Do Location and Choice Possibilities Affect the Gender Gap in STEM Specialisation? Evidence from French High Schools

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Abstract

How to fight against the underrepresentation of women in science, technology, engineering and mathematics (STEM)? A first step in tackling this issue is to understand the roots of this phenomenon, which is responsible for a large part of the gender pay gap. Using French administrative data on high school students and survey data on the active French population and exploiting the 2019 reform of the high school system, this study investigates the impact of location and of specialisation possibilities on STEM specialisation, at the High School level. Results show that living in a departement where the gender pay gap is relatively lower is not associated with a lower gender gap in STEM. Focusing on the 2019 reform which widely increased the specialisation choices for the last two years of high school indicates however that wide specialisation possibilities have a general significant negative impact on the gender gap in STEM specialisation. This impact varies depending on the socio-economic status and the student's ability: the gender gap largely widened for students of high socio-economic background and those most gifted in Mathematics, but slightly decreased for others. Overall, the reform could be a setback of at least 20 years in the fight against gender inequalities in these fields.

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Contents

1 Introduction

The gender pay gap remains one of today's greatest injustices and an important policy challenge. According to the International Labour Organisation's Global Wage Report 2018-19, women earn on average about 20% less than men. Although there are wide variations across countries, this gap in earnings is still a reality in developed economies: in 2022, the gender pay gap in the French private sector was around 4%, for the same volume of work and job position[2]. This gap can be explained by multiple factors, such as part-time work, career choices (often influenced by family responsabilities) but also by the over-representation of women in low-paying sectors and jobs with low levels of responsability. Indeed, women are over-represented in the sectors of care, health or education, but are missing in science, technology, engineering and mathematics (STEM) related occupations which is one of the highest paid sectors. In fact, the permanently lower women-to-men ratio in STEM education and in employment in high-end sectors of science and technology can be one of the drivers of the persistent gender pay gap in developed countries (Brown and Corcoran, 1997; Bobbitt-Zeher, 2007; Black et al., 2008; Petrenko and Cadil, 2024). Morevoer, economically developed countries and countries with higher levels of gender equality (gender equality being strongly correlated with economic development) actually perform worse in attracting women to STEM, a phenomenon first underlined by Charles and Bradley (2009) and now known as the "gender equality paradox" (GEP). Contrarily to common belief, study fields (and hence occupations) become increasingly gender differentiated as a country becomes more economically developed and more equalitarian (Charles and Bradley, 2009; Charles, 2017; Stoet and Geary, 2018; Thelvall and Mas-Bleda, 2020). Importantly, it seems that this trend could be explained by stronger gender-math stereotypes in these societies, leading girls to feel more mathematics-related anxiety and shy away from mathematics-related jobs. Indeed, countries with higher levels of gender equality are seemingly characterized by lower parental valuation of mathematics for girls, and countries' level of development and of gender equality is positively correlated to essentialist gender norms regarding math aptitudes and appropriate occupational choices (Stoet et al., 2016; Breda et al., 2020; Napp and Breda, 2022). In the words of Erik Mac Giolla and Petri Kajonius, we can speculate that "as gender equality increases both men and women gravitate towards their traditional gender roles" (Mac Giolla and Kajonius, 2019), so where mathematics is widely considered a male topic women will turn away from STEM occupations to signal their gendered self.

It hence becomes imperative to tackle the under-representation of women in STEM education and employment in order to fight the bigger issue of the gender pay gap. In this aim,

[2] Insee, 2022. "Gender pay gap in 2022". Accessible here

understanding the roots of the phenomenon is necessary: does living in a location where gender stereotypes are stronger have an impact on STEM specialisation? Does providing more choice to students at an early stage in their lives impact the gender gap in STEM? It is important to start tackling this issue at an early stage of the educational path as the "leaky STEM pipeline" starts leaking early: the initial college major choice is responsible for 57% of the total gender gap in STEM and is hence the most important step when women turn away from STEM occupations (Speer, 2021). If more economically affluent and gender equal locations develop stronger horizontal norms regarding the "suitable" occupations of women and stereotypes that "men are naturally better at mathematics", it could be the case that women specialise less in STEM as a result. Indeed, adding negative stereotypes about lower ability leads to gaps in confidence, in participation in risky or ambitious options and in performance, which explains what is observed in gender and in mathematics (Nosek et al., 2009; Jouini et al., 2018). In addition, conditional on grades and performance, students who are keen to compete are significantly more likely to choose a mathematics-intensive specialisation later in their lives. Yet, boys are already embracing competition (and often encouraged in this way), whilst women shy away from it (Niederle and Vesterlund, 2007; Booth and Nolen, 2012; Buser et al., 2017). Adding to this effect that boys are already more confident in challenging mathematics contexts than identically talented girls and that mathematics ability beliefs influence students in specialisation choices (Perez-Felkner et al., 2017), there is an intuition that location could play an important role on women's STEM specialisation. Secondly, providing more choice at an earlier stage to students could imply pushing them to choose specialisation at an age when they are not clear about their future ambitions, and when they are more permeable to stereotypes and gender norms. It could also mean that students do not get the chance to discover potential interests in scientific subjects.

This study focuses on the impact of location and specialisation systems on High School students' specialisation choices in the French context. This focus is useful for two reasons: first, French administrative data on High School students has been gathered for a long time, so the quality of the data at hand allows for an in-depth investigation of the different factors affecting the gap in STEM specialisation. Second, France undertook a wide reform of the High School system in 2019, under the supervision of the (then) Minister of Education Michel Blanquer. The main change brought by the reform was a wide increase in the specialisation possibilities for the two last years of High School : students were to choose between 3 specialisation track before the reform, and can now specialise in 144 different ways. This natural experiment gives a unique opportunity to analyse how students adapt their behaviours when given the opportunity to specialise much more precisely at an earlier age. The paper is organised as follow: the next section places this study in its related literature; section 3 presents in detail the data used and some summary statistics. Sections 4 focuses the empirical strategy, and section 5 provides the results of the analysis of the reform. Section 6 goes beyond the study of supply effects and examines the existence of the gender equality paradox at the local level. Section 7 concludes.

2 Related literature

This study is linked to the literature studying the gender gap in STEM education, which has been particularly developing in the past twenty years. After the first articles underlining the gender segregation across fields of study (Charles and Bradley, 2002; Charles and Bradley, 2009), a wide range of literature from both the sociological and economics fields started studying why are women still under-represented in STEM studies. Multiple reasons have been studied: women's aversion to competition (Booth and Nolen, 2012; Buser et al., 2017), girls' lower confidence and mathematics ability beliefs compared to similarly talented boys (Perez-Felkner et al., 2017; Breda et al., 2019), differences in workplace preferences and taste (Zafar, 2013), absence of female peers (Bostwick and Weinberg, 2022), influence of the parents' occupation (Oguzoglu and Ozbeklik, 2016a, Guo et al., 2019). Adding to this literature, this study aims at investigating the impact of location and specialisation possibilities. It does so focusing on students in High School, evaluating their specialisation choices for the last two years of High School and their probability to be "STEM-ready" when applying to university degrees. There is evidence to focus on this level: initial college major choice is the main driver of the gender gap in STEM (Speer, 2021). We also find that the gender gap in fraction of males and females with STEM prerequisites is high, contrarily to what has been underlined by Card and Payne (2021). If this cumulates with the second (significant) driver of the gap in STEM studies they find - the low rate of entry by non-science-oriented males - the gap in the share of boys and girls being STEM ready will additionally largely influence the gender gap in STEM as soon as when students enter university.

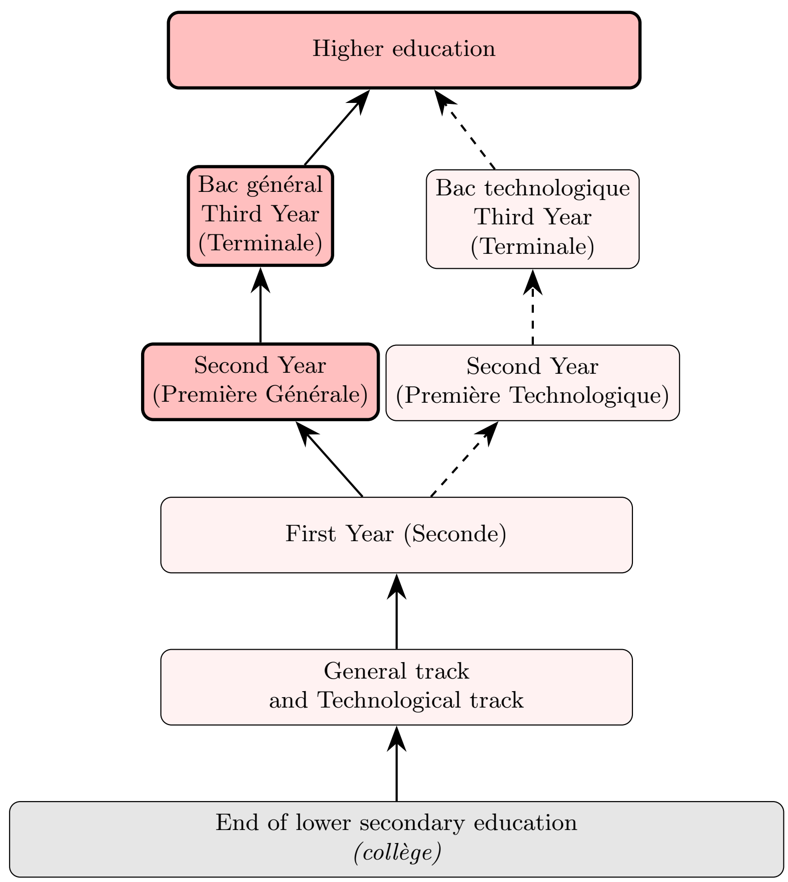
Secondly, this paper complements the literature on the gender equality paradox, which describes the phenomenon of increased gender differences in occupational choices and personality traits in more gender equal and developed countries. The first studies observing this effect trace back to the beginning of the 21st century, and conclude that measures aiming at increasing the degree of gender equality in countries impacts some forms of gender inequality more than others. Importantly, the horizontal sex segregation – i.e., the gender segregation across fields of study – appears to be less impacted (Charles and Bradley, 2002; Charles and Bradley, 2009). As of today, this relationship has been proven to be even stronger: the more equalitarian the country is, the more women and men are segregated academically and professionally. The most striking result shows that women are disproportionately absent from STEM-related education and employment (Stoet and Geary, 2018; Breda et al., 2020). Similar cross-country paradoxical relationships have been underlined with a large range of other gender gaps: mathematical anxiety (Stoet et al., 2016), gender segregation between fields of research (Thelvall and Mas-Bleda, 2020), gender differences in personality traits (Costa et al., 2001; Mac Giolla and Kajonius, 2019), adolescent subjective well-being, self-esteem, depression, or basic human values (Hopcroft and Bradley, 2007; Schwartz and Rubel-Lifschitz, 2009; Zuckerman et al., 2016; Zuckerman et al., 2017; Guo et al., 2024), but also gender stereotypes that girls lack talent (Napp and Breda, 2022). Overall, previous studies focused on the international level, which allows to understand how variations in laws and institutions as well as changes in gender norms impact the gender gap in STEM studies. By examining whether the gender gap in STEM specialisation varies at the local level depending on the degree of departemental gender wage inequality, this study aims to understand if the gender equality paradox exists at the local level, which would yield additional evidence that the differences in the gender gap come from differences in gender norms beliefs and not from intrinsic gender differences, as students have similar school conditions nationally and have thus the same ”freedom to choose”.

3 Institutional background

3.1 The French education system

In France, secondary education is divided in two stages: *collège* (middle school) and *lycée* (high school). Students attend collège for the first four years (when aged 11 to 15), where education is compulsory and common for all pupils. The end of lower secondary education is sanctioned by the *Diplôme national du brevet* (DNB), during which students are mainly evaluated on their level in French, Mathematics and History and Geograhy. However, the admission to upper secondary level is not conditional upon success in the DNB. After these four years, students (between the ages of 15 and 18) enter upper secondary education which is dispensed for three years in “general and technological lycées” (academic secondary education) or in “professional lycées” (vocational secondary education). Then, students can choose between three educational paths: the general path prepares pupils for long-term higher studies, whilst the technological path mainly prepares pupils for higher technological studies and the professional path leads to active working life (but also enables students to continue their studies in higher education). Students have to choose whether to pursue the professional path at the end of collège, and are sent in this case directly to "professional lycées". The other students go to "general and technological lycées", where they are dispensed a common education during the first year (the *Seconde*). At the end of this year, students choose whether to continue in the general path or to pursue the technological path for the two remaining years. The end of upper secondary education is sanctioned by the *Baccalauréat*, and access to tertiary education is conditional on its obtention. Note that education remains compulsory until students reach 16 years old, after which they can drop out of school and directly enter the professional world.

Figure 1: Educational pathway in general and technological lycées



This paper will focus on students in the general path because it is the main one preparing students to pursue further higher education, in universities or other tertiary institutions. When focusing on gender disparities in STEM education, it has to be noted that most STEM careers require undergraduate or graduate degrees, which can mainly be achieved after completing the general path in lycées and then continuing in tertiary education, either in universities or in engineering schools.

3.2 The Blanquer reform

Before 2019

In High-schools, students in the general track are asked to further specialise throughout the last two years, so as to prepare for tertiary education. Since 1995, students were separated into three different branches:

- ”Humanities” track: focuses heavily on French literature, foreign languages, philosophy and art. Students have no mathematics classes and only a small amount of sciences in the second year (the Première), unless they choose the ”mathematics” option. No science classes are offered in third year (the Terminale).
- ”Economics and Social Sciences” track: students study heavily economics and social sciences. Some mathematics and science classes are included in the program throughout the two years.
- ”Scientific” track: Students study mainly mathematics, chemistry, biology and physics. In their last year, students are asked to further specialize in one of the three subjects (Mathematics, Physics and Chemistry, or Biology), which implies four additional hours of class on that subject per week.

This specialization is a first indicator of the gender gap in STEM studies: following the Scientific track is necessary to pursue Engineering or other science related studies at the tertiary level. Moreover, the gender gap is already present at this stage: in 2015, girls represented only 47% of students in the Scientific track, but 60% of students in the Economics and Social Science track and 80% of students in the Literature track. [3].

After 2019

In 2018, a reform of the High School system proposed by the (then) minister of National Education Jean-Michel Blanquer changed the specializations. This reform was mainly justified by the ambition to ”ensure the coherence of the pathways offered to high school students and to properly prepare for success in higher education”, and to answer the problems of ”a failure rate of 60% in the first year of university and almost one young adult of less than 25 years old in four

[3] *Femmes et hommes, l'égalité en question*, édition 2017 - Insee Références

without employment"[4]. More importantly, this reform also aimed at reducing the "elitism" of the Scientific track. Concretely, this reform abolished the three tracks system to adopt a system much more flexible and similar to the English Sixth Form. Throughout the last two years of general high-school, all students follow classes of French, history and geography, languages, philosophy, sciences and sport. At the end of the Seconde, students now additionally choose three classes to specialize in, amongst twelve subjects (arts, ecology, humanities, history and geography, languages, mathematics, literature, computer science, economic and social science, physics and chemistry, engineering sciences or biology and geology). In their final year, students drop one speciality. Importantly, only seven of the twelve specialities are mandatory to all schools: the availability of the certain specialization classes vary.

This reform was adopted in 2018 and was applied to all students in the first year of High School in 2019 (hence finishing their upper secondary education in 2021). It allows students to specialize with even more detail, but segregration is still evident: whilst girls represent 56% of all students in Terminale in 2020, they represent only 36% of students specializing in Mathematics and Physics and Chemistry, the most common combination for students willing to pursue engineering studies. [5]

Expected effect

This study aims at observing whether providing more choice to students at an early stage of their lives has an impact on their choice of specialisation, and subsequently whether it impacts the gender gap in STEM specialisation. There is a strong intuition that the gender gap might be increased as a result: stereotypes associating STEM subjects with masculine characteristics tend to drive girls away from such specialisation, and giving girls more choice earlier in their lives might lead their decision to be more oriented oriented as they might be more sensitive to such stereotypes. Moreover, too much choice too early might inefficiently close doors to students who might discover an interest in scientific topics later on : before the reform, the Scientific section implied that students had an increased amount of classes on scientific topics, but were (generally) still able to apply to various university degrees, STEM-related and not. Students now have to specialise much more precisely, which requires them to be much more conscious of their future aspirations at a young age. Because "about 24% of the total gender pay gap can be explained by an overrepresentation of women in relatively low-paying sectors, such as care,

[4]Mathiot, P. (2018). Un nouveau baccalauréat pour construire le lycée des possibles. *Rapport remis au Ministre de l'Éducation nationale.*

[5]*Femmes et hommes, l'égalité en question*, édition 2022 - Insee Références

health or education"[6], fighting against stereotypes pushing women away from STEM studies and careers - which are some of the highest-paying sectors - is an important step towards pay equality.

4 Data and summary statistics

4.1 Data

This project uses individual data on students' specialization choices from the SYSCA database, provided by the Directorate of Evaluation, Forecasting, and Performance (DEPP), a body of the Ministry of National Education contributing to the evaluation of public policies related to education. This very rich dataset provides information on a broad time frame, from 2006 to 2023, so as to evaluate both the impact of geographical localisation on specialization choices and the impact of the recent reform on the gender gap in STEM choices. The SYSCA dataset gathers individual information on pupils' specialisation choices, their economic and social background, and the type of high-school they are in (public or private). Overall, 99% of French students are included in the scope of the dataset. This dataset is used jointly with data on the DNB from 2006 to 2023, also provided by the DEPP and including the grades obtained by students at the Brevet des Collèges (a national examination at the end of middle school). Overall, this rich dataset has the highest degree of granularity as it regroups administrative data on all individuals in the universe of students in secondary education (including private and public institutions).

To further study the impact of students' geographical location on their specialization choices, this study also uses individual survey data on workers' salaries and working situation. This publicly available data comes from the Continuous Employment Survey, the only source providing a measure of the concepts of activity, unemployment and employment as defined by the International Labour Office (ILO). The first survey was realized in 1950 and from 2003, is conducted every week of the year throughout France. This survey provides information on individuals' declared salary, the declared number of hours worked per week, the type of contract (full-time or part-time), the highest diploma obtained (largely detailed), the age of the individual (used as a proxy for experience), and their department of residence. This study relies on the individual data gathered between 2010 and 2019, so as to gather enough data representative at the departmental level. Even if this data is not administrative but self-declared by individuals, the largeness of the study allows for a high degree of detail.

[6]"Understanding the gender pay gap: definitions and causes", 04-04-2023, European Parliament. Article accessible here

Moreover, because we focus on the gender gap in scientific specialisation at the high-school level and further consider the socio-economic status (SES) of the students and the students' ability in mathematics, a few definitions need to be clarified.

First, we consider that a student is "STEM-specialised" if they are following enough scientific classes to be able to apply to STEM-related university degrees after obtaining their Baccalauréat. Before the reform, only students in the "Scientific" track were able to apply to engineering schools, medical degrees and other scientific tertiary education are were thus "STEM-specialised". After the reform, students need to have picked the Mathematics specialization course (as Mathematics became only an option), and must have a class time volume on scientific subjects similar to that of students in the former "Scientific" track.

Table 1: Timetable of students in the last year of General High School

Before the reform		**After the reform**	
Common courses		*Common courses*	
First and second languages	4h	First and second languages	4h
Sports	2h	Sports	2h
Civic, legal and social education	0h30	Civic, legal and social education	18h*
Personalised support	2h	Philosophy	4h
		History and Geography	3h
		Sciences	2h
Courses specific to the Scientific series		*Specialisation courses: 2 to choose from (among those chosen in Premiere)*	
Mathematics	4h	Arts	6h
Physics and Chemistry	5h	Biology and Ecology	6h
Biology	3h30	History, Geography, Geopolitics	
or Biology, Agronomy and		and Political Science	6h
Sustainable Development	5h30	Humanities, literature and Philosophy	6h
or Engineering Sciences	8h	Languages, foreign literature and culture	6h
Philosophy	3h	Literature, languages and	
		cultures of the Antiquity	6h
A choice of one speciality subject among:		Mathematics	6h
Mathematics	2h	Digital and Computer Sciences	6h
Physics and Chemistry	2h	Physics and Chemistry	6h
Biology	2h	Biology	6h
Computer and Digital Sciences	2h	Engineering Sciences	6h
Territory and Citizenship	2h	Economics and Social Sciences	6h

*throughout the year

Sources: Bulletin officiel n°1 du 04-2-2010, Ministère de l'Education Nationale. Accessible here
Bulletin officiel n°29 du 19-7-2018, Ministère de l'Education Nationale. Accessible here

Concretely, this means that students in their last year of High-School must have chosen any of the following pairs of specializations classes: Mathematics - Physics and Chemistry; Mathematics - Biology; Mathematics - Digital and Computer Sciences; Mathematics - Engineering Sciences. The precise number of hours for each subject in specialisation tracks before and after the reform are detailed in the table below.

Secondly, the socio-economic status of the students was determined based on the SES of their parents, relying on the nomenclature of professions and "catégories socio-professionnelles" established in France in 1982. This indicator classifies the population according to the current (or former) occupation, the status (employee or not), the number of people working in the company for the self-employed and, for employees, the nature of the employer (public or private) and the level of qualification[7]. Students' parents are classified into eight categories:

- 1: Farmers and farm managers (*agriculteurs exploitants*)
- 2: Craftsmen, shopkeepers, and business owners (*artisans, commerçants et chefs d'entreprise*)
- 3: Executives and higher intellectual professions (*cadres et professions intellectuelles supérieures*)
- 4: Intermediate professions (*professions intermédiaires*)
- 5: Employees (*employés*)
- 6: Workers (*ouvriers*)
- 7: Retirees (*retraités*)
- 8: Other individuals without a professional activity (*autres personnes sans activité professionnelle*)

Using the Continuous Employment Survey, a description of each category's economic characteristics can be established (Table A1). This source of data provides information on working categories only (1 to 6) and not on unemployed or inactive individuals (categories 7 and 8), but further characteristics of the last two categories can be assumed. Categories 1, 2 and 7 are hard to characterize because individuals' salaries in the first two categories are subject to large variations and because retirees' revenues are also greatly varying. However, categories 3 and 4 are characterized by relatively high mean and median salaries, and a smaller variation in individuals' revenues. Hence, individuals in these categories are considered as having a "high" socio-economic status. Similarly, categories 5 and 6 are characterized by relatively low revenues

[7] Definition from the National Institute of Statistics and Economic Studies (INSEE)

(not largely varying) and category 8 can be assumed to include mostly individuals with low revenues (either unemployed or inactive). Subsequently, individuals of categories 5, 6 and 8 are considered as having a "low" SES. Applied to the student context, a student is considered as having a "high" SES if both their parents are belonging to the categories 3 or 4, and has a "low" SES if both their parents are belonging to the categories 5, 6 or 8. In the rest of this paper, this distinction allows us to study the gender gap in STEM-specialisation across students with different socio-economic status. Because the administrative data on students only provides the socio-economic status of the parents and no other estimations of socio-economic position, this classification is the best that can be done to associate students to certain SES.

Thirdly, I examine students' ability in Mathematics by dividing them into four categories, depending on the grade they obtained at the Mathematics examination of the Brevet des Collèges. All students being examined on the same standardized test at the national level, the grade is representative of the relative ability of students in Mathematics and is not likely to be biased by other factors. The four categories are as follows: the first quartile represents students who obtained a grade in the top 25% of the year they passed the Brevet des Collèges. The second quartile regroups students who obtained a grade below the top 25% but still above the median, and students in the third quartile obtained a grade that was worse than 50% of the students but better than the last 25%. Finally, the last quartile understands the students who obtained grades at the bottom 25% (i.e., worse than 75% of the students).

4.2 Summary statistics

The data on students' specialisation choices in High School is extracted from the SYSCA database, and includes all individuals in third year of general High School (terminale générale), which means each year includes more than 300,000 observations. Between 2006 and 2023, the share of girls in the last year of High School is relatively stable and always higher than fifty percents (varying between 56% and 58%), which means that there are always slightly more females than males at that level. Matching this data with the data from the DNB dataset (which provides information on individuals' grades at the Brevet des Collèges) reduces slightly the number of observations because some individuals could not be found in the two databases. Note as well that data was matched from 2009 onwards, as a student taking their Brevet des Collèges in 2006 would be in their third year of High School in 2009. Overall, I was able to match more than 60% of the individuals for each years. Because of the low percentage of observations matched in 2023, I disregard this year when analysing the STEM specialisation of students given their ability in Mathematics. The overall number of observations can be found in Appendix Table A2.

This dataset combining observations from SYSCA and DNB databases include in total more than 3 million observations, and each individual can be further categorized into different socio-economic status (SES) and level of ability in mathematics. Table 2 describes the number of observations fitting into each category. Interestingly, the SES of students is highly correlated to their mathematics ability ranking: 33.3% of students with a high SES are in ranked in the first quartile for mathematics ability, and only 16.2% of them are ranked in the last quartile. On the contrary, 15.3% of the students with a low SES ranked in the top quartile and 35.1% of them ranked in the bottom quartile.

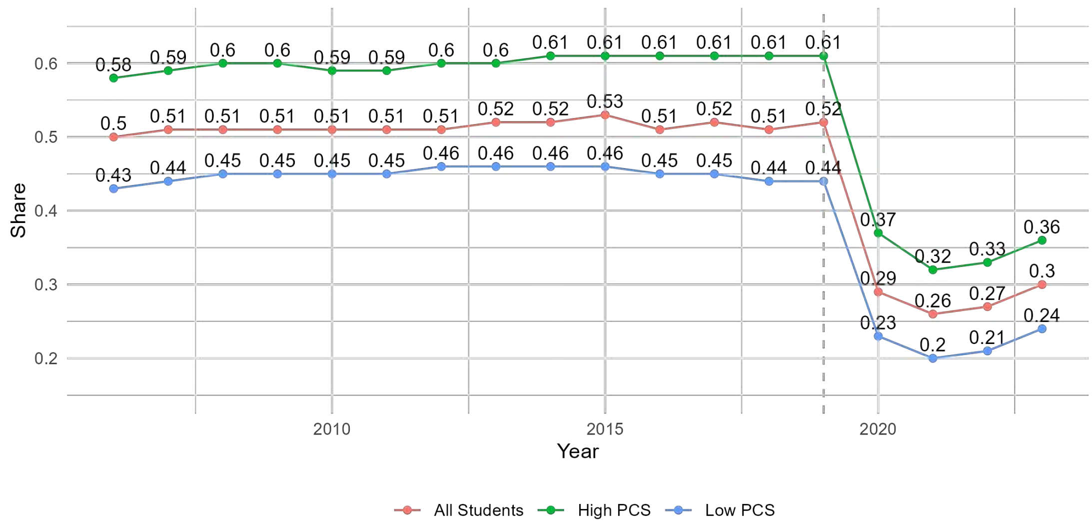
Table 2: Observations, depending on SES and Mathematics ability

Ability in Mathematics	Total	High SES	Low SES
Top 25%		307,612	109,845
Upper middle (25% - 50%)		259,911	160,205
Lower middle (50% - 75%)		206,511	194,710
Bottom 25%		149,546	251,114
Total	3,751,660	925,629	718,124

Source: MENJ-DEPP, databases SYSCA and DNB, 2009-2022

The Scientific section was the main track chosen by students before the reform: amongst all students, 50% chose to specialise in sciences. This share remains stable throughout the period 2006-2019. Further observing the characteristics of the students in the Scientific track, there is an over-representation of students with a high socio-economic status, and an under-representation of students with a low SES. These characteristics remained after the Blanquer reform of 2019, even if the reform implied a large drop in the share of students specialising in STEM (in 2020, only 29% of all students chose specialisation classes that allowed them to pursue STEM studies at the tertiary level). These shares are underlined in the figure below:

Figure 2: Share of students STEM-specialised, by SES



Source: MENJ-DEPP, databases SYSCA, 2006-2023

Secondly, this study also relies on data from the Continuous Employment Survey, produced by INSEE. Observations are gathered between 2010 and 2019, and are likely to be representative of the salaries in the departement (there are more than 1,000 observations for each localisation, as indicated in Appendix Table A3). The data includes observations from each French department, including Corsica but excluding other overseas departments. Because the salaries described in this dataset are declared by the individuals, one must remember that there might be significant differences between these declared numbers and the objective revenues of individuals (which could be retrieved from administrative sources). Because of time constraints, I was however not able to gather administrative data on individuals' revenues. Table A1 describes the mean and median salaries for each socio-economic status (as declared in the dataset), as well as the standard deviations. Without surprise, the richest departement (highest median salary) is Paris (75), while the poorest departement is the Aude (11).

5 Empirical strategy

5.1 Model

The gender differences in STEM specialisation are computed using two different techniques. First, the gender difference in STEM specialisation is studied through the evolution of the indicator of male advantage, comparing the proportion of science baccalaureates between boys and girls:

$$\text{Male Advantage} = \frac{\text{Share of boys STEM-specialised in their last year of high school}}{\text{Share of girls STEM-specialised in their last year of high school}}$$

This value indicates how much more likely a boy is to obtain a 'science' baccalaureateas compared to a girl.

More importantly, I also compute the *gender gap in STEM specialisation*, which examines the evolution of the difference between the percentage of boys and the percentage of girls specialising in sciences. Hence, for a given year, the gender gap is computed as the percentage of boys choosing a scientific specialisation, minus the percentage of girls specialising in the same way. The goal is to examine whether the difference between the percentages of boys and girls specialising in sciences changed drastically after the reform. Specifically, I use a difference-in-differences strategy to compare the change in female STEM specialised students to the change in male STEM specialised students before and after the Blanquer reform, using the gender STEM gap level in 2019 as baseline. The key identifying assumption is that any relative change in application behavior is attributable to the reform. Deviating from the static analysis, I estimate an event study version using:

$$Y_i = \alpha + \sum_{\substack{t=2006 \\ t\neq 2019}}^{2023} \beta_t(\text{Female}_i \times 1[\tau = t]) + \text{FE}_{gender} + \text{FE}_{year} + \epsilon$$

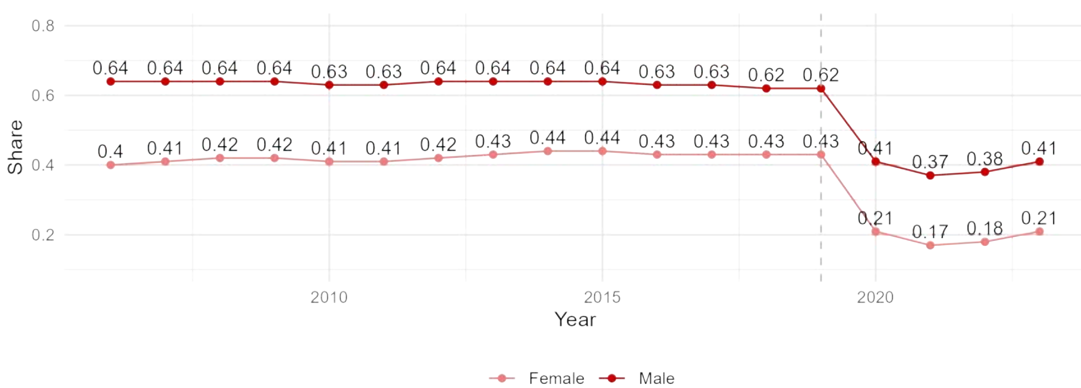
where Y_i is a binary operator for STEM specialisation (equal to 1 if the individual is STEM specialised, and 0 otherwise), Female_i a binary variable describing whether the individual is female or not. I include gender and year fixed effects to account for year-specific shocks and differences in gender. the vector of coefficients β indicates the variation in the gender gap in years before and after 2019. A positive (negative) value implies that the gender gap decreased (increased) as compared to the gender gap level in 2019. This regression is first realised on the whole group of students, of all socio-economic status. I also replicate the study restricting the dataset to students with a high SES, and then with a low SES. Finally, the same regression is ran restricting the dataset to students of different mathematics ability.

5.2 Validity of the specification

My identification relies on the assumption that the gender gap in STEM specialisation would have remained in the same stable (and slightly decreasing) trend without the event of the Blanquer reform. To assess the plausibility of parallel trends, I examine observed trends in girls and boys' STEM specialisation decisions over time.

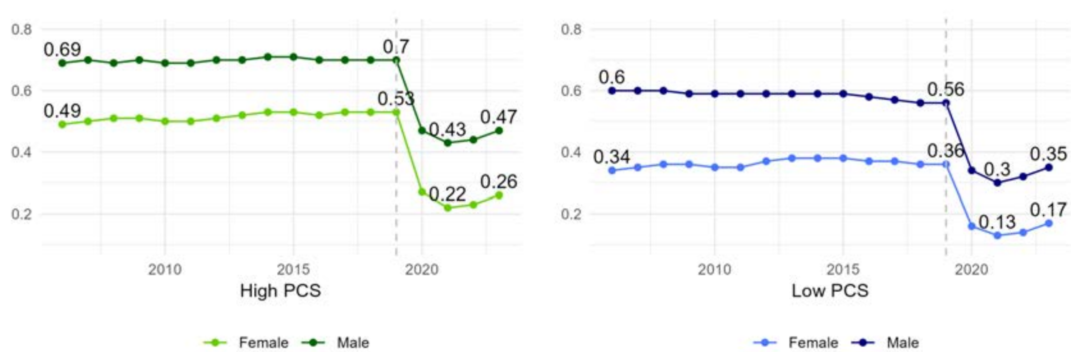
Figures 3 and 4 shows that the proportion of female and male specialisation in STEM remained stable over the period 2014-2019, with a constant gap over this period (of roughly 20 percentage points for all students, 17 p.p. for students of high SES and of 20 p.p. for students of low SES). The gender gap is slightly wider in periods before. Overall, a slight decreasing trend can be observed over the period 2006-2014, continued by a stable gender gap up until 2019. In 2020, the gender gap in STEM specialisation increased by 1 percentage point overall, and remained at that level in the following years. Narrowing the analysis on students with a high SES, the gender STEM gap increased by 3 percentage points in 2020. On the other hand, the gender STEM gap decreased by 2 percentage points in 2020 for students with a low SES. These patterns provide relative support for common trends in the pre-period as well as suggestive evidence of a treatment effect of the Blanquer reform, as the gender STEM gap is unlikely to adopt an increasing trend after more than 10 years in a decreasing pattern without any external event.

Figure 3: Share of STEM-specialised students, by gender



Source: MENJ-DEPP, databases SYSCA, 2006-2023

Figure 4: Share of STEM-specialised students, by gender and SES



Source: MENJ-DEPP, databases SYSCA, 2006-2023

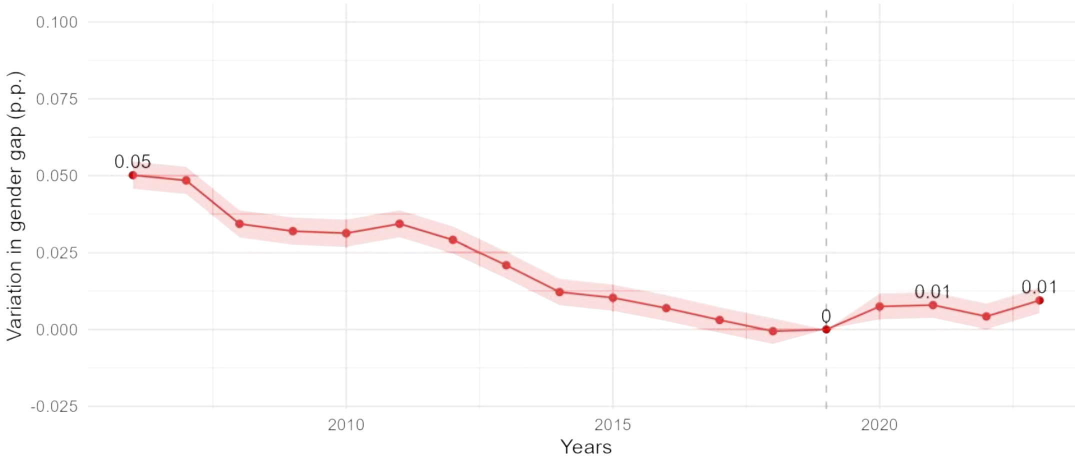
6 Results

6.1 Main results

Overall, it seems the reform pushed girls further away from sciences. Figures 3 and 4 remind us that the gender gap is a reality for all students, even before this change in systems: between 2006 and 2019, approximately 60% of boys where is the Scientific track during their last year of General High School, but only 40% of the girls were STEM-specialised. Moreover, this gap exists across all socio-economic statuses: if a larger share of students with a high SES are STEM-specialized, the gap between boys and girls remains relatively similar across categories. Restricting the analysis to students with a high SES, 70% of boys and 50% of girls were STEM-specialised in 2019 (a difference of 17 p.p.). Similarly, the gap in specialisation between boys and girls with a low SES is of 20 percentage points. The reform drastically reduced the number of girls specialising in sciences. Overall, the percentage of girls being STEM-specialised decreased from 43% to 21% in one year. Such a reduction is particularly important because a STEM specialisation in High School is the necessary condition to pursue sciences studies in University (or other tertiary education schools): this implies that even less girls will follow a STEM-oriented tertiary education and will pursue a career in this field. This decline is particularly dramatic for girls with a low SES, who were already underrepresented amongst students specialised in STEM: Before the reform, 53% of girls with a high SES specialised in sciences, but only 36% of girls with a low SES did so. Two years after the reform, this number dropped to only 13%.

Moreover, the gender gap was slowly diminishing in the years before the reform. Figure 5 shows that the gender gap in 2006 was 5 percentage points larger than in 2019, and that the trend was moving towards more gender equality over the years. The reform implied a strong step back in this regard: it is the first time in more than 10 years that the gender gap in STEM-specialisation widened. This change in trend is significant, even if the actual increase in the gap is rather small (around 1 p.p.). Such a result is worrying regarding gender equality.

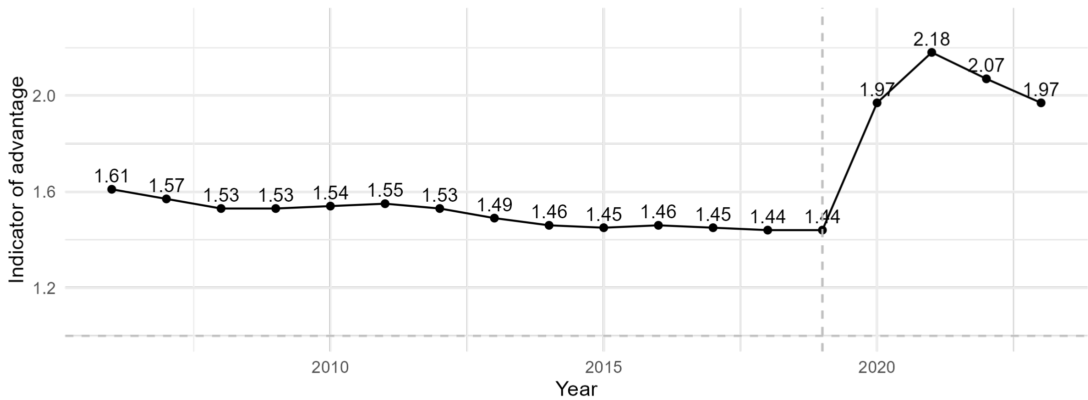
FIGURE 5: IMPACT OF THE REFORM ON THE GENDER GAP IN SCIENCES



Source: MENJ-DEPP, databases SYSCA, 2006-2023
Note: The variation in the gender gap in STEM specialisation is computed as compared to the level of the gender gap in 2019. A value of 0.05 in 2006 means that the gender gap in STEM specialisation was 5 percentage points larger in 2006 than in 2019.

In addition, the male advantage in access to STEM-specialisation jumped as a result of the reform even after following a decreasing trend in the years before (Figure 6). In 2006, a boy was 1,61 time more likely to be specialised in sciences than a girl of the same cohort. In 2019, this advantage diminished to 1,44, due to the decrease in the gender gap. However, the accumulation of the increase in the gender gap and the decrease in the share of girls specializing in sciences resulted in an important increase in the male advantage: in 2021, a boy was 2.18 times more likely than a girl to be STEM-specialised in his last year of High School. This increase is phenomenal: by extrapolating the trend of male advantage between 2006 and 2019, we would have to go back to 1975 to obtain a indicator of male advantage of 1,97 (the male advantage in 2020, one year after the reform). The reform thus seems like a step backwards of at least 40 years in the fight for gender equality in STEM.

Figure 6: Indicator of male advantage in access to STEM-specialisation



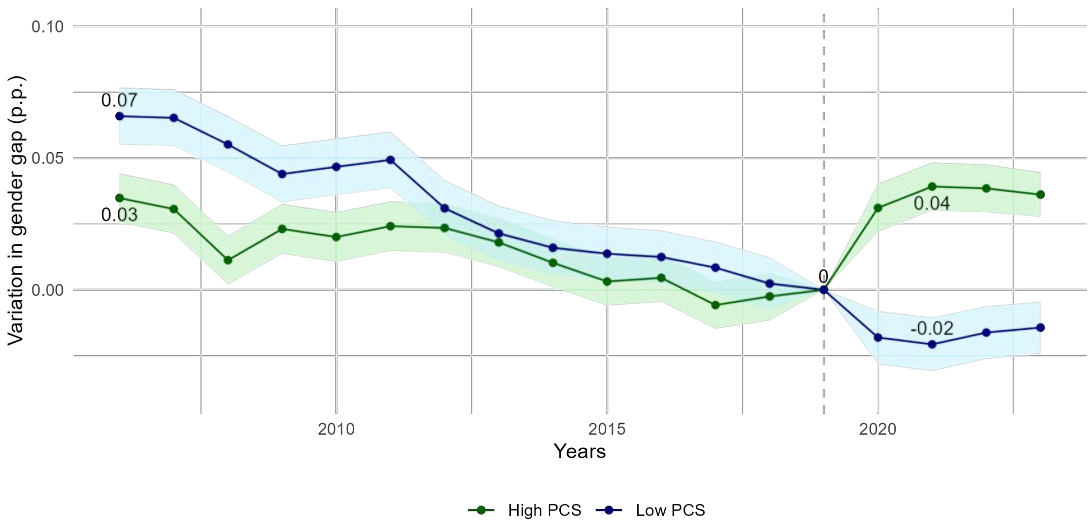
Source: MENJ-DEPP, databases SYSCA, 2006-2023
How to read this figure: in 2015, a boy in his last year of High School was 1,45 times more likely to be STEM-specialized than a girl.

6.2 Heterogeneity of the treatment

The reform impacted students differently depending on their socio-economic status

Interestingly, the reform impacted the gender gap differently depending on the students' SES (Figure 7). While the gender gap had been stable for five years between girls and boys of high socio-economic origin, it increased largely (by 4 percentage points) after 2019. Amongst students with a high SES, the reform hence drove girls away from sciences much more than boys. On the contrary, the gender gap decreased by 2 p.p. for students with a low SES, continuing a trend that was existing before the reform.

Figure 7: Impact of the reform on the gender gap in sciences



Source: MENJ-DEPP, databases SYSCA, 2006-2023

At first, the impact of the reform on the gender gap in STEM specialisation can seem paradoxical and reminds us of the findings of the gender equality paradox: the reform increased the gender gap between students with a high socio-economic status, but decreased the gender gap between students with a low SES.

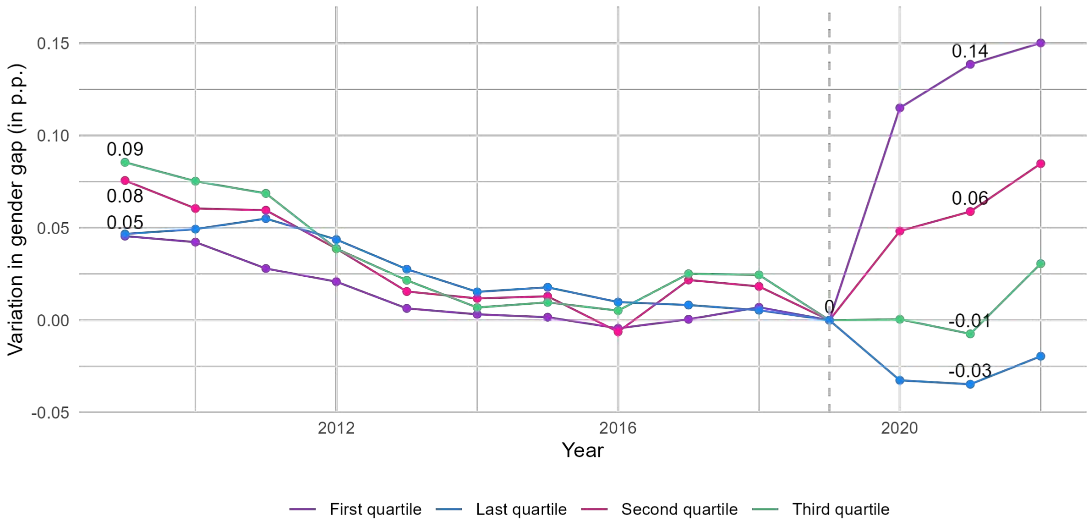
This phenomenon could actually have multiple origins. First, it could be that STEM specialisation and the subsequent STEM-related occupations are regarded differently depending on your family's SES. Indeed, parents with relatively low SES might value scientific studies more because it could be viewed as a way to achieve well-payed jobs, regardless of the gender of their child. Hence, boys and girls with a low SES might be more incentivized to specialise in sciences, because it is a way to achieve a higher socio-economic position and get better paid jobs. These monetary considerations and the overall status of STEM-related jobs might be more important to the parents than any beliefs about sciences being "for boys". Moreover, because the scientific section was considered widely as an "elitist" track before the reform, students from low backgrounds could haven been self-censoring because they (wrongly) believe they do not fit in such a section. Hence, because the reform made the specialisation in sciences seen as less elitist, more students from low backgrounds may choose to specialise themselves in such a way. Both these arguments might explain why the gender gap in sciences decreased for students of low SES after the 2019 reform of High Schools.

On the other hand, the increase in the gender gap between students of high SES could be explained by the elitism of the Scientific section before the reform, and a more pregnant belief that mathematics is "not for girls". First, the gender gap in STEM specialisation could have been kept to a relatively low level before the reform because the Scientific section was considered as the "elitist" one, allowing students "not to close any doors for the future". Parents of high SES might have valued the Scientific section more for their children (regardless of their gender) because it was seen as "the best" track. Such a strategic behaviour from parents of high SES could have been driving the over-representation of children of high SES in the Scientific section before the reform. After 2019, sciences are less seen as the privileged specialisation so parents could give more weight to their internal beliefs that "mathematics is not for girls". Moreover, this belief could be more important amongst parents of high socio-economic position because they can afford not to value the revenues of occupations as much as parents with lower SES. Overall, parents with relatively high SES might have stronger beliefs that "mathematics is not for girls", and the decrease in perceived "elitism" of the STEM specialisation in High-School might give more weight to those gendered beliefs, leading to the increase in the gender gap that we observe in the data.

We are losing the best (girl) students: gendered analysis including ability

Finally, analysing how the reform impacted the gender gap in STEM specialisation depending on students' academic level in mathematics provides striking results. This analysis was possible as I was able to link individual data on specialisation choices with the individual data on grades at the Brevet des collèges, for a large majority of the students (Appendix Table A2). Results show that, as expected, individuals in the top 25% almost always specialise in sciences, whilst students in the bottom 25% almost never do. A drop in STEM specification is observed for all genders and all levels of ability after the reform (Appendix Figure B3). Importantly, examining the variations in gender gap for students of different ability levels shows a similar trend as when dividing students according to their socio-economic status: on the one hand, the gender gap in STEM specialisation increased for students who obtained grades above the median in their year, and increased especially for students in the top 25% (for them, the gender STEM gap increased by 14 percentage points in 2012 as compared to the gender gap level in 2019). On the other hand, the gender gap decreased for the students in the bottom 50%, and even more strongly for the students in the bottom 25% (for them, the gender gap decreased by 3 percentage points in 2021 as compared to the 2019 level).

Figure 8: Impact of the reform on the gender gap in sciences, by ability in Mathematics



Source: MENJ-DEPP, databases SYSCA and DNB, 2009-2022

It is interesting to see that providing more choice to students at an earlier stage do not impact the gender gap in STEM specialisation in the same way depending on your ability in mathematics or on your SES. Because the SES is strongly correlated to the level of mathematic ability, it could be that the results for students of different socio-economic status are driven by differences in ability. However, it is still possible that the SES still plays a role in specialisations, even after controlling for students' mathematics level. Because of time constraints, such analysis is not provided in this paper. Further studies are required to disentangle the impact of the reform depending on ability and depending on the SES of the students.

7 Beyond supply effects: the local gender equality paradox

Going further than the reform of the High School initiated in 2019, another goal of this study is to investigate the existence of the gender equality paradox (GEP) within the French context. As explained before, previous studies focused on the international level to compare the gender gap in STEM specialisation between different countries with different degrees of wealth and different legislation regarding gender equality (often using results of the PISA study, which allows for interesting comparison of 15-year old students across more than 30 countries on their levels in mathematics, sciences, literature, and their interest in pursuing further studies in mathematics or science). Because these studies are limited in interpreting the origin of the gender equality paradox, examining this phenomenon at the local level could help determine if the paradox mainly results from variations in gender beliefs and cultural particularities (that could vary within countries) or only due to institutional differences. Whilst an analysis of the impact of the reform depending the specialisation offered by the schools could provide also interesting information on the impact of locations (as not all schools have the same specialisation offers, and hence students in different location do not enjoy the same possibilities), such a study was not performed here because of time constraints. This should however be done in a future step. As such, I here focus on the impact of relative gender wage inequality at the departemental level on the gender gap in STEM specialisation, before 2019.

7.1 Strategy

Within France, the goal is to observe the link between gender beliefs (especially stereotypes linking mathematics and sciences to boys) or indicators of gender equality and the gender gap in sciences specialisation. Intuitively, if the gender equality paradox stems from the fact that norms regarding girls change depending on the socio-economic environment (and that the belief that "mathematics is not for girls" is increasingly present as gender inequality decreases), then it should be observed as well between communes and departments of the same country. Because of data and time constraints, this paper focuses on linking indicators of salary equality to indicators of the gender gap in STEM specialisation, within France.

This analysis is hence done in three steps. First, an indicator of salary inequality is computed for each French department, including Corsica but excluding other overseas departments. Observations are gathered from the Continuous Employment Survey between 2010 and 2019, and are likely to be representative of the salaries in the departement (there are more than 1,000 observations for each localisation, as indicated in Table A3).The indicators of the gender gap in salary are obtained by regressing the declared revenue of individuals on the interaction of departement fixed effects and gender fixed effects, and controlling for multiple variables impacting the salary: type of contract, last diploma acquired, hours worked, etc. The regression is as follows:

$$Y_i = \alpha + \beta_1 \text{Age}_i + \beta_2 Age_i^2 + \beta_3 \text{Hours worked}_i + \delta \text{Diploma}_i + \gamma \text{Type of contract}_i$$

$$+\text{FE}_{year} + \text{FE}_{departement} + \eta \text{Gender} * \text{Department}_i + \epsilon$$

with Y_i the individual's wage, Age_i and Age_i^2 proxies for experience in the job, Hours worked$_i$

describes the declared number of hours worked per week, $Diploma_i$ is a vector of binary variables describing whether the indvidual holds one of the diplomas listed, Type of contract$_i$ a vector describing whether the individual is hired full-time or part-time. Year and department fixed effects are also included to control for specific year shocks and uncontrollable departement characteristics. Finally, the vector of coefficients η describes the impact of being a woman in a specific department, i.e. the difference between men and women's salaries in a specific department that is not explained by the other variables described above.

Secondly, an indicator of the gender gap in STEM specialisation at the High School level is computed for each department, using a similar approach as the indicator computed above. The OLS regression is as follows:

$$Y_i = \alpha + \delta \text{Grades of the Brevet}_i + \text{FE}_{year}$$

$$+\text{FE}_{departement} + \gamma \text{Gender}_i * \text{Department}_i + \epsilon$$

With Y_i a binary variable describing whether the individual is STEM-specialised in their last year of High School or not, *Grades of the Brevet*$_i$ a vector of variables describing the grades obtained by the student at the Mathematics, French and History and Geograhy exams of the Brevet des Collèges. The regression also includes year fixed effects (for both the years of the brevet and the years of specialisation) and department fixed effects, to control for yearly shocks in the grades at the Brevet des Collèges and in the specialization choices, as well as to control for unobserved departemental characteristics. As before, γ is a vector of coefficients describing the change in likelihood of being STEM-specialised when being a girl in a certain department. These coefficients indicate the gender gap in STEM specialisation in each department.

Finally, these coefficients are linked in two final regressions observing the correlation between the dependent variable, the gender gap in STEM specialisation, and the explanatory variable, the gender gap in salary for each department. The first OLS regression examines the existence of a linear relationship between the coefficients:

$$\text{Gender gap in STEM specialisation}_d = \alpha + \beta \text{Gender gap in salary}_d + \epsilon$$

The second regression is polynomial, so as to observe whether the relationship between the two coefficients is not linear:

$$\text{Gender gap in STEM specialisation}_d = \alpha + \beta \text{Gender gap in salary}_d$$

$$+\delta \text{Gender gap in salary}_d^2 + \epsilon$$

Plotting the predictions of gender gap in STEM specialisation on the degree of salary inequality will indicate how the two indicators interact with each other.

Intuitively, for the gender equality paradox to be present at the local level, one expects the relationship between the gender gap in STEM specialisation and the gender gap in salary to have a U-shape (or at least to be decreasing): the gender gap in STEM specialisation should be highest when salary inequality is highest and lowest. Indeed, departements where salary inequality is highest are likely to be characterised by a strong societal belief that women are 'unfit' for working ("vertical" gender norms), and hence are pushed away from demanding studies and hence away from sciences. Similarly, departements where salary inequality is lowest are likely to be characterised by a more widespread belief that if men and women should both be part of the labour market, they are not fit for the same occupations ("horizontal" gender norms), hence spreading the belief that "mathematics is not for girls". Such a shape would be observed in the second polynomial regression, if it exists.

7.2 Results

All departements are characterised by some degree of salary inequality and gender gap in STEM specialisation, with some having particularly large coefficients as compared to the other locations. The distribution of those departemental coefficients are displayed in appendix figures C1 and C2.

Contrary to expectations, the results do not seem to indicate the presence of a gender equality paradox between French departements. As shown graphically in Figure 9, the relationship between the two coefficients do not follow a U-shape. In fact, the study indicates a small (insignificant) positive relationship between salary inequality and the gender gap in STEM specialisation, which implies that departements with a low level of salary inequality also display a low gender gap in STEM specialisation (Table 4). Hence, if anything, this would indicate that more gender equality in other spheres (like in the salary) implies better equality in sciences specialisation in High School, which is a good result per se. However, in reality both coefficients are mostly uncorrelated as the coefficients are not significant. Any relationship between the two indicators is weak.

Table 3: Linear regression of the two coefficients of gender gap

	Dependent variable:
	Coeff. of gender gap in sciences specialisation
Coeff. of salary inequality	0.043^{*}
	(0.026)
Constant	-0.122^{***}
	(0.009)
Observations	96
Adjusted R^2	0.018
Note:	*p<0.1; **p<0.05; ***p<0.01
Source:	INSEE, Continuous Employment Survey, 2010-2019
	MENJ-DEPP, databases SYSCA and DNB, 2009-2022

Table 4: Polynomial regression of the two coefficients of gender gap

	Dependent variable:
	Coeff. of gender gap in sciences specialisation
Coeff. of salary inequality	0.12
	(0.16)
Coeff. of salary inequality squared	0.11
	(0.23)
Constant	-0.11^{***}
	(0.03)
Observations	96
Adjusted R^2	0.01
Note:	*p<0.1; **p<0.05; ***p<0.01
Source:	INSEE, Continuous Employment Survey, 2010-2019
	MENJ-DEPP, databases SYSCA and DNB, 2009-2022

Figure 9: Relationship between salary inequality and STEM-specialisation within departments

Source: INSEE, Continuous Employment Survey, 2010-2019. MENJ-DEPP, databases SYSCA and DNB, 2009-2022

This study on the impact of location on the gender gap in STEM specialisation hints that living in a more gender equal environment induces a lower gender gap in sciences specialisation at the High School level. This result contradicts the eventual presence of the gender equality paradox at the local level, where the gender gap in STEM specialisation would be strongest in both the most and least gender equal localisations. However, such a result is not definitive: because of time constraints, this study focuses on indicators of salary inequality, that were computed using declared salary in the Continuous Employment Survey. Computing the same indicator using other statistical sources could bring different and (maybe) more precise results. Moreover, other indicators of gender equality should be used to study this relationship, such as the gender gap in participation to the labour market, the gender gap in type of contract (as more women than men often sign part time contracts, especially when raising children), etc. Survey data on gender equality beliefs at the departemental or communal level would bring important complementary information on how individuals perceive the place of women in STEM. If such a survey at this degree of precision is not yet existing (to the author's knowledge), it could be imagined to be done in further studies, asking individuals in different localisations whether they agree with different statements such as: "Men are naturally better at mathematics and scientific subjects", "A woman should not take part of the labour market", etc. This first result do not hint towards the existence of the gender equality paradox at the local level, but cannot provide a definite response to the question.

8 Conclusion

Why are women underrepresented in STEM studies and occupations? This worldwide phenomenon raises many questions that are still missing answers today. Using administrative data on French general high schools, where students first start specialising for tertiary education, this study first aims to observe the impact of two possible factors influencing the gender gap. First, the localisation of students seem to have no impact on the gender gap in STEM specialisation: living in a departement where the gender wage gap is relatively low does not imply that the gender gap in STEM specialisation will be lower in the High schools of the departement. However, further studies combining multiple indicators of gender equality and gender equality beliefs at the local level are necessary to provide a firm answer to the potential impact of the localisation on the gender gap in STEM specialisation.

Secondly, it is investigated whether giving more specialisation choice to student at a young age (when they might be more permeable to stereotypes) impacts the gender gap in STEM. To observe this factor, the 2019 reform of the High School system provides a unique opportunity: the reform aimed at reintroducing more choice for students in High School, in order to allow students to "better prepare for tertiary education" and to fight the "elitism" of the Scientific section. In fact, this reform had a desastrous effect not only on the overall number of students specialising in sciences (the share of students specialising in STEM went from 52% in 2019 to 26% in 2021), but also on the gender gap in STEM specialisation: after slowly decreasing for more than 15 years, the overall gender STEM gap indeed increased again as a result of the reform. In addition, because the share of women specialising in STEM suddenly dropped, the male advantage in science specialisation strongly increased (a man was 1.44 times more likely to be STEM-specialised in 2019, and 2.18 times more likely in 2021). Whilst public services have been actively fighting for years to increase gender equality in sciences, the reform undermines this goal. This effect is also contrasted depending on the student's SES. In fact, the gender gap in STEM specialisation increased largely for students of high SES (+4p.p. between 2019 and 2021), but decreased for students of low SES (-2p.p. between 2019 and 2021). This trend recalls the conclusions of the gender equality paradox, which shows that the gender gap in STEM is larger in more developed and gender-equal countries. If women in less developed nations are more likely to choose STEM fields based on the increased need for security and good pay, then maybe this is true as well for women with low SES. Similar results are obtained when considering the students' ability in mathematics, so further studies are needed to determine whether these socio-economic differences are only a result of the differences in ability. In any case, this result is worrying: the reform increased the gender gap in STEM specialisation by 14 p.p. for students with Mathematics grades in the top 25% and is thus widely pushing high-achieving women away from sciences studies.

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Appendix

Part A - Summary statistics

Table A1: Summary statistics of "Catégories Socio-Professionnelles" (PCS)

Catégorie socio-professionnelle		**Salaries (in euros)** Mean	Median	Standard deviation
Individual categories				
Farmers and farm managers	(1)	1705	1500	1228
Craftsmen, shopkeepers and business owners	(2)	2808	2250	1972
Executives and higher intellectual professions	(3)	3099	2826	1447
Intermediate professions	(4)	1932	1870	766
Employees	(5)	1300	1300	584
Workers	(6)	1478	1458	589
Aggregated categories				
(3) and (4)		2386	2142	1224
(5) and (6)		1376	1374	592

Source: INSEE, Continuous Employment Survey, 2010-2019

Table A2: Matched observations between the SYSCA and DNB databases

Year	Matched observations	Original observations	Percentage matched
2006	-	314,468	-
2007	-	312,034	-
2008	-	315,541	-
2009	222,993	315,429	70.7%
2010	280,643	315,224	89%
2011	290,921	322,344	90.3%
2012	289,639	327,836	88.4%
2013	289,609	332,121	87.2%
2014	295,967	343,525	86.2%
2015	300,453	357,620	84%
2016	306,097	374,143	81.8%
2017	284,767	397,773	71.6%
2018	279,840	394,938	70.9%
2019	251,272	396,954	63.3%
2020	204,519	387,028	52.8%
2021	230,007	386,298	59.5%
2022	224,933	395,244	56.9%
2023	10,518	392,599	2.7%

Source: MENJ-DEPP, databases SYSCA and DNB, 2009-2022

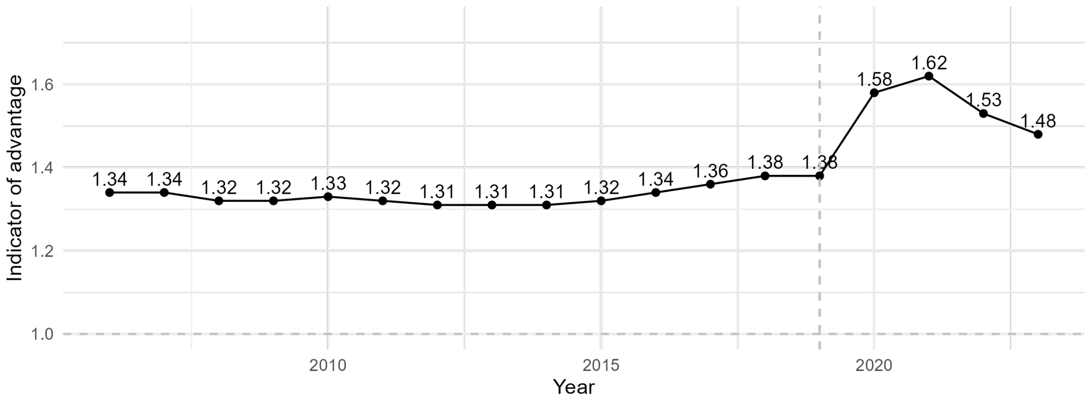
Table A3: Number of observations per département

01	02	03	04	05	06	07	08	09	10	11	12
5983	4754	2618	928	516	8361	2881	3516	791	3340	2576	1490
13	14	15	16	17	18	19	21	22	23	24	25
16092	7564	1212	2364	4534	2028	4081	6009	5722	1683	3705	7254
26	27	28	29	2A	2B	30	31	32	33	34	35
4550	6393	3453	8870	1283	554	5792	12440	1129	12927	8943	10627
36	37	38	39	40	41	42	43	44	45	46	47
2225	5821	11618	3630	2742	2235	8084	2425	14177	7456	1338	3007
48	49	50	51	52	53	54	55	56	57	58	59
59	8164	5057	9437	2082	2365	7471	1056	6594	10731	2439	25049
60	61	62	63	64	65	66	67	68	69	70	71
9733	3391	13401	5990	6195	1718	2322	12612	8352	16063	3182	3978
72	73	74	75	76	77	78	79	80	81	82	83
5996	2807	7554	19094	12372	15375	13661	4504	4320	4628	1347	7387
84	85	86	87	88	89	90	91	92	93	94	95
4712	6334	5545	7591	3448	3367	1272	11776	14914	10642	11340	11119

Source: INSEE, Continuous Employment Survey, 2010-2019

Part B - Study of the reform

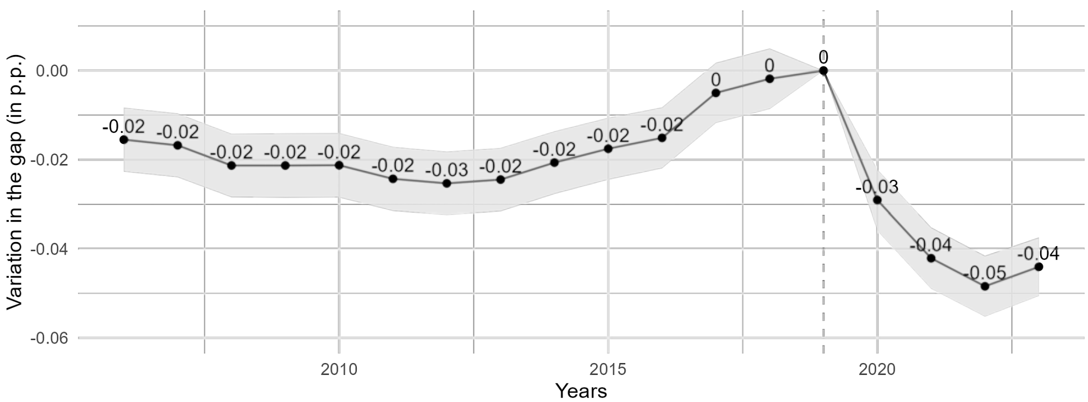
Figure B1: Indicator of advantage for children with a High SES in access to STEM-specialisation



Source: MENJ-DEPP, databases SYSCA, 2006-2023

How to read this figure: in 2015, a student with a high SES was 1,32 times more likely to be STEM-specialized than a student with a low SES.

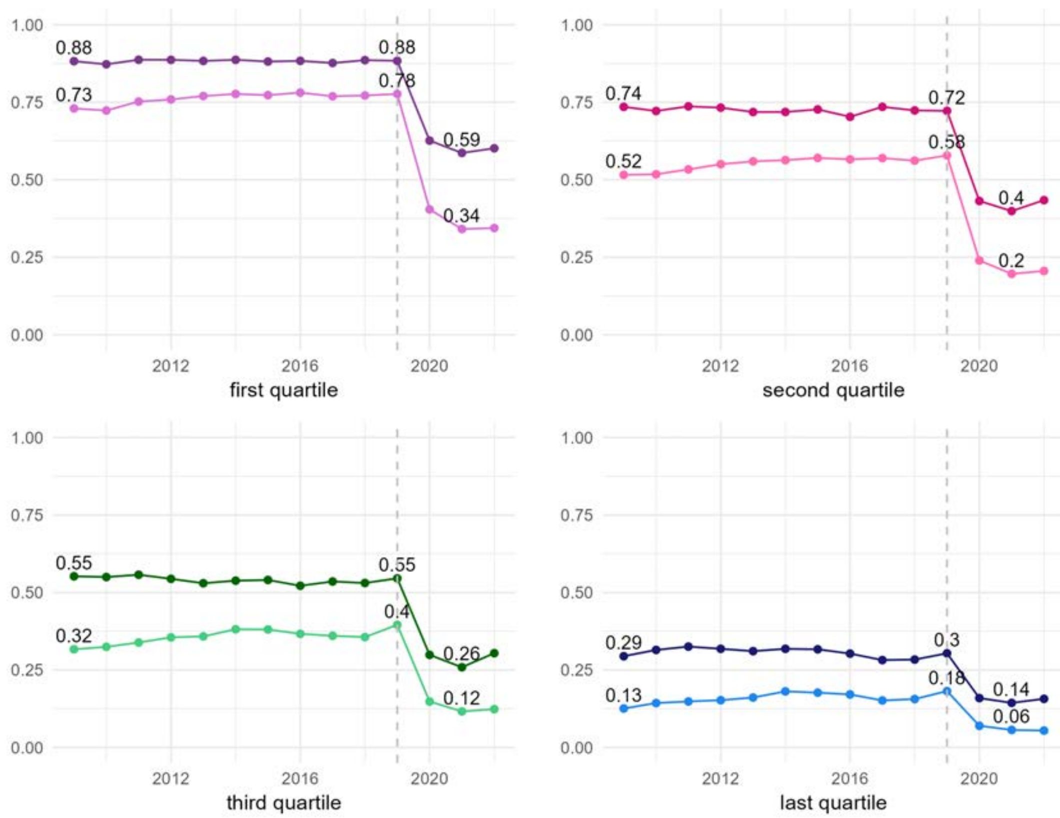
Figure B2: Impact of the reform on the gap in Sciences specialisation between students with high and low SES



Source: MENJ-DEPP, databases SYSCA, 2006-2023

Note: The variation in the gap in STEM specialisation is computed as compared to the level of the gap in 2019. A value of -0.02 in 2015 means that the gap in STEM specialisation was 2 percentage points smaller in 2015 than in 2019.

Figure B3: Share of STEM-specialized students, by gender and mathematics ability

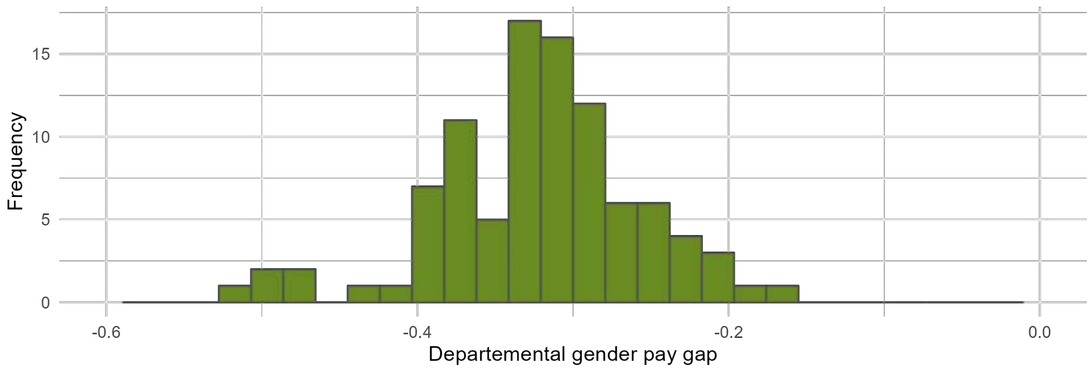


Source: MENJ-DEPP, databases SYSCA and DNB, 2009-2022

Note: the share of girls is always below the share of boys, in all graphs and in all years.

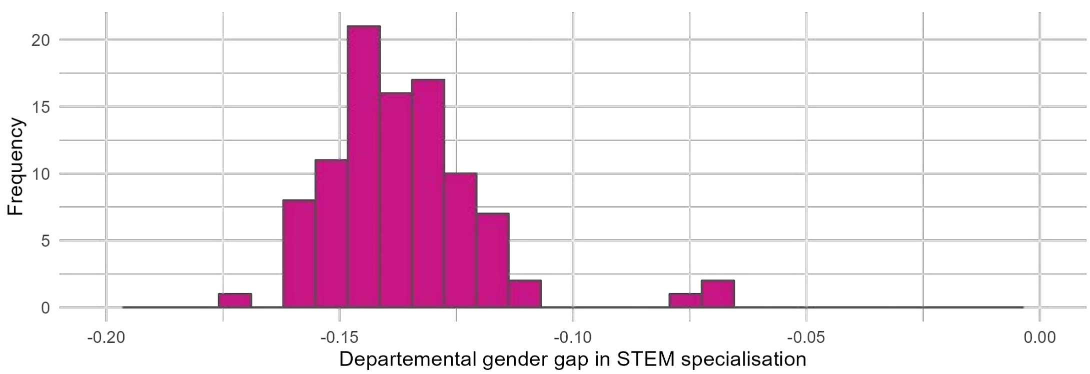
Part C - Beyond supply effects: the local GEP

Figure C1: Histogram of the estimated gender gap in salary within departments



Source: INSEE, Continuous Employment Survey, 2010-2019

Figure C2: Histogram of the estimated gender gap in STEM-specialization within departments



Source: MENJ-DEPP, databases SYSCA and DNB, 2009-2022