(0.13)	(0.14)
2014 fixed effect	-0.0620	-0.0548	-0.00496	0.00111
	(-1.10)	(-0.97)	(-0.08)	(0.02)
2015 fixed effect	-0.0807	-0.0795	-0.00421	-0.00323
	(-1.69)	(-1.69)	(-0.08)	(-0.06)
Aosta Valley fixed effect	0.0177	0.0180	-0.0112	-0.0109
	(0.27)	(0.26)	(-0.17)	(-0.16)
Lombardy fixed effect	-0.107*	-0.0961	-0.158**	-0.149**
	(-1.97)	(-1.77)	(-2.99)	(-2.84)
Bolzano fixed effect	-0.102	-0.106	-0.181*	-0.185*
	(-1.05)	(-1.10)	(-1.96)	(-2.03)
Trento fixed effect	-0.0587	-0.0632	-0.133	-0.137
	(-0.56)	(-0.61)	(-1.26)	(-1.30)
Veneto fixed effect	-0.129*	-0.121*	-0.157**	-0.150**
	(-2.24)	(-2.07)	(-2.77)	(-2.63)
Friuli-Venezia Giulia fixed effect	-0.0473	-0.0403	-0.0463	-0.0403
	(-0.75)	(-0.65)	(-0.80)	(-0.71)
Liguria fixed effect	-0.0471	-0.0527	-0.130*	-0.135*
	(-0.70)	(-0.79)	(-1.99)	(-2.05)
Emilia-Romagna fixed effect	-0.131*	-0.144*	-0.109	-0.120*
	(-2.31)	(-2.48)	(-1.92)	(-2.07)
Tuscany fixed effect	-0.105	-0.0903	-0.0734	-0.0608
	(-1.85)	(-1.59)	(-1.39)	(-1.15)
Umbria fixed effect	-0.109	-0.0865	-0.0988	-0.0795
	(-1.71)	(-1.36)	(-1.54)	(-1.25)
Marche fixed effect	-0.108	-0.0882	-0.0843	-0.0674
	(-1.78)	(-1.46)	(-1.41)	(-1.15)
Lazio fixed effect	-0.0926	-0.0986	-0.0920	-0.0970
	(-1.67)	(-1.76)	(-1.71)	(-1.80)
Abruzzo fixed effect	-0.104	-0.0901	-0.182*	-0.170*

	(-1.37)	(-1.16)	(-2.32)	(-2.14)
Molise fixed effect	-0.199*	-0.190	-0.136	-0.128
	(-1.99)	(-1.81)	(-1.44)	(-1.32)
Campania fixed effect	-0.187**	-0.180**	-0.232***	-0.225***
	(-3.26)	(-3.09)	(-4.01)	(-3.88)
Apulia fixed effect	-0.170**	-0.161*	-0.145*	-0.137*
	(-2.64)	(-2.53)	(-2.18)	(-2.10)
Basilicata fixed effect	-0.204*	-0.199*	-0.220*	-0.215*
	(-2.42)	(-2.35)	(-2.30)	(-2.23)
Calabria fixed effect	-0.218**	-0.192**	-0.156*	-0.135
	(-3.07)	(-2.67)	(-2.07)	(-1.76)
Sicily fixed effect	-0.147*	-0.141	-0.206**	-0.201**
	(-2.00)	(-1.92)	(-2.79)	(-2.73)
Sardinia fixed effect	-0.0881	-0.0918	-0.143	-0.146
	(-0.94)	(-0.98)	(-1.59)	(-1.62)
Constant	-0.201	-0.211*	0.143	0.134
	(-1.94)	(-2.03)	(1.29)	(1.22)
N	1946	1946	1946	1946
R_2	0.338	0.348	0.272	0.283

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year is 2006, and the omitted region is Piedmont.

Then, Table 8 shows the results for the IV approach when it is conducted on the restricted sample of non-married women. This analysis concerns the first sub-hypothesis, which stipulates that the effects shown in Table 7 should be stronger when focusing on women who are not married (a category that includes widowed, single, divorced or simply cohabiting with a partner). The first thing to notice when considering these results is that the sample size has been reduced significantly from 1,946 to 347 observations. Such a decrease, although not causing missing observations in any of the sub-categories highlighted by the control variables, imposes the need to employ additional carefulness in interpreting the results obtained. Interestingly, the hypothesis appears to be confirmed, as the average increase in the employment rate for non-married women linked to having a child attending pre-school is almost double the one observed in the sample for all women, with a significant coefficient of 45.5%. The same is true also for the relationship with labor force participation rate, which increases from 20% in Table 7 to 37.8%. The same pattern is identified when using the weekly hours spent at pre-school as main regressor, as the estimator of the average effect on employment rate is 1.5% and the one for the effect on the activity rate is 1.3%.

It is also interesting to highlight that the R_2 for the various models remains quite high and consistent throughout the whole analysis. In fact, the explanatory power of the IV approach shown in Table 7 is around 34% with respect to the employment rate, while it is slightly smaller (27-28%) with respect to the labor force participation rate. Similarly, in the case of the OLS model (Table 6) the estimates for the R_2 are respectively of 34-35% and 27-28%, and in the case of the IV regression only for non-married mothers it increases slightly for employment rate to 40% and decreases for the activity rate to 24-25%. In general, the consistency of the R_2 across the different specifications provides confidence in the robustness of the results obtained.

Table 8: IV regression restricting the sample on non-married women

	Regression of pre-school attendance on employment (out of total population)	Regression of weekly hours of pre-school on employment (out of total population)	Regression of pre-school attendance on labor force participation rate	Regression of weekly hours of pre-school on labor force participation rate
Pre-school attendance	0.455**	-	0.378*	-
	(2.95)		(2.29)	
Weekly hours spent at pre-school	-	0.0153**	-	0.0127*
		(2.98)		(2.25)
Highest ISCED level attained	0.0272	0.0325	0.0473*	0.0517*
	(1.07)	(1.31)	(2.05)	(2.25)
Age at the end of the reference income period	0.0153***	0.0159***	0.00181	0.00232
	(3.47)	(3.70)	(0.35)	(0.45)
Weekly hours of childcare by a professional childminder	0.00416	0.00720*	0.00378	0.00630
	(1.20)	(2.18)	(1.49)	(1.86)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.0127***	0.0136***	0.00749***	0.00831***
	(6.22)	(6.09)	(3.75)	(3.73)
Number of children	-0.0659	-0.0815*	-0.0165	-0.0294
	(-1.88)	(-2.41)	(-0.40)	(-0.69)
Degree of urbanization	-0.00350	0.0140	-0.0803*	-0.0657
	(-0.10)	(0.42)	(-2.30)	(-1.81)
Attending nursery school	0.270**	-0.184	0.212*	-0.164
	(3.17)	(-1.81)	(2.34)	(-1.60)
Quintile of child- or family-related allowances	0.0459***	0.0433***	0.0256*	0.0234*
	(3.80)	(3.59)	(2.16)	(1.97)
Quintile of disposable household income	0.0251	0.0276	-0.00123	0.000884
	(1.20)	(1.35)	(-0.06)	(0.05)
2007 fixed effect	-0.215	-0.246	-0.252*	-0.278*
	(-1.60)	(-1.67)	(-1.97)	(-2.11)
2008 fixed effect	-0.267*	0.00509	-0.156	0.0687
	(-2.09)	(0.03)	(-1.24)	(0.49)
2009 fixed effect	-0.00166	-0.0144	-0.130	-0.141
	(-0.01)	(-0.10)	(-1.15)	(-1.18)
2010 fixed effect	-0.0186	-0.0641	0.0136	-0.0241
	(-0.13)	(-0.42)	(0.11)	(-0.20)
2011 fixed effect	-0.280*	-0.302*	-0.291*	-0.309*
	(-2.11)	(-2.09)	(-2.38)	(-2.53)
2012 fixed effect	-0.175	-0.182	-0.101	-0.108
	(-1.44)	(-1.35)	(-0.92)	(-0.95)
2013 fixed effect	-0.217	-0.234	-0.183	-0.196
	(-1.47)	(-1.52)	(-1.40)	(-1.49)

2014 fixed effect	-0.179	-0.214	-0.0401	-0.0690
	(-1.41)	(-1.52)	(-0.32)	(-0.52)
2015 fixed effect	-0.341**	-0.381*	-0.150	-0.184
	(-2.59)	(-2.56)	(-1.17)	(-1.35)
Aosta Valley fixed effect	-0.142	-0.125	-0.144	-0.130
	(-0.82)	(-0.64)	(-0.97)	(-0.78)
Lombardy fixed effect	-0.479***	-0.419***	-0.405***	-0.356***
	(-3.67)	(-3.45)	(-3.74)	(-3.42)
Bolzano fixed effect	-0.344*	-0.347*	-0.311*	-0.313*
	(-2.48)	(-2.48)	(-2.30)	(-2.38)
Trento fixed effect	-0.285	-0.254	-0.349	-0.322
	(-0.73)	(-0.63)	(-1.06)	(-0.96)
Veneto fixed effect	-0.0949	-0.0796	-0.121	-0.109
	(-0.83)	(-0.68)	(-1.18)	(-1.00)
Friuli-Venezia Giulia	-0.0550	0.00787	-0.173	-0.120
fixed effect	(-0.37)	(0.06)	(-1.35)	(-1.03)
Liguria fixed effect	-0.162	-0.166	-0.241*	-0.244*
	(-1.25)	(-1.29)	(-1.99)	(-2.03)
Emilia-Romagna fixed	-0.308**	-0.296*	-0.138	-0.129
effect	(-2.74)	(-2.57)	(-1.86)	(-1.60)
Tuscany fixed effect	-0.250*	-0.215*	-0.158*	-0.129
	(-2.32)	(-1.97)	(-2.00)	(-1.56)
Umbria fixed effect	-0.240	-0.203	-0.110	-0.0800
	(-1.49)	(-1.38)	(-0.79)	(-0.54)
Marche fixed effect	-0.302*	-0.259*	-0.169	-0.133
	(-2.33)	(-2.08)	(-1.65)	(-1.25)
Lazio fixed effect	-0.0417	-0.0450	-0.181*	-0.184*
	(-0.40)	(-0.41)	(-2.21)	(-2.06)
Abruzzo fixed effect	-0.214	-0.166	-0.169	-0.129
	(-1.30)	(-1.00)	(-1.00)	(-0.75)
Molise fixed effect	-0.382*	-0.442***	-0.656***	-0.705***
	(-2.14)	(-3.56)	(-5.75)	(-6.80)
Campania fixed effect	-0.230	-0.211	-0.300*	-0.283*
	(-1.87)	(-1.66)	(-2.55)	(-2.29)
Apulia fixed effect	-0.579***	-0.519***	-0.245	-0.195
	(-4.76)	(-4.32)	(-1.52)	(-1.19)
Basilicata fixed effect	-0.358**	-0.320*	-0.0881	-0.0567
	(-2.61)	(-2.16)	(-0.24)	(-0.15)
Calabria fixed effect	-0.710***	-0.577***	-0.532*	-0.422*
	(-4.89)	(-4.28)	(-2.53)	(-2.01)
Sicily fixed effect	-0.354*	-0.265	-0.491**	-0.418*
	(-2.28)	(-1.59)	(-3.15)	(-2.51)
Sardinia fixed effect	-0.396*	-0.355	-0.475*	-0.440*
	(-2.09)	(-1.83)	(-2.52)	(-2.25)
Constant	0.0544	-0.0255	0.809***	0.742**
	(0.22)	(-0.10)	(3.41)	(3.02)
N	347	347	347	347
R_2	0.399	0.400	0.249	0.242

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year is 2006 and the omitted region is Piedmont.

Finally, the last sub-hypothesis concerns the presence of different results between the northern regions of the country and the southern ones. In fact, it is expected that the effects are weaker, if not non-existent, in the South, that is the part of the country that has traditionally experienced a lower economic development and where employment rates lag behind. Table 9 shows that,

according to the 2015 wave of the EU-SILC survey, there is a strong dividend across north and south of Italy in terms of employment and participation to the labor force, as the individuals from northern regions displayed, on average, a 17% higher employment rate and a 9.8% higher activity rate. A difference that increases substantially when focusing on women, for whom the gap between the North and the South of the country is 20.2% for the employment rate and 17.1% for the labor force participation rate.

Table 9: Differences in the employment rate, computed out of the total population, between the North and the South of the country for different groups in 2015

	Employment rate Full sample	Employment rate Only men	Employment rate Only women	Labor force participation rate Full sample	Labor force participation Only men	Labor force participation Only women
Northern regions	0.170***	0.137***	0.202***	0.0980***	0.0218*	0.171***
	(22.76)	(13.18)	(19.45)	(13.71)	(2.48)	(16.30)
Constant	0.471***	0.583***	0.361***	0.626***	0.783***	0.472***
	(78.57)	(68.58)	(44.86)	(107.54)	(109.93)	(56.38)
N	27736	13588	14148	27736	13588	14148
R_2	0.029	0.021	0.040	0.011	0.001	0.030

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the estimates are presented through a regression between the outcome of interest (at the top of each column) and a nominal variable for whether or not the household of the respondent is located in the North of the country, as observations needed to be weighted (which cannot be done with a simple t-test in Stata). The coefficient of the main regressor can be interpreted as the difference between the outcomes in the northern regions and the outcome in the southern ones. The constant can be interpreted as the average value of the outcome for the southern regions.

However, Table 10 and Table 11 do not appear to support this last hypothesis. In fact, according to Table 10, the average effect of pre-school attendance on employment rate in the North is around 18%, while it is 32.7% in the South, with an almost double magnitude, although 1,240 observations are from the North and only 706 are from the South. Yet, when looking at the effect on labor force, pre-school attendance appears to significantly affect the outcome only in the North, with a coefficient of 21.5%. Accordingly, Table 11, which presents the results for the IV regressions using the weekly hours of pre-school attended by the child as main regressor, presents similar results, with a significant coefficient of 0.6% higher employment rate for each additional hour the child spends at pre-school in the North and a significant coefficient of 1.3% for each additional hour in the South. Interestingly, also in this case the effect on labor force participation is significant only in the northern regions of the country, with a coefficient of 21.5% for pre-school attendance and of 0.8% for the weekly hours of pre-school. By contrast, the coefficients for the South are not significant, although they are similar in magnitude and direction to the ones for the North. For what concerns the control variables, the signs of the various coefficients are consistent with previous specifications of the model although sometimes they appear to be less precisely estimated, likely due to the smaller sample size.

Table 10: IV regressions of the pre-school attendance rate among children and their mothers' employment outcomes for regions in the North of Italy and in the South of Italy.

	Employment rate (out of total population) Northern regions only	Employment rate (out of total population) Southern regions only	Labor force participation rate Northern regions only	Labor force participation rate Southern regions only
Pre-school attendance	0.180*	0.327**	0.215*	0.189
	(2.13)	(2.82)	(2.53)	(1.44)
Highest ISCED level attained	0.0326*	0.0449*	0.0322*	0.0506**
	(2.31)	(2.52)	(2.27)	(2.70)
Age at the end of the reference income period	0.00899**	0.0114**	0.0106**	0.00326
	(2.73)	(3.06)	(3.14)	(0.78)
Weekly hours of childcare by a professional childminder	0.0139***	0.0120	0.0127***	0.0113*
	(5.30)	(1.65)	(5.88)	(2.07)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00972***	0.0102***	0.00788***	0.00829***
	(6.40)	(5.73)	(5.39)	(5.00)
Number of children	-0.0675**	-0.0647**	-0.0979***	-0.0711**
	(-3.23)	(-2.60)	(-4.75)	(-2.58)
Degree of urbanization	-0.00749	-0.0404	-0.0269	-0.0127
	(-0.32)	(-1.41)	(-1.15)	(-0.40)
Attending nursery school	0.233***	0.227***	0.232***	0.166*
	(4.41)	(3.95)	(4.35)	(2.55)
Quintile of child- or family-related allowances	0.00868	0.00370	0.00936	0.000308
	(1.11)	(0.42)	(1.19)	(0.03)
Quintile of disposable household income	0.110***	0.125***	0.0704***	0.0982***
	(7.53)	(7.18)	(4.96)	(5.58)
2007 fixed effect	-0.141*	0.0812	-0.0883	0.0289
	(-2.04)	(1.03)	(-1.34)	(0.34)
2008 fixed effect	-0.0557	0.0831	0.0219	0.0936
	(-0.93)	(1.17)	(0.37)	(1.13)
2009 fixed effect	-0.00291	0.0405	0.0155	0.0625
	(-0.05)	(0.52)	(0.26)	(0.74)
2010 fixed effect	-0.0150	0.0999	0.0448	0.0561
	(-0.22)	(1.26)	(0.67)	(0.65)
2011 fixed effect	-0.0928	-0.0249	-0.0536	0.0600
	(-1.51)	(-0.32)	(-0.84)	(0.69)
2012 fixed effect	-0.105	0.0925	-0.0960	0.0726
	(-1.70)	(1.17)	(-1.48)	(0.82)
2013 fixed effect	-0.124*	0.212	-0.0820	0.143
	(-1.97)	(1.91)	(-1.27)	(1.33)
2014 fixed effect	-0.125	0.0521	-0.0330	0.0555
	(-1.67)	(0.56)	(-0.45)	(0.53)
2015 fixed effect	-0.135*	0.0162	-0.0974	0.144

	(-2.14)	(0.21)	(-1.55)	(1.62)
Aosta Valley fixed effect	0.00268	-	-0.0102	-
	(0.04)		(-0.14)	
Lombardy fixed effect	-0.106	-	-0.173***	-
	(-1.95)		(-3.29)	
Bolzano fixed effect	-0.120	-	-0.192*	-
	(-1.22)		(-2.14)	
Trento fixed effect	-0.0514	-	-0.133	-
	(-0.49)		(-1.30)	
Veneto fixed effect	-0.123*	-	-0.163**	-
	(-2.12)		(-2.90)	
Friuli-Venezia Giulia fixed effect	-0.0350	-	-0.0438	-
	(-0.56)		(-0.76)	
Liguria fixed effect	-0.0387	-	-0.128*	-
	(-0.59)		(-1.99)	
Emilia-Romagna fixed effect	-0.126*	-	-0.111*	-
	(-2.23)		(-1.98)	
Tuscany fixed effect	-0.0951	-	-0.0734	-
	(-1.69)	-	(-1.39)	-
Umbria fixed effect	-0.111		-0.0937	
	(-1.70)	-	(-1.44)	-
Marche fixed effect	-0.0980		-0.0787	
	(-1.63)		(-1.30)	
Lazio fixed effect	-	-0.0261	-	0.0659
		(-0.27)		(0.73)
Abruzzo fixed effect	-	-0.0101	-	-0.0489
		(-0.09)		(-0.47)
Molise fixed effect	-	-0.112	-	0.00281
		(-0.90)		(0.02)
Campania fixed effect	-	-0.114	-	-0.0677
		(-1.14)		(-0.70)
Apulia fixed effect	-	-0.0774	-	0.0216
		(-0.78)		(0.22)
Basilicata fixed effect	-	-0.0829	-	-0.0637
		(-0.73)		(-0.53)
Calabria fixed effect	-	-0.124	-	-0.00276
		(-1.19)		(-0.03)
Sicily fixed effect	-	-0.0443	-	-0.0466
		(-0.42)		(-0.46)
Constant	-0.0788	-0.448**	0.153	-0.0382
	(-0.58)	(-2.64)	(1.11)	(-0.20)
N	1240	706	1240	706
R_2	0.284	0.349	0.243	0.270

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year is 2006, while the omitted region is Piedmont for the regressions concerning the north of Italy and it is Sardinia for the ones concerning the south.

Table 11: IV regressions of the weekly hours of preschool attended by children and their mothers' employment outcomes for regions in the North of Italy and in the South of Italy.

	Employment rate (out of total population) Northern regions only	Employment rate (out of total population) Southern regions only	Labor force participation rate Northern regions only	Labor force participation rate Southern regions only
Weekly hours spent at pre-school	0.00590*	0.0132**	0.00705*	0.00763
	(2.16)	(2.83)	(2.56)	(1.46)
Highest ISCED level attained	0.0314*	0.0467**	0.0307*	0.0517**
	(2.23)	(2.66)	(2.17)	(2.83)
Age at the end of the reference income period	0.00855**	0.0125***	0.0101**	0.00388
	(2.59)	(3.39)	(2.98)	(0.96)
Weekly hours of childcare by a professional childminder	0.0143***	0.0122	0.0131***	0.0115*
	(5.28)	(1.55)	(5.91)	(2.04)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00976***	0.0106***	0.00793***	0.00847***
	(6.40)	(5.73)	(5.40)	(4.99)
Number of children	-0.0722***	-0.0645**	-0.104***	-0.0711**
	(-3.49)	(-2.61)	(-5.07)	(-2.62)
Degree of urbanization	-0.00234	-0.0447	-0.0207	-0.0151
	(-0.10)	(-1.56)	(-0.90)	(-0.48)
Attending nursery school	0.0606	-0.122	0.0260	-0.0359
	(1.15)	(-1.28)	(0.51)	(-0.35)
Quintile of child- or family-related allowances	0.00760	0.00631	0.00807	0.00182
	(0.97)	(0.70)	(1.03)	(0.19)
Quintile of disposable household income	0.110***	0.122***	0.0697***	0.0964***
	(7.51)	(6.96)	(4.94)	(5.47)
2007 fixed effect	-0.133	0.0708	-0.0782	0.0229
	(-1.92)	(0.88)	(-1.19)	(0.27)
2008 fixed effect	0.0673	0.274*	0.169*	0.204
	(0.91)	(2.52)	(2.29)	(1.69)
2009 fixed effect	0.00663	0.0277	0.0269	0.0551
	(0.11)	(0.35)	(0.47)	(0.66)
2010 fixed effect	-0.0210	0.0752	0.0377	0.0418
	(-0.31)	(0.96)	(0.57)	(0.50)
2011 fixed effect	-0.0954	-0.00573	-0.0567	0.0711
	(-1.54)	(-0.07)	(-0.89)	(0.81)
2012 fixed effect	-0.110	0.116	-0.102	0.0862
	(-1.80)	(1.45)	(-1.59)	(0.96)
2013 fixed effect	-0.125*	0.218	-0.0829	0.147
	(-1.99)	(1.92)	(-1.30)	(1.35)
2014 fixed effect	-0.123	0.0757	-0.0309	0.0691
	(-1.66)	(0.76)	(-0.43)	(0.63)
2015 fixed effect	-0.134*	0.0163	-0.0971	0.144

	(-2.20)	(0.21)	(-1.59)	(1.62)
Aosta Valley fixed effect	-0.00154	-	-0.0152	-
	(-0.02)		(-0.21)	
Lombardy fixed effect	-0.0974	-	-0.163**	-
	(-1.81)		(-3.15)	
Bolzano fixed effect	-0.125	-	-0.199*	-
	(-1.28)		(-2.25)	
Trento fixed effect	-0.0543	-	-0.137	-
	(-0.52)		(-1.34)	
Veneto fixed effect	-0.117*	-	-0.155**	-
	(-2.01)		(-2.76)	
Friuli-Venezia Giulia fixed effect	-0.0300	-	-0.0377	-
	(-0.50)		(-0.67)	
Liguria fixed effect	-0.0419	-	-0.132*	-
	(-0.64)		(-2.04)	
Emilia-Romagna fixed effect	-0.134*	-	-0.120*	-
	(-2.34)		(-2.11)	
Tuscany fixed effect	-0.0834	-	-0.0594	-
	(-1.49)		(-1.13)	
Umbria fixed effect	-0.0965	-	-0.0762	-
	(-1.50)		(-1.19)	
Marche fixed effect	-0.0820	-	-0.0596	-
	(-1.40)		(-1.01)	
Lazio fixed effect	-	-0.0363	-	0.0600
		(-0.37)		(0.66)
Abruzzo fixed effect	-	0.0237	-	-0.0293
		(0.21)		(-0.27)
Molise fixed effect	-	-0.0815	-	0.0204
		(-0.62)		(0.17)
Campania fixed effect	-	-0.0970	-	-0.0576
		(-0.93)		(-0.59)
Apulia fixed effect	-	-0.0539	-	0.0352
		(-0.53)		(0.36)
Basilicata fixed effect	-	-0.0539	-	-0.0470
		(-0.46)		(-0.38)
Calabria fixed effect	-	-0.0687	-	0.0289
		(-0.63)		(0.27)
Sicily fixed effect	-	-0.0189	-	-0.0319
		(-0.17)		(-0.31)
Constant	-0.0679	-0.536**	0.167	-0.0891
	(-0.50)	(-2.97)	(1.21)	(-0.45)
N	1240	706	1240	706
R_2	0.299	0.338	0.256	0.283

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year is 2006, while the omitted region is Piedmont for the regressions concerning the North of Italy and it is Sardinia for the ones concerning the South.

Therefore, these results appear to point towards a stronger effect on employment, computed out of the total population (and not just the active one), in the South of the country rather than in the North, where the effect of pre-primary education is almost halved, while the opposite is true for labor force participation. In order to better understand these seemingly conflicting results, it could be helpful to split the sample across two main periods: the years before the Great Financial Crisis and the years after it. In fact, such event greatly impacted the Italian economy in different ways depending on the region and thus, by focusing on the comparison of the results

before and after it, it could be possible to identify some trends that have not been uncovered in the previous analysis. This further step would, decrease the number of observations of the sample, as only certain years would be considered for each regression, but increase the precision of the estimates, as the individuals who are compared among themselves would be drawn from a smaller period of time and thus should be overall more comparable. Table 12 reports the results for the regressions of pre-school attendance on employment rate and activity rate for the years before the financial crisis (from 2006 to 2009) and for the years after (from 2010 to 2015). It is worthy to notice that the effects of pre-school on labor outcomes are stronger for the 2010-2015 period. In fact, in the case of the employment rate, the average effect linked to having the child attend pre-primary education is an increase of 27.6% in the latter period, while it is of only about 16% in the former. Accordingly, although for both periods the coefficients for the relationship with the activity rate are not significant, the estimate is almost doubled in magnitude for the years from 2010 to 2015 and it falls short of significance at the 95% confidence interval with a z-score of 1.94. Similarly, Table 16 in Appendix 2 shows comparable results when employing the weekly hours of childcare provided at a pre-primary education establishment as the main regressor.

Table 12: IV regressions of pre-school attendance on the outcomes of interest for the years before and after the financial crisis

	Employment rate (out of total population) 2006 - 2009	Employment rate (out of total population) 2010 - 2015	Labor force participation rate 2006 - 2009	Labor force participation rate 2010 - 2015
Pre-school attendance	0.158*	0.276*	0.139	0.231
	(2.01)	(2.49)	(1.70)	(1.94)
Highest ISCED level attained	0.0644***	0.0150	0.0554***	0.0274
	(3.78)	(1.05)	(3.32)	(1.80)
Age at the end of the reference income period	0.0136***	0.00834*	0.0133***	0.00490
	(3.81)	(2.53)	(3.57)	(1.39)
Weekly hours of childcare by a professional childminder	0.0140***	0.0109**	0.0125***	0.0106***
	(5.07)	(3.13)	(5.08)	(4.15)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00761***	0.0114***	0.00579***	0.00957***
	(4.24)	(8.22)	(3.43)	(7.00)
Number of children	-0.0432	-0.0768***	-0.0750**	-0.0949***
	(-1.74)	(-3.74)	(-2.99)	(-4.34)
Degree of urbanization	-0.0116	-0.0196	-0.00926	-0.0248
	(-0.45)	(-0.83)	(-0.35)	(-0.98)
Attending nursery school	0.0765	0.308***	0.0840	0.259***
	(1.19)	(6.03)	(1.24)	(4.68)
Quintile of child- or family-related allowances	-0.00129	0.0118	0.00324	0.00576
	(-0.15)	(1.47)	(0.37)	(0.69)
Quintile of disposable	0.101***	0.122***	0.0698***	0.0883***

household income	(5.97)	(8.73)	(4.20)	(6.28)
2007 fixed effect	-0.0569	-	-0.0560	-
	(-1.16)		(-1.10)	
2008 fixed effect	0.00814	-	0.0605	-
	(0.18)		(1.26)	
2009 fixed effect	0.0110	-	0.0295	-
	(0.23)		(0.62)	
2010 fixed effect	-	0.0970	-	0.0431
		(1.74)		(0.74)
2011 fixed effect	-	0.00455	-	-0.00963
		(0.09)		(-0.18)
2012 fixed effect	-	0.0413	-	-0.0331
		(0.78)		(-0.57)
2013 fixed effect	-	0.0883	-	0.00780
		(1.43)		(0.12)
2014 fixed effect	-	0.0180	-	-0.00416
		(0.27)		(-0.06)
Aosta Valley fixed effect	0.00962	0.0423	-0.112	0.0745
	(0.10)	(0.44)	(-1.24)	(0.77)
Lombardy fixed effect	-0.113	-0.0879	-0.182*	-0.135*
	(-1.28)	(-1.30)	(-2.37)	(-1.97)
Bolzano fixed effect	-0.189	-0.0534	-0.292**	-0.121
	(-1.53)	(-0.40)	(-2.64)	(-0.92)
Trento fixed effect	-0.00679	-0.0615	-0.107	-0.129
	(-0.05)	(-0.43)	(-0.88)	(-0.90)
Veneto fixed effect	-0.137	-0.115	-0.126	-0.181*
	(-1.52)	(-1.51)	(-1.65)	(-2.34)
Friuli-Venezia Giulia fixed effect	-0.00178	-0.0774	-0.0425	-0.0543
	(-0.02)	(-0.91)	(-0.58)	(-0.67)
Liguria fixed effect	-0.0903	-0.0490	-0.227*	-0.0912
	(-0.80)	(-0.63)	(-2.19)	(-1.15)
Emilia-Romagna fixed effect	-0.0471	-0.161*	-0.139	-0.0820
	(-0.51)	(-2.31)	(-1.73)	(-1.10)
Tuscany fixed effect	-0.122	-0.0831	-0.168	-0.0177
	(-1.28)	(-1.20)	(-1.96)	(-0.27)
Umbria fixed effect	-0.0907	-0.105	-0.0950	-0.0931
	(-0.88)	(-1.27)	(-1.06)	(-1.06)
Marche fixed effect	-0.142	-0.0852	-0.249**	-0.000176
	(-1.42)	(-1.14)	(-2.67)	(-0.00)
Lazio fixed effect	-0.121	-0.0788	-0.189*	-0.0299
	(-1.34)	(-1.15)	(-2.38)	(-0.43)
Abruzzo fixed effect	-0.243	-0.0417	-0.406**	-0.0896
	(-1.49)	(-0.49)	(-2.72)	(-0.98)
Molise fixed effect	-0.294*	-0.131	-0.304	-0.0418
	(-2.00)	(-1.02)	(-1.88)	(-0.38)
Campania fixed effect	-0.227*	-0.159*	-0.265**	-0.201**
	(-2.41)	(-2.22)	(-3.03)	(-2.70)
Apulia fixed effect	-0.193	-0.147	-0.276**	-0.0643
	(-1.78)	(-1.85)	(-2.87)	(-0.73)
Basilicata fixed effect	-0.198	-0.230*	-0.117	-0.309**
	(-1.27)	(-2.41)	(-0.74)	(-2.82)
Calabria fixed effect	-0.272**	-0.171	-0.208	-0.114
	(-2.60)	(-1.87)	(-1.67)	(-1.19)
Sicily fixed effect	-0.248**	-0.0732	-0.347***	-0.102
	(-2.58)	(-0.72)	(-3.80)	(-0.99)
Sardinia fixed effect	-0.0622	-0.102	-0.167	-0.135
	(-0.42)	(-0.91)	(-1.17)	(-1.23)

Constant	-0.293 (-1.92)	-0.212 (-1.47)	0.0201 (0.14)	0.198 (1.22)
N	853	1093	853	1093
R_2	0.324	0.372	0.260	0.304

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year for the period 2006-2009 is 2006, while for the period 2010-2015 is 2015.

The comparison between the analysis conducted on women from the North and the South of the country is provided in Table 13 and Table 14 that display, respectively, the effects of pre-school attendance on the employment rate of mothers in the North and the South in the years 2006-2009 and 2010-2015, and the effects of pre-school attendance on the activity rate of mothers in the North and the South in the years 2006-2009 and 2010-2015. More specifically, Table 13 shows that, for the years from 2006 to 2009, having the child attend pre-school significantly increases, on average, the employment rate of mothers in the South by 37.9%, while it has no significant effect on mothers in the North (for whom the coefficient is close to zero). By contrast, for the years from 2010 to 2015, this pattern is reversed, with a significant and positive effect of pre-school on the employment rate of mothers living in the North of the country, which increases by 30.6%, and a positive but insignificant effect for those living in the southern regions.

The relationships between the outcome and the various controls appear to remain consistent to what observed also in the previous models, with some loss of precision in the estimations, probably due to the smaller sample sizes, which in turn inflate the standard errors.

Table 13: IV regressions of the relationship between pre-school attendance and employment rate for the North and the South of the country and for the years before and after the financial crisis

	Employment rate (out of total population) 2006-2009, North	Employment rate (out of total population) 2010-2015, North	Employment rate (out of total population) 2006-2009, South	Employment rate (out of total population) 2010-2015, South
Pre-school attendance	0.00637 (0.06)	0.306* (2.21)	0.379** (2.93)	0.197 (1.02)
Highest ISCED level attained	0.0491* (2.29)	0.0126 (0.66)	0.0811** (2.86)	0.0171 (0.81)
Age at the end of the reference income period	0.0114* (2.36)	0.00632 (1.43)	0.0114 (1.88)	0.0107* (2.00)
Weekly hours of childcare by a professional childminder	0.0125*** (4.31)	0.0137*** (3.90)	0.0201** (2.77)	-0.0121 (-0.95)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00555* (2.05)	0.0119*** (6.62)	0.0106*** (5.03)	0.0105*** (4.09)
Number of children	-0.0773*	-0.0658*	-0.0151	-0.0848**

	(-2.42)	(-2.44)	(-0.38)	(-2.90)
Degree of urbanization	0.0196	-0.0286	-0.0941*	-0.00986
	(0.60)	(-0.85)	(-2.04)	(-0.30)
Attending nursery school	0.0246	0.339***	0.101	0.272***
	(0.28)	(5.03)	(1.04)	(3.44)
Quintile of child- or family-related allowances	0.00579	0.0142	-0.00690	0.00634
	(0.49)	(1.38)	(-0.55)	(0.54)
Quintile of disposable household income	0.127***	0.106***	0.0823**	0.147***
	(5.65)	(5.62)	(3.15)	(6.59)
2007 fixed effect	-0.120	-	0.0791	-
	(-1.75)		(1.00)	
2008 fixed effect	-0.0192	-	0.109	-
	(-0.32)		(1.49)	
2009 fixed effect	0.0108	-	0.0578	-
	(0.18)		(0.74)	
2010 fixed effect	-	0.128	-	0.0378
		(1.70)		(0.46)
2011 fixed effect	-	0.0254	-	-0.0465
		(0.40)		(-0.61)
2012 fixed effect	-	0.0394	-	0.0343
		(0.58)		(0.42)
2013 fixed effect	-	0.0290	-	0.160
		(0.44)		(1.56)
2014 fixed effect	-	0.0413	-	-0.0257
		(0.48)		(-0.24)
Aosta Valley fixed effect	-0.0293	0.0617	-	-
	(-0.30)	(0.58)		
Lombardy fixed effect	-0.0837	-0.0941	-	-
	(-0.96)	(-1.39)		
Bolzano fixed effect	-0.246*	-0.0630	-	-
	(-2.05)	(-0.48)		
Trento fixed effect	0.00960	-0.0550	-	-
	(0.07)	(-0.39)		
Veneto fixed effect	-0.115	-0.108	-	-
	(-1.30)	(-1.37)		
Friuli-Venezia Giulia fixed effect	0.0401	-0.0686	-	-
	(0.46)	(-0.82)		
Liguria fixed effect	-0.0814	-0.0476	-	-
	(-0.73)	(-0.62)		
Emilia-Romagna fixed effect	-0.0459	-0.162*	-	-
	(-0.51)	(-2.31)		
Tuscany fixed effect	-0.132	-0.0707	-	-
	(-1.44)	(-1.02)		
Umbria fixed effect	-0.0781	-0.102	-	-
	(-0.79)	(-1.16)		
Marche fixed effect	-0.109	-0.0795	-	-
	(-1.11)	(-1.07)		
Lazio fixed effect	-	-	-0.130	0.0175
			(-0.87)	(0.15)
Abruzzo fixed effect	-	-	-0.201	0.0493
			(-1.02)	(0.40)
Molise fixed effect	-	-	-0.158	-0.0421
			(-0.81)	(-0.26)

Campania fixed effect	-	-	-0.277	-0.0440
			(-1.77)	(-0.36)
Apulia fixed effect	-	-	-0.150	-0.0271
			(-0.95)	(-0.23)
Basilicata fixed effect	-	-	-0.0356	-0.119
			(-0.17)	(-0.93)
Calabria fixed effect	-	-	-0.249	-0.0552
			(-1.57)	(-0.44)
Sicily fixed effect	-	-	-0.231	0.0436
			(-1.55)	(0.32)
Constant	-0.167	-0.118	-0.312	-0.408
	(-0.83)	(-0.62)	(-1.23)	(-1.62)
N	549	691	304	402
R_2	0.237	0.324	0.352	0.392

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year for the period 2006-2009 is 2006, while for the period 2010-2015 is 2015. The omitted region is Piedmont for the regression concerning the North of Italy and it is Sardinia for the one concerning the South.

Table 14 does not appear to confirm the results displayed in Table 13, as in this case the effect of pre-school enrollment on the labor force participation rate of mothers appears not to be significant. However, by analyzing the coefficients with more attention, it is possible to notice that the estimate for the average effect of pre-primary education and the activity rate of mothers in the North for the years from 2010 to 2015 is the closest one to significance, with a z-score of 1.87. Moreover, by shifting the attention to the coefficients themselves, it is possible to notice that for the years from 2006 to 2009 that of the women living in the South is bigger than the one for the mothers in the North (19.7% versus 12.1%), while this pattern is reversed for the years from 2010 to 2015. However, as already mentioned, none of the estimators for the main regressor shown in this table is significant at the 95% confidence interval, so it is not possible to state that they are different from 0 at that confidence level. The results from both tables are consistent also when using the weekly hours of childcare provided by a pre-primary education establishment as main regressor, as reported in Table 17 and in Table 18 in Appendix 3 and Appendix 4.

Table 14: IV regressions of the relationship between pre-school attendance and the labor force participation rate for the north and the south of the country and for the years before and after the financial crisis

	Labor force participation rate 2006-2009, North	Labor force participation rate 2010-2015, North	Labor force participation rate 2006-2009, South	Labor force participation rate 2010-2015, South
Pre-school attendance	0.121	0.267	0.197	0.171
	(1.19)	(1.87)	(1.39)	(0.78)
Highest ISCED level attained	0.0436*	0.0178	0.0703*	0.0370
	(2.10)	(0.89)	(2.54)	(1.57)
Age at the end of the reference income period	0.0147**	0.00802	0.0102	-0.00125
	(3.24)	(1.79)	(1.55)	(-0.21)
Weekly hours of childcare by a professional childminder	0.0118***	0.0127***	0.0139*	-0.00422
	(4.79)	(4.72)	(2.42)	(-0.37)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00464	0.00952***	0.00766***	0.00930***
	(1.92)	(5.41)	(3.57)	(4.08)
Number of children	-0.104***	-0.101***	-0.0357	-0.0811*
	(-3.35)	(-3.76)	(-0.87)	(-2.32)
Degree of urbanization	-0.0126	-0.0367	-0.0139	-0.00726
	(-0.40)	(-1.08)	(-0.29)	(-0.19)
Attending nursery school	0.110	0.287***	0.0495	0.221*
	(1.27)	(4.09)	(0.47)	(2.47)
Quintile of child- or family-related allowances	0.00528	0.0136	0.00403	-0.00354
	(0.48)	(1.29)	(0.29)	(-0.28)
Quintile of disposable household income	0.0777***	0.0702***	0.0602*	0.122***
	(3.49)	(3.83)	(2.33)	(5.30)
2007 fixed effect	-0.0782	-	-0.0115	-
	(-1.21)		(-0.13)	
2008 fixed effect	0.0521	-	0.0885	-
	(0.88)		(1.06)	
2009 fixed effect	0.0272	-	0.0486	-
	(0.47)		(0.57)	
2010 fixed effect	-	0.145	-	-0.113
		(1.93)		(-1.23)
2011 fixed effect	-	0.0367	-	-0.0980
		(0.55)		(-1.13)
2012 fixed effect	-	0.00290	-	-0.101
		(0.04)		(-1.10)
2013 fixed effect	-	0.0212	-	-0.0207
		(0.30)		(-0.19)
2014 fixed effect	-	0.0794	-	-0.122
		(0.89)		(-1.02)
Aosta Valley fixed effect	-0.114	0.0888	-	-

	(-1.24)	(0.82)		
Lombardy fixed effect	-0.183*	-0.152*	-	-
	(-2.34)	(-2.25)		
Bolzano fixed effect	-0.295**	-0.141	-	-
	(-2.66)	(-1.11)		
Trento fixed effect	-0.102	-0.129	-	-
	(-0.81)	(-0.94)		
Veneto fixed effect	-0.127	-0.182*	-	-
	(-1.65)	(-2.35)		
Friuli-Venezia Giulia fixed effect	-0.0331	-0.0472	-	-
	(-0.45)	(-0.59)		
Liguria fixed effect	-0.226*	-0.0870	-	-
	(-2.17)	(-1.10)		
Emilia-Romagna fixed effect	-0.146	-0.0855	-	-
	(-1.82)	(-1.15)		
Tuscany fixed effect	-0.181*	-0.0150	-	-
	(-2.13)	(-0.23)		
Umbria fixed effect	-0.0837	-0.0789	-	-
	(-0.93)	(-0.87)		
Marche fixed effect	-0.242*	0.00959	-	-
	(-2.56)	(0.13)		
Lazio fixed effect	-	-	-0.0365	0.134
			(-0.25)	(1.18)
Abruzzo fixed effect	-	-	-0.255	0.0463
			(-1.34)	(0.37)
Molise fixed effect	-	-	-0.114	0.0997
			(-0.56)	(0.74)
Campania fixed effect	-	-	-0.116	-0.0203
			(-0.75)	(-0.17)
Apulia fixed effect	-	-	-0.112	0.117
			(-0.75)	(0.96)
Basilicata fixed effect	-	-	0.0736	-0.146
			(0.36)	(-1.06)
Calabria fixed effect	-	-	-0.0562	0.0471
			(-0.33)	(0.38)
Sicily fixed effect	-	-	-0.194	0.0585
			(-1.31)	(0.44)
Constant	0.0544	0.135	-0.168	0.193
	(0.30)	(0.68)	(-0.63)	(0.67)
N	549	691	304	402
R_2	0.221	0.278	0.255	0.313

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the omitted year for the period 2006-2009 is 2006, while for the period 2010-2015 is 2015. The omitted region is Piedmont for the regression concerning the North of Italy and it is Sardinia for the one concerning the South.

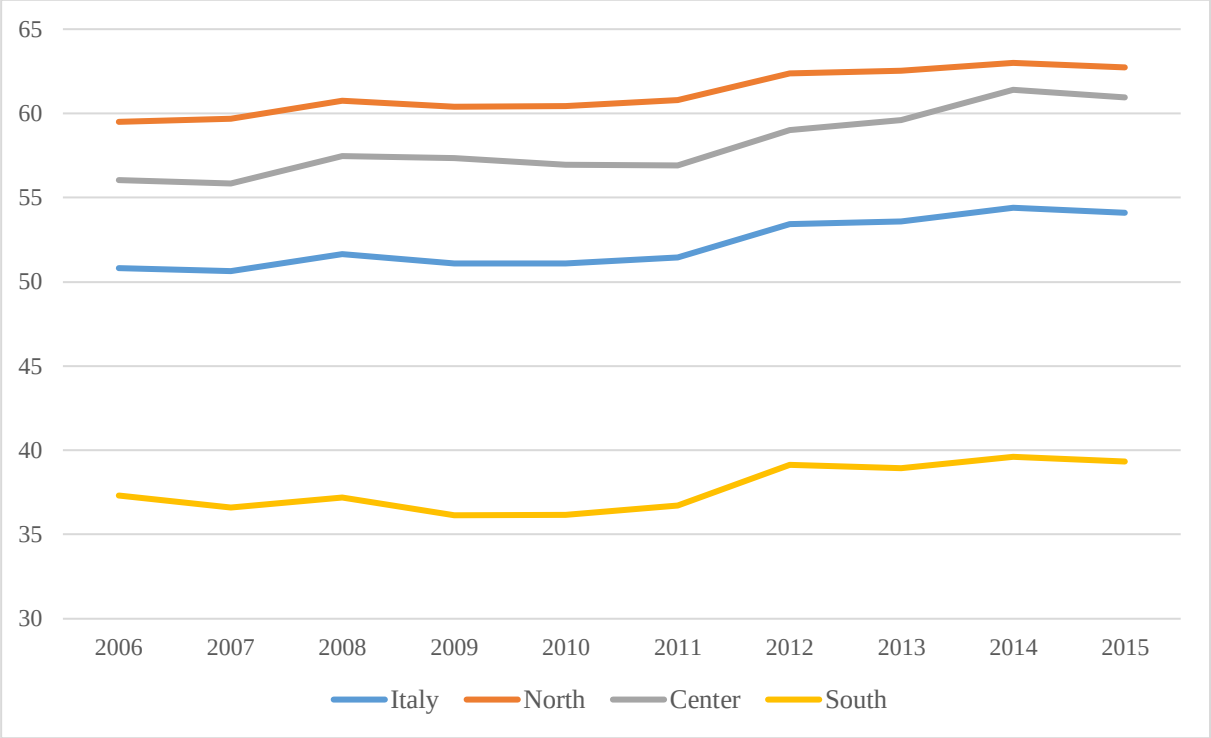
In conclusion, the results presented appear to confirm the principal hypothesis of this research, that the availability of childcare provided by pre-school increases the labor supply of mothers and allows them to increase their probability of being employed and, more in general, their activity rate. These results are consistent across the two different specifications of the main regressor, pre-school attendance and weekly hours of childcare at a pre-school, and differ only slightly from the OLS estimates. Moreover, the hypothesis that the effect of childcare provision through pre-primary education would be stronger for mothers who are not married, as they are likely to face stronger incentives to enter the labor force and contribute to the income of the

family, is confirmed as well. In fact, for these mothers, results are very strong in terms of significance, considering the much smaller sample size, and almost doubled in size with respect to the general sample. Then, the hypothesis according to which this relationship would be mainly localized in the North of the country is not confirmed. On the contrary, stronger effects are estimated for mothers living in the southern area of the country, rather than in the North. A more in depth analysis conducted breaking down the sample among the observations from 2006 to 2009 and from 2010 to 2015 has uncovered an interesting pattern according to which the effects of childcare through pre-primary education are only significant (and of a relevant magnitude) in the South for the first time period, while they are so only in the North for the second period. A possible explanation for such a pattern is presented in the next section.

5.3.1 A hypothesis for the North-South pattern in the results

As explained in the previous section, the third hypothesis of this research, that the effect of child's pre-school attendance on the labor outcomes of mothers would be only significant for mothers residing in the northern regions of the country, was not supported by the data. However, the analysis uncovered an interesting pattern, namely that, for the years from 2006 to 2009, pre-school attendance increased the employment rate of mothers in a significant manner only in the southern regions of the country, while it did so only in the North for the years from 2010 to 2015. Although the results for the labor force participation rate, presented in Table 14, are not significant for any of the four regressions, the magnitude of the coefficients and the size of the *z*-scores appears to follow the same pattern observable for the other outcome. One possible explanation could reside in the different starting positions regarding women's employment in the two areas of the country. In fact, as argued by Cipollone and D'Ippoliti (2011), there might exist an interaction between the region of residence, and its macroeconomic features, and the effect of childcare provision. Following this interpretation, the strongest effect detected in the southern regions before the crisis would be due to the fact that pre-school attendance has an increased effect on labor outcomes in this part of the country, as women are generally more excluded from employment than in the northern regions. Thus, the marginal effect of the availability of childcare would interact with the more segregated local labor market, explaining the results observed. By contrast, in the period from the year 2010 to 2015 (the end of available data), the disappearance of the significant effect in the South on the mothers' employment rate could be linked to a stagnation of the labor market in those regions following the economic downturn. The ISTAT data on the activity rate of women in the different geographical regions of Italy presented in Figure 4 seem to provide some weak support, and only qualitative, to this hypothesis (ISTAT, 2020).

Figure 4: Female activity rate in Italy, computed out of the 15-64 years old population.



Note: the definition provided by ISTAT of the three geographical areas under scrutiny are as follow. North: Aosta Valley, Piedmont, Liguria, Lombardy, Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, Emilia-Romagna. Center: Tuscany, Umbria, Marche, Lazio. South: Basilicata, Campania, Abruzzo, Molise, Apulia, Calabria, Sicily, Sardinia. This classification differs from the one of the analysis carried out in this research due to the fact that Italian regions were classified only between North (Aosta Valley, Piedmont, Liguria, Lombardy, Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Tuscany, Umbria, and Marche) and South (Lazio, Basilicata, Campania, Abruzzo, Molise, Apulia, Calabria, Sicily, and Sardinia).

According to the figure, the female activity rate in the southern regions suffered a downturn between 2009 and 2011, while in the North and Center it only stalled and then went back to grow again in 2012. Although this evidence cannot be considered as causal nor sufficient to explain the observed pattern between the different geographical areas of the country, it points toward the possible explanation that was highlighted in this section and provides the basis for further research. In fact, it is argued that the inversion in the significance of the coefficients for the employment rate between the northern and the southern regions in the periods before and after the crisis constitutes a potentially interesting phenomenon, which cannot be properly analyzed with the data available to us, nor with the qualitative evidence provided.

6 Conclusions

This final section briefly summarizes the main results of the analysis, comments on their robustness and on their main limitations, and finally provides some policy implications and advice.

6.1 Summary of results

For what concern the summary of results, throughout section 5.3 we have provided an affirmative answer to the main research question of this research, that is whether pre-primary education, as a form of childcare, is effective in increasing mothers' labor outcomes. In fact, the main hypothesis drafted at the end of section 3.3 has been confirmed by the results of Table 7, which reports positive and significant results at the 99.9% confidence level for both the

employment rate (computed out of the total population) and the labor force participation rate. More precisely, having a child enrolled in pre-school increases, on average, the employment rate by 23.5% and the labor force participation rate by 19.9%. These coefficients, which display an important magnitude, are similar to, although slightly larger than, the ones from the OLS regression estimation, provided in Table 6. This similarity is reassuring in terms of the robustness of results, that appear to be not too volatile.

Then, we have shown that also the first sub-hypothesis, concerning women who are not married, appears to be confirmed, as the results in Table 8 are still significant for both outcomes and display a larger coefficient (45.5% for the employment rate and 37.8% for the labor force participation rate, always considering the pre-school attendance rate as the instrumented variable), in accordance with what found by Goux and Maurin (2010).

Finally, the second sub-hypothesis, concerning an expected stronger effect in the individuals residing in the northern regions rather than in the South of the country, has not been confirmed by the data. However, it has been found an interesting patter across the two geographical areas for the years from 2006 to 2009 and from 2010 to 2015, which has been further investigated in section 5.3.1. These results should motivate further research on this topic, in order to uncover the true drivers of such a pattern.

As discussed in section 4.2.2, the data and the methodology employed suffer from some limitations. Namely, the limited sample size that made it necessary to merge together 10 different waves of the survey, the impossibility to access the most recent data from 2016 to 2018 (which would have provided information about the new policies concerning child allowances launched by the Italian Government in those years), and the lack of a "sharp" instrument, all need to be considered when interpreting the results. In fact, all these issues contribute to harming the external validity of the results obtained. In other words, the coefficients obtained are specific to the effect that enrollment in pre-primary education has on the labor outcomes of mothers of children who are born around the threshold (in terms of quarter) to benefit from this form of childcare. Hence, they can hardly be extrapolated to the general population of mothers, or of mothers of children below the age required to enter mandatory education (i.e., 6 years old).

Nevertheless, this paper has contributed to the existing academic research by applying an already known instrument to the case of Italy to generate original causal estimates of the effectiveness of childcare through early schooling and its effect on female employment.

The next sub-section will focus on the potential policy implications of these results.

6.2 Policy implications

The results presented in this analysis are consistent with other pieces of research on Italy and point towards an extension of childcare as an effective way to increase female participation to the labor market. As a matter of facts, the broad consensus, shared also by the OECD (2018), is that childcare provided by educational establishments should be extended, through public provision or subsidizing private providers, to children below the age of 3, as to allow mothers to achieve a higher employment rate. Italy however, as mentioned, mandates education only to children above the age of 6 years old. Although the attendance rate of pre-school in Italy is generally very high, the results presented in this research support an extension of the mandatory education to the pre-primary level and suggest a strengthening of the provision of nurseries as

well. In fact, the supply of seats in nurseries in Italy only covers 24.7% of the basin of children aged between 0 and 3 years old, and varies considerably across regions (ISTAT, 2020). The importance of improving the coverage of such services is reinforced by Goux and Maurin's (2010) findings that anticipating school enrollment at the age of 2 has no negative effect on the children's future educational outcomes.

However, the contribution by Kazepov and Ranci (2017) leads us to be wary when approaching the issue of low female participation in the labor market in Italy by a unique solution (i.e., provision of childcare). In fact, following their thesis, the effectiveness of social investment is maximum when it is met by some specific conditions of the target country, that, they argue, are lacking in Italy. For this reason, we argue that the issue of female employment should be addressed through a holistic approach, that considers both supply-side and demand-side policies. For example, tax incentives could be coupled with an increase in the coverage of childcare services.

Nevertheless, this analysis also stresses the importance of further research on the topic of female employment, in order to better understand other possible barriers that women might be facing. Namely, it is argued that the particular pattern observed in the results shown in Table 13 and Table 14 should be further researched to grasp how to target more properly potential policies aimed at improving women's labor outcomes also in regions where the female labor force participation rate is consistently lower than the average. Furthermore, another interesting potential direction of research concerns the distributional effects of childcare, as to better understand the differential impacts that childcare has on mothers of diverse socio-economic backgrounds.

It is also worth mentioning that this research could be helpful for policy makers facing the challenges of a global scale health crisis, such as the one occurring in most of the world's countries as of May 2020, and especially in Italy. As a matter of fact, Italy has been under a strict lockdown policy since the beginning of March 2020 until the beginning of May 2020, following the spread of the Coronavirus disease 2019 (COVID-19 or SARS-Cov-2). This measure translated in the stop of most of the productive activities of the country as well as in limitations to the capabilities of individuals to leave their own houses (Presidence of the Council of the Ministers, 2020). However, towards the beginning of May 2020, the Italian Government has started to move the first paces towards the reopening of the productive activities across the country. In this perspective, this research provides a compelling argument for prioritizing, among other key measures, the resuming of childcare provision by public and private establishments. In fact, were the authorities unable to support parents in the provision of childcare, Italian mothers would suffer strongly in their capability to work, hindering other attempts at boosting the national economic activity in the wake of a two-months long lockdown. Finding innovative ways to provide and extend childcare - consistently with these times' health needs - is going to be a crucial challenge, that will allow millions of mothers, not only in Italy, to maintain and strengthen their role as actors in the labor market instead of being penalized with additional barriers.

Appendix

Appendix 1

Table 15: Robustness check for Table 7 including in the sample also the mothers of twins

	Regression of pre-school attendance on employment (out of total population)	Regression of weekly hours of pre-school on employment (out of total population)	Regression of pre-school attendance on labor force participation rate	Regression of weekly hours of pre-school on labor force participation rate
Pre-school attendance	0.207**	-	0.187**	-
	(3.04)		(2.60)	
Weekly hours spent at pre-school	-	0.00719**	-	0.00651**
		(3.08)		(2.63)
Highest ISCED level attained	0.0368***	0.0354***	0.0404***	0.0391***
	(3.41)	(3.32)	(3.68)	(3.59)
Age at the end of the reference income period	0.0108***	0.0106***	0.00736**	0.00723**
	(4.45)	(4.41)	(2.85)	(2.82)
Weekly hours of childcare by a professional childminder	0.0120***	0.0127***	0.0109***	0.0115***
	(5.19)	(5.28)	(6.22)	(6.29)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00972***	0.00984***	0.00813***	0.00823***
	(8.76)	(8.78)	(7.47)	(7.49)
Number of children	-0.0573***	-0.0599***	-0.0770***	-0.0793***
	(-3.68)	(-3.84)	(-4.72)	(-4.85)
Degree of urbanization	-0.0103	-0.00667	-0.0195	-0.0162
	(-0.60)	(-0.40)	(-1.08)	(-0.91)
Attending nursery school	0.218***	0.0150	0.196***	0.0122
	(5.61)	(0.32)	(4.74)	(0.26)
Quintile of child- or family-related allowances	0.00396	0.00343	0.00147	0.000996
	(0.68)	(0.60)	(0.24)	(0.17)
Quintile of disposable household income	0.114***	0.113***	0.0780***	0.0772***
	(10.56)	(10.50)	(7.28)	(7.20)
2007 fixed effect	-0.0688	-0.0620	-0.0629	-0.0567
	(-1.37)	(-1.23)	(-1.24)	(-1.13)
2008 fixed effect	-0.00774	0.119*	0.0444	0.159*
	(-0.17)	(2.01)	(0.94)	(2.55)
2009 fixed effect	0.0137	0.0185	0.0343	0.0386
	(0.29)	(0.39)	(0.73)	(0.84)
2010 fixed effect	0.00346	-0.00735	0.0356	0.0258
	(0.07)	(-0.15)	(0.69)	(0.51)
2011 fixed effect	-0.0700	-0.0722	-0.0102	-0.0122
	(-1.51)	(-1.55)	(-0.21)	(-0.25)

2012 fixed effect	-0.0375	-0.0330	-0.0322	-0.0281
	(-0.78)	(-0.69)	(-0.63)	(-0.55)
2013 fixed effect	-0.00279	-0.00304	-0.00141	-0.00164
	(-0.05)	(-0.05)	(-0.02)	(-0.03)
2014 fixed effect	-0.0687	-0.0631	-0.00829	-0.00322
	(-1.23)	(-1.13)	(-0.14)	(-0.05)
2015 fixed effect	-0.0886	-0.0860	-0.0123	-0.00996
	(-1.88)	(-1.85)	(-0.24)	(-0.20)
Aosta Valley fixed effect	-0.00942	-0.00928	-0.0272	-0.0271
	(-0.14)	(-0.14)	(-0.42)	(-0.40)
Lombardy fixed effect	-0.122*	-0.112*	-0.172***	-0.163**
	(-2.29)	(-2.12)	(-3.34)	(-3.20)
Bolzano fixed effect	-0.123	-0.127	-0.192*	-0.196*
	(-1.28)	(-1.32)	(-2.11)	(-2.18)
Trento fixed effect	-0.0761	-0.0799	-0.146	-0.149
	(-0.73)	(-0.77)	(-1.38)	(-1.42)
Veneto fixed effect	-0.147**	-0.140*	-0.173**	-0.167**
	(-2.62)	(-2.48)	(-3.14)	(-3.01)
Friuli-Venezia Giulia	-0.0613	-0.0542	-0.0430	-0.0366
fixed effect	(-0.99)	(-0.89)	(-0.76)	(-0.66)
Liguria fixed effect	-0.0758	-0.0825	-0.155*	-0.161*
	(-1.16)	(-1.26)	(-2.41)	(-2.49)
Emilia-Romagna fixed	-0.139*	-0.149**	-0.100	-0.109
effect	(-2.51)	(-2.65)	(-1.80)	(-1.93)
Tuscany fixed effect	-0.121*	-0.111*	-0.0861	-0.0769
	(-2.22)	(-2.04)	(-1.69)	(-1.52)
Umbria fixed effect	-0.121*	-0.103	-0.105	-0.0891
	(-1.97)	(-1.70)	(-1.70)	(-1.46)
Marche fixed effect	-0.126*	-0.109	-0.0982	-0.0826
	(-2.09)	(-1.82)	(-1.68)	(-1.43)
Lazio fixed effect	-0.0936	-0.0993	-0.0934	-0.0985
	(-1.73)	(-1.82)	(-1.80)	(-1.88)
Abruzzo fixed effect	-0.159*	-0.143	-0.232**	-0.217**
	(-2.14)	(-1.89)	(-3.03)	(-2.81)
Molise fixed effect	-0.224*	-0.215*	-0.150	-0.143
	(-2.24)	(-2.08)	(-1.61)	(-1.48)
Campania fixed effect	-0.205***	-0.198***	-0.249***	-0.243***
	(-3.64)	(-3.47)	(-4.40)	(-4.27)
Apulia fixed effect	-0.178**	-0.171**	-0.150*	-0.144*
	(-2.84)	(-2.76)	(-2.34)	(-2.28)
Basilicata fixed effect	-0.233**	-0.228**	-0.236*	-0.232*
	(-2.80)	(-2.75)	(-2.50)	(-2.43)
Calabria fixed effect	-0.188**	-0.174*	-0.137	-0.125
	(-2.64)	(-2.47)	(-1.89)	(-1.72)
Sicily fixed effect	-0.169*	-0.164*	-0.225**	-0.220**
	(-2.33)	(-2.26)	(-3.06)	(-3.01)
Sardinia fixed effect	-0.0899	-0.0956	-0.128	-0.133
	(-1.03)	(-1.10)	(-1.52)	(-1.58)
Constant	-0.193	-0.199*	0.171	0.165
	(-1.91)	(-1.96)	(1.57)	(1.53)
N	2022	2022	2022	2022
R_2	0.336	0.347	0.271	0.282

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 2

Table 16: IV regressions of weekly hours spent at pre-school by the child on the outcomes of interest for the years before and after the financial crisis

	Employment rate (out of total population) 2006 - 2009	Employment rate (out of total population) 2010 - 2015	Labor force participation rate 2006 - 2009	Labor force participation rate 2010 - 2015
Weekly hours spent at pre-school	0.00677*	0.00829*	0.00595	0.00693*
	(2.02)	(2.53)	(1.72)	(1.96)
Highest ISCED level attained	0.0648***	0.0145	0.0557***	0.0270
	(3.87)	(1.02)	(3.44)	(1.77)
Age at the end of the reference income period	0.0135***	0.00840**	0.0132***	0.00495
	(3.73)	(2.58)	(3.57)	(1.41)
Weekly hours of childcare by a professional childminder	0.0147***	0.0117**	0.0131***	0.0113***
	(4.79)	(3.26)	(4.81)	(4.31)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00759***	0.0116***	0.00578***	0.00971***
	(4.31)	(8.23)	(3.48)	(6.99)
Number of children	-0.0510*	-0.0784***	-0.0818***	-0.0962***
	(-2.08)	(-3.83)	(-3.35)	(-4.41)
Degree of urbanization	-0.0112	-0.0129	-0.00889	-0.0193
	(-0.43)	(-0.57)	(-0.34)	(-0.78)
Attending nursery school	-0.0739	0.0500	-0.0483	0.0432
	(-1.40)	(0.69)	(-0.90)	(0.58)
Quintile of child- or family-related allowances	-0.00111	0.0105	0.00340	0.00461
	(-0.13)	(1.33)	(0.39)	(0.56)
Quintile of disposable household income	0.1000***	0.120***	0.0692***	0.0866***
	(5.88)	(8.57)	(4.15)	(6.12)
2007 fixed effect	-0.0536	-	-0.0532	-
	(-1.09)		(-1.04)	
2008 fixed effect	0.130	-	0.168*	-
	(1.79)		(2.25)	
2009 fixed effect	0.0141	-	0.0323	-
	(0.30)		(0.69)	
2010 fixed effect	-	0.0783	-	0.0275
		(1.50)		(0.50)
2011 fixed effect	-	0.00504	-	-0.00922
		(0.11)		(-0.18)
2012 fixed effect	-	0.0358	-	-0.0377
		(0.71)		(-0.68)
2013 fixed effect	-	0.0797	-	0.000554
		(1.33)		(0.01)
2014 fixed effect	-	0.00727	-	-0.0131
		(0.12)		(-0.19)
Aosta Valley fixed effect	0.00579	0.0372	-0.116	0.0702

	(0.06)	(0.37)	(-1.22)	(0.71)
Lombardy fixed effect	-0.0995	-0.0877	-0.170*	-0.135*
	(-1.10)	(-1.32)	(-2.19)	(-2.01)
Bolzano fixed effect	-0.194	-0.0411	-0.296**	-0.111
	(-1.58)	(-0.30)	(-2.74)	(-0.83)
Trento fixed effect	-0.0243	-0.0608	-0.123	-0.128
	(-0.19)	(-0.43)	(-0.99)	(-0.90)
Veneto fixed effect	-0.129	-0.113	-0.119	-0.180*
	(-1.41)	(-1.46)	(-1.53)	(-2.31)
Friuli-Venezia Giulia fixed effect	-0.0122	-0.0621	-0.0517	-0.0415
	(-0.13)	(-0.77)	(-0.65)	(-0.53)
Liguria fixed effect	-0.0953	-0.0530	-0.231*	-0.0945
	(-0.82)	(-0.70)	(-2.17)	(-1.21)
Emilia-Romagna fixed effect	-0.0551	-0.175*	-0.146	-0.0938
	(-0.58)	(-2.50)	(-1.78)	(-1.24)
Tuscany fixed effect	-0.111	-0.0690	-0.159	-0.00585
	(-1.15)	(-1.00)	(-1.84)	(-0.09)
Umbria fixed effect	-0.0756	-0.0818	-0.0817	-0.0737
	(-0.73)	(-0.99)	(-0.90)	(-0.85)
Marche fixed effect	-0.126	-0.0655	-0.235*	0.0163
	(-1.25)	(-0.90)	(-2.53)	(0.23)
Lazio fixed effect	-0.122	-0.0858	-0.190*	-0.0358
	(-1.31)	(-1.26)	(-2.32)	(-0.52)
Abruzzo fixed effect	-0.288	-0.0163	-0.445**	-0.0684
	(-1.75)	(-0.19)	(-2.94)	(-0.74)
Molise fixed effect	-0.290	-0.120	-0.300	-0.0322
	(-1.89)	(-0.88)	(-1.77)	(-0.28)
Campania fixed effect	-0.238*	-0.140	-0.275**	-0.186*
	(-2.45)	(-1.94)	(-3.05)	(-2.47)
Apulia fixed effect	-0.200	-0.129	-0.281**	-0.0490
	(-1.84)	(-1.67)	(-2.92)	(-0.58)
Basilicata fixed effect	-0.181	-0.228*	-0.102	-0.307**
	(-1.18)	(-2.27)	(-0.64)	(-2.72)
Calabria fixed effect	-0.235*	-0.157	-0.176	-0.102
	(-2.12)	(-1.72)	(-1.38)	(-1.06)
Sicily fixed effect	-0.262**	-0.0563	-0.359***	-0.0881
	(-2.67)	(-0.56)	(-3.82)	(-0.85)
Sardinia fixed effect	-0.0694	-0.104	-0.173	-0.138
	(-0.46)	(-0.95)	(-1.19)	(-1.26)
Constant	-0.313*	-0.209	0.00249	0.201
	(-2.00)	(-1.47)	(0.02)	(1.25)
N	853	1093	853	1093
R_2	0.329	0.387	0.272	0.318

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 3

Table 17: IV regressions of the relationship between weekly hours spent at pre-school by the child and the mothers' employment rate for the north and the south of the country and for the years before and after the financial crisis

	Employment rate (out of total population) 2006-2009, North	Employment rate (out of total population) 2010-2015, North	Employment rate (out of total population) 2006-2009, South	Employment rate (out of total population) 2010-2015, South
Weekly hours spent at pre-school	0.000260	0.00856*	0.0170**	0.00682
	(0.06)	(2.24)	(2.84)	(1.03)
Highest ISCED level attained	0.0491*	0.0120	0.0834**	0.0179
	(2.30)	(0.64)	(3.07)	(0.85)
Age at the end of the reference income period	0.0114*	0.00621	0.0120	0.0112*
	(2.35)	(1.43)	(1.93)	(2.07)
Weekly hours of childcare by a professional childminder	0.0125***	0.0147***	0.0219*	-0.0125
	(4.29)	(3.96)	(2.34)	(-0.95)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00555*	0.0120***	0.0102***	0.0107***
	(2.05)	(6.60)	(4.97)	(4.03)
Number of children	-0.0777*	-0.0679*	-0.0264	-0.0850**
	(-2.53)	(-2.50)	(-0.65)	(-2.92)
Degree of urbanization	0.0198	-0.0229	-0.113*	-0.00617
	(0.62)	(-0.70)	(-2.26)	(-0.19)
Attending nursery school	0.0186	0.0623	-0.261**	0.0728
	(0.29)	(0.74)	(-2.74)	(0.50)
Quintile of child- or family-related allowances	0.00577	0.0109	-0.00609	0.00724
	(0.49)	(1.08)	(-0.46)	(0.62)
Quintile of disposable household income	0.127***	0.104***	0.0872**	0.144***
	(5.50)	(5.51)	(3.16)	(6.35)
2007 fixed effect	-0.120	-	0.0661	-
	(-1.76)		(0.78)	
2008 fixed effect	-0.0140	-	0.373**	-
	(-0.15)		(2.71)	
2009 fixed effect	0.0112	-	0.0460	-
	(0.19)		(0.55)	
2010 fixed effect	-	0.111	-	0.0210
		(1.57)		(0.28)
2011 fixed effect	-	0.0237	-	-0.0369
		(0.39)		(-0.49)
2012 fixed effect	-	0.0210	-	0.0420
		(0.33)		(0.51)

2013 fixed effect	-	0.0184	-	0.156
		(0.29)		(1.54)
2014 fixed effect	-	0.0248	-	-0.0230
		(0.31)		(-0.21)
Aosta Valley fixed effect	-0.0296	0.0541	-	-
	(-0.30)	(0.51)		
Lombardy fixed effect	-0.0830	-0.0955	-	-
	(-0.97)	(-1.45)		
Bolzano fixed effect	-0.247*	-0.0458	-	-
	(-2.08)	(-0.34)		
Trento fixed effect	0.00911	-0.0540	-	-
	(0.07)	(-0.39)		
Veneto fixed effect	-0.115	-0.108	-	-
	(-1.31)	(-1.35)		
Friuli-Venezia Giulia fixed effect	0.0398	-0.0523	-	-
	(0.45)	(-0.66)		
Liguria fixed effect	-0.0815	-0.0515	-	-
	(-0.73)	(-0.68)		
Emilia-Romagna fixed effect	-0.0461	-0.175*	-	-
	(-0.51)	(-2.47)		
Tuscany fixed effect	-0.131	-0.0565	-	-
	(-1.43)	(-0.82)		
Umbria fixed effect	-0.0776	-0.0789	-	-
	(-0.79)	(-0.90)		
Marche fixed effect	-0.108	-0.0576	-	-
	(-1.12)	(-0.80)		
Lazio fixed effect	-	-	-0.137	0.0125
			(-0.85)	(0.11)
Abruzzo fixed effect	-	-	-0.284	0.0768
			(-1.43)	(0.60)
Molise fixed effect	-	-	-0.123	-0.0295
			(-0.57)	(-0.18)
Campania fixed effect	-	-	-0.298	-0.0249
			(-1.77)	(-0.20)
Apulia fixed effect	-	-	-0.157	-0.00783
			(-0.96)	(-0.07)
Basilicata fixed effect	-	-	0.0385	-0.115
			(0.18)	(-0.88)
Calabria fixed effect	-	-	-0.133	-0.0373
			(-0.72)	(-0.29)
Sicily fixed effect	-	-	-0.242	0.0641
			(-1.54)	(0.45)
Constant	-0.167	-0.0906	-0.391	-0.448
	(-0.82)	(-0.50)	(-1.46)	(-1.65)
N	549	691	304	402
R_2	0.238	0.345	0.294	0.400

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 4

Table 18: IV regressions of the relationship between weekly hours spent at pre-school by the child and the mothers' labor force participation rate for the north and the south of the country and for the years before and after the financial crisis

	Labor force participation rate 2006-2009, North	Labor force participation rate 2010-2015, North	Labor force participation rate 2006-2009, South	Labor force participation rate 2010-2015, South
Weekly hours spent at pre-school	0.00491	0.00747	0.00887	0.00593
	(1.21)	(1.89)	(1.41)	(0.78)
Highest ISCED level attained	0.0436*	0.0173	0.0715**	0.0377
	(2.14)	(0.87)	(2.73)	(1.61)
Age at the end of the reference income period	0.0144**	0.00793	0.0105	-0.000770
	(3.16)	(1.77)	(1.65)	(-0.13)
Weekly hours of childcare by a professional childminder	0.0119***	0.0135***	0.0149*	-0.00461
	(4.64)	(4.77)	(2.25)	(-0.39)
Weekly hours of childcare by a relative/friend/neighbor (not the parents)	0.00463	0.00959***	0.00750***	0.00948***
	(1.93)	(5.39)	(3.65)	(3.99)
Number of children	-0.112***	-0.103***	-0.0415	-0.0813*
	(-3.82)	(-3.81)	(-1.03)	(-2.34)
Degree of urbanization	-0.00850	-0.0318	-0.0235	-0.00405
	(-0.28)	(-0.96)	(-0.47)	(-0.11)
Attending nursery school	-0.00497	0.0456	-0.139	0.0476
	(-0.08)	(0.54)	(-1.38)	(0.30)
Quintile of child- or family-related allowances	0.00497	0.0108	0.00445	-0.00276
	(0.45)	(1.03)	(0.32)	(-0.22)
Quintile of disposable household income	0.0759***	0.0688***	0.0628*	0.120***
	(3.33)	(3.75)	(2.39)	(5.05)
2007 fixed effect	-0.0715	-	-0.0183	-
	(-1.11)		(-0.21)	
2008 fixed effect	0.151	-	0.226	-
	(1.70)		(1.60)	
2009 fixed effect	0.0340	-	0.0424	-
	(0.60)		(0.51)	
2010 fixed effect	-	0.131	-	-0.127
		(1.84)		(-1.52)
2011 fixed effect	-	0.0352	-	-0.0896
		(0.54)		(-1.01)
2012 fixed effect	-	-0.0131	-	-0.0943
		(-0.19)		(-1.01)
2013 fixed effect	-	0.0120	-	-0.0241
		(0.17)		(-0.23)
2014 fixed effect	-	0.0650	-	-0.119

		(0.78)		(-1.00)
Aosta Valley fixed effect	-0.120	0.0821	-	-
	(-1.25)	(0.75)		
Lombardy fixed effect	-0.170*	-0.153*	-	-
	(-2.19)	(-2.32)		
Bolzano fixed effect	-0.302**	-0.126	-	-
	(-2.83)	(-0.98)		
Trento fixed effect	-0.111	-0.129	-	-
	(-0.87)	(-0.94)		
Veneto fixed effect	-0.119	-0.182*	-	-
	(-1.55)	(-2.33)		
Friuli-Venezia Giulia fixed effect	-0.0391	-0.0330	-	-
	(-0.51)	(-0.43)		
Liguria fixed effect	-0.228*	-0.0904	-	-
	(-2.15)	(-1.17)		
Emilia-Romagna fixed effect	-0.150	-0.0967	-	-
	(-1.85)	(-1.28)		
Tuscany fixed effect	-0.172*	-0.00260	-	-
	(-2.03)	(-0.04)		
Umbria fixed effect	-0.0743	-0.0591	-	-
	(-0.82)	(-0.66)		
Marche fixed effect	-0.229*	0.0286	-	-
	(-2.47)	(0.40)		
Lazio fixed effect	-	-	-0.0402	0.129
			(-0.27)	(1.13)
Abruzzo fixed effect	-	-	-0.298	0.0702
			(-1.58)	(0.52)
Molise fixed effect	-	-	-0.0957	0.111
			(-0.44)	(0.81)
Campania fixed effect	-	-	-0.127	-0.00372
			(-0.81)	(-0.03)
Apulia fixed effect	-	-	-0.115	0.133
			(-0.77)	(1.07)
Basilicata fixed effect	-	-	0.112	-0.143
			(0.52)	(-1.02)
Calabria fixed effect	-	-	0.00418	0.0627
			(0.02)	(0.49)
Sicily fixed effect	-	-	-0.200	0.0763
			(-1.34)	(0.55)
Constant	0.0499	0.159	-0.209	0.158
	(0.27)	(0.81)	(-0.79)	(0.51)
N	549	691	304	402
R_2	0.231	0.295	0.268	0.324

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Bibliography

Aaronson, D., Dehejia, R., Jordan, A., Pop-Eleches, C., Samii, C., & Schulze, K. (2018). The effect of fertility on mothers' labor supply over the last two centuries. *NBER Working paper No. 23717*.

Adamson, E. (2017). *Starting Strong IV: Monitoring quality in early childhood education and care country note - Italy.* Paris: OECD Publisher.

Akgunduz, Y. E., & Plantenga, J. (2013). Labour market effects of parental leave in Europe. *Cambridge Journal of Economics, Vol. 37(4)*, 845–862.

Angrist, J. A., & Evans, W. N. (1998). Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size. *American Economic Review*, 450-477.

Angrist, J. D., & Krueger, A. B. (1991). Does Compulsory School Attendance Affect Schooling and Earnings? *The Quarterly Journal of Economics*, pp. 979–1014.

Barua, R., & Lang, K. (2016). School Entry, Educational Attainment, and Quarter of Birth: A Cautionary Tale of a Local Average Treatment Effect. *Journal of Human Capital, Vol. 10(3)*, 347-376.

Bound, J., & Jaeger, D. A. (1996). On the Validity of Season of Birth as an Instrument in Wage Equations: A Comment on Angrist and Krueger 'Does Compulsory School Attendance Affect Schooling and Earnings? *NBER Working Paper No 5835*.

Brilli, Y., Del Boca, D., & Pronzato, C. D. (2016). Does child care availability play a role in maternal employment and children's development? Evidence from Italy. *Review of Economics of the Household, Vol. 14*, 27-51.

Buckles, K., & Hungerman, D. M. (2008). Season of Birth and Later Outcomes: Old Questions, New Answers. *NBER Working Paper No. 14573*.

Chiuri, M. C. (2000). Quality and Demand of Child Care and Female Labour Supply in Italy. *Labour, Vol. 14(1)*, 97-118.

Cipollone, A., & D'Ippoliti, C. (2011). Women's Employment: Joining Explanations Based on Individual Characteristics and onContextual Factors. *The American Journal of Economics and Sociology, Vol. 70(3)*, 756-783.

Datta Gupta, N., Smith, N., Verner, & Mette. (2008). The Impact of Nordic Countries' Family Friendly Policies on Employment, Wages, and Children. *Review of Economics of the Household, Vol. 6*, 65-89.

Del Boca, D. (2002). The effect of child care and part time opportunities on participation and fertility decisions in Italy. *Journal of Population Economcis*, 549-573.

Del Boca, D. (2015). Child Care Arrangements and Labor Supply. *IDB Working Paper, No. 569*.

Del Boca, D., & Yuri, D. (2007). The Mismatch between Employment and Child Care in Italy: The Impact of Rationing. *Journal of Population Economics, Vol. 20(4)*, 805-832.

Del Boca, D., Pasqua, S., & Pronzato, C. (2009). Motherhood and market work decisions in institutional context: a European perspective. *Oxford Economic Papers, Vol. 61*, i147–i171.

Esping-Andersen, G. (1990). *The Three Worlds of Welfare Capitalism.* Princeton, NJ: Princeton University Press.

Esping-Andersen, G. (2009). *The Incomplete Revolution: Adapting to Women's New Roles.* Cambridge: Polity Press.

Eurostat. (2020). *EUROPEAN UNION LABOUR FORCE SURVEY (EU LFS)*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey

Eurostat. (2020). *EUROPEAN UNION STATISTICS ON INCOME AND LIVING CONDITIONS (EU-SILC)*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions

Eurostat. (2020). *Fertility rates by age*. Retrieved from Eurostat: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_frate&lang=en

Ferragina, E. (2019). Does Family Policy Influence Women's Employment?: Reviewing the Evidence in the Field. *Political Studies Review, Vol 17(1),* 65-80.

Ferragina, E. (2019). The political economy of family policy expansion. *Review of International Political Economy, Vol. 26(6),* 1238-1265.

Ferragina, E. (2020). Family policy and women's employment outcomes in 45 high-income countries: A systematic qualitative review of 238 comparative and national studies. *Social Policy Administration*, 1-51.

Givord, P., & Marbot, C. (2015). Does the cost of child care affect female labor market participation? An evaluation of a French reform of childcare subsidies. *Labour Economics, Vol. 36*, 99-111.

Goldin, C. (2006). The quiet revolution that transformed women's employment, education, and family. *NBER Working paper No. 11953*.

Goux, D., & Maurin, E. (2010). Public school availability for two-year olds and mothers' labour supply. *Labour Economics*, pp. 951-962.

INPS. (2019). *Bonus Bebè 2019: importo, requisiti e domanda*. Retrieved from Istituto Nazionale della Previdenza Sociale (National Institute of Social Security): https://www.inps.it/nuovoportaleinps/default.aspx?itemdir=52847

ISTAT. (2019). Indagine sul Reddito e le Condizioni di Vita (EU-SILC).

ISTAT. (2020). *Activity rate*. Retrieved from ISTAT: http://dati.istat.it/Index.aspx?DataSetCode=DCCV_TAXOCCU1#

ISTAT. (2020). *Supply of services for early childhood education*. Retrieved from ISTAT: https://www.istat.it/en/archivio/241571

Jaumotte, F. (2003). *Labour Force Participation of Women: Empirical Evidence on the Role of Policy and Other Determinants in OECD Countries.* Paris: OECD Economic Studies.

Kamernian, S. B., & Kahn, A. J. (1994). Family policy and the under-3s: Money, services, and time in a policy package. *International Social Security Review, Vol. 47,* 31–43.

Kazepov, Y., & Ranci, C. (2017). Is every country fit for social investment? Italy as an adverse case. *Journal of European Social Policy, Vol. 27(1)*, 90-104.

Leibniz Institute for the Social Sciences. (2020). *Metadata for Official Statistics*. Retrieved from Gesis: https://www.gesis.org/en/missy/metadata/EU-SILC/2015/Cross-sectional/original

Ministry of Education, Ministry of University and Research. (2020). *Scuola dell'Infanzia (Pre-Primary school)*. Retrieved from Ministero dell'Istruzione Ministero dell'Università e della Ricerca: https://www.miur.gov.it/web/guest/scuola-dell-infanzia

Misra, J., Budig, M. J., & Moller, S. (2007). Reconciliation policies and the effects of motherhood on employment, earnings and poverty. *Journal of Comparative Policy Analysis: Research and Practice, Vol. 9(2)*, 135-155.

OECD. (2018). *How does access to early childhood education services affect the participation of women in the labour market?* Education Indicators in Focus, No. 59. Paris: OECD Publishing.

OECD. (2019). *Country brief: Italy - Uno sguardo all'istruzione.* Paris: OECD Publishing.

Orloff, A. S. (1993). Gender and the Social Rights of Citizenship: The Comparative Analysis of Gender Relations and Welfare States. *American Sociological Review, Vol. 58(3)*, 303-328.

Presidence of the Council of the Ministers. (2020, March 11). *Decree of the President of the Council of the Ministers 11 March 2020*. Retrieved from Governo Italiano - Presidenza del Consiglio dei Ministri: http://www.governo.it/it/articolo/coronavirus-conte-firma-il-dpcm-11-marzo-2020/14299.

Sànchez-Mangas, R., & Sanchez-Marcos, V. (2008). Balancing family and work: The effect of cash benefits for working mothers. *Labour Economics, Vol. 15(6)*, 1127-1142.

Shirley, P. (2020). First-Time Mothers and the Labor Market Effects of the Earned Income Tax Credit, to appear in *IZA Journal of Labor Policy*.

Stadelmann-Steffen, I. (2011). Dimensions of Family Policy and Female Labor Market Participation: Analyzing Group-Specific Policy Effects. *Governance, Vol. 24*, 331–357.

Thévenon, O. (2011). Family Policies in OECD Countries: A Comparative Analysis. *Population and Development Review*.

Waldfogel, J., Higuchi, Y., & Abe, M. (1999). Family leave policies and women's retention after childbirth: Evidence from the United States, Britain, and Japan. *Journal of Population Economics, Vol. 12*, 523-545.

Zimmerman, S. L. (1995). *Understanding Family Policy: Theories & Applications.* Sage.

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Pre-school attendance and the labor supply of women in Italy- Evidence from an Instrumental Variable approach

Edoardo, Magalini

Abstract

Among European Union countries, Italy distinguishes itself for its dramatically low female participation rate in the labor market and fertility rate. This analysis investigates the effect of the provision of childcare through pre-primary education on the labor supply of Italian mothers, through the development of an instrumental variable approach based on the quarter of birth of their children. In accordance with the literature on this matter, the results highlight a strong and significant impact of enrollment in pre-school on the mothers' participation rate in the labor force and their employment rate. Moreover, said effects appear to be stronger for non-married mothers and for mothers living in southern regions. These results point towards a strengthening of childcare provision through an extension of mandatory education to pre-primary levels and to an increase in the coverage of nurseries. Finally, these findings are especially crucial in the current context as they highlight a priority for policymakers that are trying to understand what services' reopening should be prioritized following the lockdown for the COVID-19 pandemic.

Key words

Female participation to the labor market, childcare, family policy.