

TIMING OF PARENTHOOD AND CHILDREN'S EDUCATIONAL OUTCOMES: A NEW APPROACH FOCUSING ON EDUCATION AS A POSITIONAL GOOD

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Abstract. As the timing of parenthood is steadily increasing in many Western countries, scholars have been interested in the consequences of later motherhood on children's educational outcomes. Previous studies have shown that, in several contexts, the effect of maternal age on children's education is positive. The mechanisms behind this positive effect, however, are unclear, since both the availability of higher socio-economic resources of older mothers and positive period trends in education may explain the gradient. In this study, I argue that to clarify the association between maternal age and children's education, it is important to consider a relative measure of children's education, focusing on education as a *positional good*. By means of the French survey *Formation et Qualification Professionnelle* (FQP) 2014-2015, and a siblings fixed-effects design, I estimate the effect of maternal age on children's level of education measured in absolute (highest level of education attained) and relative (highest level attained relatively to others in the same age group) terms. Results show that, also in France, maternal age is positively associated with children's – absolute – level of education. Still, the positive gradient disappears when children's education is measured in relative terms. These findings support the argument according to which the positive gradient in children's education by maternal age is substantially driven by educational expansion.

1. Introduction

Parents' socio-economic characteristics are considered important determinants of the level of education that an individual attains, contributing to an increase in educational inequalities (Breen and Müller 2020). Differential demographic behaviour by socio-economic characteristics is at the roots of the reproduction of educational inequalities (Breen et al. 2019; Choi et al. 2020). The timing of parenthood, and maternal age more specifically, received great attention among scholars as one of the dimensions affecting children's education. As timing of motherhood continues to rise, concerns about its effects on children's educational outcomes have been increasing too (Myrskylä et al. 2017; Grätz and Wiborg 2024).

Most research shows a positive effect of maternal age on children's education, which is in contrast with explanations related to biological mechanisms such as reproductive ageing. Reproductive ageing would imply a negative effect of maternal

age on child education because of the risks related to preterm births, lower birth weight, or risks in cognitive disabilities (Cohen 2014). Instead, there exist several reasons maternal age may be positively associated with children's level of education.

First, younger mothers tend to have lower human capital contrary to older mothers, who might have accumulated socio-economic resources and life experiences useful at parenting (Kalmijn and Kraaykamp 2005; Powell et al. 2006; Fishman and Min 2018). Next, using Swedish data and a siblings fixed-effects design, Barclay and Myrskylä (2016a) showed that advanced maternal age could be beneficial for children's education because of benefits derived from positive period trends in educational expansion. A later born may be more likely to obtain a tertiary level of education due to enhancements in access to higher education.

To account for period trends, Barclay and Myrskylä (2016a) included the year of birth of the child as a control variable in the siblings fixed-effects model. This approach has been criticized though. The reason is that maternal age and children's year of birth are linearly dependent in the siblings fixed-effects model, hence it is not possible to identify the effect of one or the other (Keiding and Andersen 2016; Kravdal 2019). Thus, while the siblings fixed-effects model is the ideal technique to account for socio-economic resources of the family where children grow up, it could be less efficient in testing mechanisms relating to period trends. A possible alternative would be to apply a multilevel-multiprocess model of mothers' fertility and children's education (Kravdal 2019), which, however, remains demanding in terms of data availability.

In this study, I argue that to analyse the association between maternal age and children's educational level, considering period effects, it is important to use the siblings fixed-effects model in combination with alternative measures of children's education. None of previous studies focused on measuring education in relative terms, i.e., interpreting education as a *positional good* (Hirsch 1976). This implies that the value of an individual's level of education depends on the level of attainment of others in the same age group. This is an important gap, especially when examining the link between maternal age and children's educational outcomes.

I fill this gap by testing the effect of maternal age on children's educational level measured in absolute and relative terms, applying a paired siblings fixed-effects model to French data from the survey *Formation et Qualification Professionnelle* (FQP) 2014-2015. Results show that, also in France, maternal age is positively associated with children's – absolute – level of education. Still, the positive gradient disappears when children's education is measured in relative terms.

2. On the link between maternal age and children's educational attainment

2.1. Previous findings

Previous studies on the effect of maternal age on children's educational attainment showed a positive effect in the Netherlands (Kalmijn and Kraaykamp 2005), and in Sweden (Barclay and Myrskylä 2016a). Both studies applied a siblings fixed-effects model. This model accounts for family unobserved characteristics, shared by the siblings, that are assumed to be constant over time.

Moreover, these studies were the solely accounting for period trends. The Dutch study included in the model the proportion of tertiary educated of a birth cohort. However, the inclusion of this variable did not lead to any conclusive result because of an overcontrol bias, given that the within-family variation is substantially driven by siblings' timing in enrolment (Grätz and Wiborg 2024). The Swedish study has been also criticized because of the issue of linear dependencies between independent variables (Kravdal 2019). In sum, in both studies, it was not possible to disentangle the effect of maternal age from periods trends.

Several other studies have found a positive effect of maternal age on children's outcomes (Powell et al. 2006; Cantalini et al. 2020; Grätz and Wiborg 2024), while a study also found a nonlinear relationship (Fishman and Min 2018), showing a disadvantage for children of teenagers and very old mothers. Still, the level of analysis remained mainly descriptive since unobserved confounders, and models' specification issues may have contributed to alter the estimates.

2.2. Research question and hypotheses

Do children born to older mothers have a *real* educational advantage net of other mother-related characteristics? In line with previous findings, it is expected that also in France children born to older parents are more likely to attain a high level of education relative to children born to younger parents. I formulate the first hypothesis, according to which there is a positive gradient in children's educational level by maternal age, when education is measured in absolute terms (**H1**).

The positive effect, however, could disappear when we consider education as a *positional good*, i.e., when the value of an individual's education depends on the level of education that other individuals of the same age acquire. Over time, due to educational expansion, more and more graduated individuals have easier access to tertiary education, and the educational distribution across children's birth-cohorts changes. Thus, the positive gradient in children's educational attainment by maternal age could be substantially driven by positive trends in educational expansion. Therefore, according to the second hypothesis, it is expected that when measuring children's education in relative terms, to account for positive period trends, the positive gradient by maternal age disappears or flattens (**H2**).

3. Data and methods

3.1. Sample selection

To test these hypotheses, I use data from the French survey *Formation et Qualification Professionnelle* (FQP) 2014-2015 ((FQP), INSEE, 2015). The survey took place from April 2014 to December 2015 with a sample of 26,861 people born between 1950-1992. The survey deals with topics related to social mobility, school to work transition, the relationship between education, occupation, and income. Beyond information about the mother and the father, respondents were requested to answer questions about a sibling, who, during the interview, was randomly chosen among all siblings (if any).

The sample is constituted by respondents with at least one sibling, respondents without siblings (N = 2,690), or with missing information about sibling's year of birth (N=174) or sibling's educational level (N=2,224) were excluded from the analysis. It is more likely that by 25 years old, individuals have reached their final educational attainment, hence, if respondents (or their sibling) were younger than 25 years old at the time of the survey, they were excluded (N = 2,441). Respondents with missing information about mother's year of birth (N = 893) were also dropped from the analysis. Respondents were dropped from the analysis if there were any inconsistencies between the age of the mother and that of the children (N = 14), or between siblings' ages (N = 12), or in case the mother was younger than 15 years old at birth (N = 208), or older than 50 years old (N = 15). Overall, the sample totalled of 18,190 pairs of siblings, i.e., 36,380 units of analysis, born between 1927-1990.

The main outcome variable is the highest level of education reached at the time of survey by the respondent and the respondent's sibling. The absolute level of education is operationalized in six values, in terms of the International Standard Classification of Education (ISCED) from 2011: (1) individuals without a degree or with primary studies only; (2) individuals who completed the lower-secondary level; (3) individuals who obtained a high school diploma, i.e., upper-secondary level; (4) individuals who obtained a diploma with two more years after finishing the upper-secondary level; (5) lower-tertiary level graduates, i.e., those who attained a bachelor degree; (6) individuals who completed a master or a higher degree. Then, a dichotomous variable indicating whether the individual obtained at least a lower-tertiary degree has been created.

Besides measuring the highest level of education in absolute terms, I have also used a relative measure, which accounts for educational expansion across cohorts (Bukodi and Goldthorpe 2016; Triventi et al. 2016). There is not only one - best - way of constructing a relative measure, since it depends on the data, the research question, and the analytical method applied (Bukodi and Goldthorpe 2016). In line with previous work, I have re-operationalized the absolute variable using quartiles,

namely collapsing the categories of the variable based on changes across cohorts, according to the proportions of cohort members holding a certain degree. Hence, the new variable consists of four values ('1' is the lowest quartile, '4' is the highest quartile, defined by birth cohort). Then, I have constructed a dichotomous variable indicating whether the individual is in the highest quartile or not. Note that birth-cohorts refer to categories of multiple years (below 1949; 1950-1959; 1960-1969; 1970-1979; 1980-1990)¹.

The main covariate of interest is maternal age at birth of the respondent and the respondent's sibling, and it is operationalized in six categories (15-19; 20-24; 25-29; 30-34; 35-39; 40+) to account for nonlinearities. I have also included siblings' sex and birth order as control variables, since both variables have been shown to be relevant in analysing children's educational outcomes (Barclay and Myrskylä 2016a). Table 1 summarizes the distribution of outcome variables and covariates in the sample considered.

Table 1 - Description of the variables in the sample considered.

Outcome Variables	N	%
<i>Absolute Educational Level</i>		
Did not obtain a tertiary degree	29309	80,6
Obtained a tertiary degree	7071	19,4
<i>Relative Educational Level</i>		
Not in the highest education quartile	30033	82,6
Highest education quartile	6347	17,4
Independent Variables		
<i>Maternal age at birth</i>		
15-19	2212	6,1
20-24	11272	31,0
25-29	12295	33,8
30-34	6877	18,9
35-39	2862	7,9
40+	862	2,4
<i>Sex</i>		
Male	17870	49,1
Female	18510	50,9
<i>Birth order</i>		
First born	11954	32,9
Second or higher order	24426	67,1
Total	36380	100

Notes: Own elaboration on FQP 2014-2015 data, N paired siblings = 18190.

¹ Conclusions remain the same when using single birth-years (results available upon request).

3.2. Analytical strategy

I have applied a paired siblings fixed-effects design, which allows to compare siblings within the same family to each other, taking into account all unobserved family related variables that are constant over time. This approach permits to estimate the effect of maternal age at birth on children's educational attainment, net of unobserved family characteristics. Using the binary variable as outcome, I apply a linear probability model (LPM) with fixed-effects, formally, it can be written:

$$Y_{ij} = \alpha + \beta X_{ij} + U_i + e_{ij}$$

Y_{ij} corresponds to the best ordinary least squares (OLS) estimate for $\hat{P}(Y_{ij} = 1)$, the probability of acquiring the highest educational level for sibling j of mother i , X_{ij} relate to covariates whose values change across siblings, U_i represents normally distributed systematic differences between families/mothers, $U_i \sim N(0, \sigma_u^2)$, e_{ij} corresponds to the normally distributed within-siblings error of j^{th} order for the i^{th} mother $e_{ij} \sim N(0, \sigma_e^2)$.

While with binary dependent variables, the logit model could be preferable, recently, researchers have acknowledged that the application of a LPM could be a better analytical strategy facilitating the interpretation of results, and the comparison of models (Mood 2010; Timoneda 2021). Nevertheless, I have also estimated a logit fixed-effects model, and the conclusions remain substantially the same to those reported here (results available upon request).

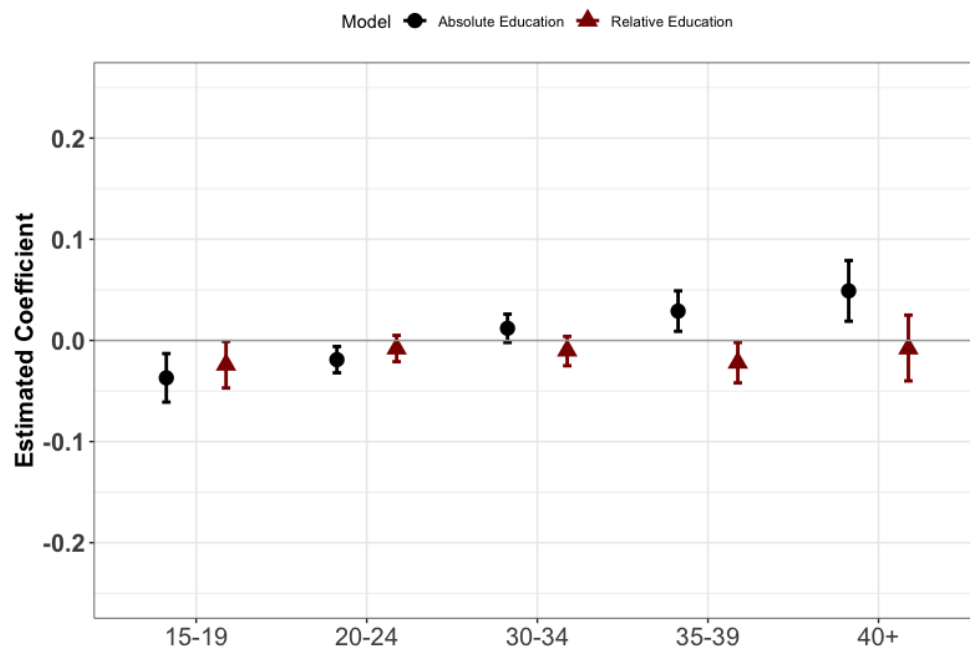
4. Results

This section describes results obtained for the two outcomes. In the first model, the outcome variable is the probability of reaching a tertiary degree, thus it focuses on children's educational attainment in *absolute* terms. The second model, instead, focuses on children's educational attainment in *relative* terms, and the outcome is the probability to be in the highest quartile of the educational distribution relative to the individual's birth-cohort group. By using a fixed-effects design, the effect of maternal age is not biased by other - measured or unmeasured - background factors.

Figure 1 shows the effect of maternal age at the birth of the child for each model. In line with the first hypothesis (**H1**), according to which there is a positive gradient in children's educational level by maternal age, when education is measured in absolute terms; I have found that children born to mothers who are younger than 25 years old at birth are less likely to acquire a tertiary degree relatively to children born to mothers who are 25-29 years old at birth (the reference category). Additionally, children born to mothers who are older than 29 years old at birth are more likely to acquire a tertiary degree relatively to children in the reference category.

This result for the French context is also in line with what has been found earlier in other contexts. The effect of mother's socio-economic background is ruled out because of the siblings fixed-effect design. Consequently, the positive association found can be explained by positive trends in educational expansion. Later born are more likely to acquire a tertiary degree because they can benefit from educational expansion processes.

Figure 1 – Effect of maternal age on the probability to acquire a tertiary degree (black estimates), and the probability to be in the highest quartile of the educational distribution relatively by birth cohort (red estimates). The reference category are children born to mothers aged 25-29 years old at the birth of the child.



Notes: Own elaborations on FQP 2014-2015 data, error bars indicate 95% confidence intervals. Models control for sex, birth order, and family fixed effects.

While it is not possible to test this mechanism by including children's year of birth in the model, which would be collinear with mother's age at birth in the sibling fixed-effects design (Barclay and Myrskylä 2016b), it is possible to analyse the effect of maternal age at birth on children's education measured in relative terms. This approach will account for the fact that over time the proportion of tertiary graduates tends to increase.

Results showed that, in line with the second hypothesis (**H2**), the positive gradient in children's education by maternal age substantially disappears. Children born to

teenager mothers, and to mothers who are 35-39 years old at birth are less likely to be in the highest level of the educational distribution, relative to children born to mothers who are 25-29 years old at birth. Hence, the effect of maternal age turns out to be curvilinear (inverse U-shaped), but mostly not statically significant.

Table 2 – Full models results for the outcome of absolute education (left panel), and relative education (right panel).

	Absolute Education			Relative Education		
	Coef.	95% Confidence Interval		Coef.	95% Confidence Interval	
Female (Ref. Male)	0,01	-0,002	0,017	0,01	0,002	0,021
Second or higher order (Ref. First born)	-0,03	-0,039	-0,017	-0,04	-0,054	-0,031
_cons	0,21	0,199	0,223	0,20	0,193	0,217
sigma_u	0,33			0,31		
sigma_e	0,31			0,31		
rho	0,52			0,49		

Notes: Own elaborations on FQP 2014-2015 data.

Table 2 shows full model results for the remaining covariates. In line with previous findings, females are more likely than males to acquire a higher level of education in both absolute and relative terms, even if the sex of the sibling it is not statically significant in the model of absolute education. Next, in line with the literature, results show that first born children are more likely to acquire a higher level of education rather than second or higher order children.

Moreover, Table 2 shows the “rho” parameter, which is known as the intraclass correlation, and it indicates the proportion of the variance which is due to U_i , the difference across mothers. This is about 52% in the model of absolute education, and 49% in the model of relative education, values which are pretty similar to what has been found earlier (Kalmijn and Kraaykamp 2005).

As robustness checks, I have run stratified models by mother’s educational level. The fixed-effects design already accounts for mothers’ socio-economic background, in its time-invariant aspects. However, it is plausible that among lower educated mothers there is higher variation in siblings’ year of birth than higher educated mothers, since the latter tend to have shorter birth intervals (Cigno and Ermisch 1989; Bartus et al. 2013). Obviously, sample sizes change in the stratified analyses, affecting the magnitude of coefficients and confidence intervals, still, the main conclusions remain the same to those reported here (see Table A1 in Appendix).

5. Conclusions and discussion

As the timing of parenthood is steadily increasing in many Western countries, scholars have been interested in the consequences of later motherhood on children’s educational outcomes. Previous studies have shown that, in several contexts, the

effect of maternal age on children's education is positive. The mechanisms behind this positive effect, however, are still unclear, since both socio-economic resources of mothers and positive period trends in education may explain this gradient.

In this study, I shed light on the association between maternal age and children's education by applying a paired siblings fixed-effects design on French data. Differently from previous studies, however, I also measure children's educational outcomes in relative terms, i.e., interpreting education as a *positional good*. Considering also the relative aspect of education allows to account for positive period trends in education and, as a result, it helps clarifying the association between maternal age and children's educational outcomes.

In line with *H1*, I have found that there is a positive educational gradient in children's education by maternal age also in the French context. This gradient cannot be linked to family characteristics of the siblings (e.g., mother's educational level, family size, etc.), which are time-invariant, and are addressed by the fixed-effects design. Thus, the most plausible explanation is that this positive gradient is related to time trends in educational expansion.

In line with *H2*, when children's education is measured in relative terms, the positive gradient by maternal age disappears. This occurs because the process of educational expansion is taken into account by measuring individuals' level of education in relation to the level that others in the same birth cohort have obtained. Overall, these results support the argument that maternal age at birth does not seem to have an effect *per-se* that is independent from positive period trends in education.

This study also presents a few limitations. For instance, due to data constraints, I could not analyse differences across all siblings in a family, given that the survey gathers information only on one sibling randomly chosen during the interview (INSEE 2015). Moreover, the level of education and the year of birth of the respondents' sibling are self-reported by respondents, as a result, measurement error could be higher than studies which rely on siblings' population register data (e.g., Barclay and Myrskylä 2016a). Still, the fact that the choice of the sibling is random prevents from biases derived by selecting a preferred sibling, which would be closer to the respondent in terms of age.

Next, the siblings fixed-effects design allows to control only for *time-invariant* unobserved family characteristics. While this is a great added value relatively to previous studies, the lack of time-varying information about household income and socioeconomic resources of the mother could somewhat affect the estimates. Still, additional stratified analyses by mother's education led to the same conclusions as those presented here.

Moreover, this innovative approach that combines a paired siblings fixed-effects design with a relative measure of education could be limited to fully account for the role of long-term trends in educational expansion, because the typical age-gap

between siblings is relatively small. Even so, results consistently show the importance of considering education as a *positional good*.

Overall, this study has contributed theoretically and methodologically to previous literature on the effect of maternal age on children's educational attainment. Previous studies have mentioned the role of educational expansion as possible mechanism for the positive effect of maternal age, ruling out the effect of measured and unmeasured family characteristics by also using a fixed-effects design. Still, none of previous studies has properly empirically tested the role of changes over time in the educational distribution.

This study showed that *relative education* matters. Period trends such as educational expansion may have unclear outcomes for children born to older mothers. For instance, if structural conditions are difficult, many qualified individuals have to compete on the labour market, thus educational expansion may be considered harmful to a later born. Educational expansion, differently from other positive period trends (such as medical progress, and related improvements in life expectancy), may have more ambiguous effects on children's outcomes.

Here, I have highlighted the importance of *relative education* when testing the effect of maternal age on children's outcomes. Future studies should focus more often on education as a *positional good* to determine the role of demographic behaviours in the intergenerational transmission of education.

Appendix

Robustness checks: Stratified analyses by mothers' level of education

Table A1 – *Effect of maternal age on absolute education (left panel), and relative education (right panel), stratified by mothers' educational level.*

<i>Mothers with at least high-school diploma (N = 5160)</i>		Absolute			Relative		
Maternal age at birth (Ref. 25-29)	Coef.	95% Confidence Interval		Coef.	95% Confidence Interval		
15-19	-0,08	-0,14	-0,02	-0,04	-0,10	0,02	
20-24	-0,02	-0,05	0,01	-0,01	-0,04	0,02	
30-34	0,01	-0,02	0,04	-0,03	-0,06	0,00	
35-39	0,08	0,02	0,14	-0,02	-0,08	0,03	
40+	0,10	-0,01	0,21	-0,06	-0,17	0,05	
<i>Mothers with a lower-secondary degree (N = 4894)</i>		95% Confidence Interval			95% Confidence Interval		
	Coef.			Coef.			
15-19	-0,04	-0,08	0,01	-0,01	-0,06	0,03	
20-24	-0,01	-0,03	0,02	0,00	-0,03	0,02	
30-34	0,03	0,01	0,06	0,01	-0,02	0,04	
35-39	0,04	0,00	0,08	-0,02	-0,06	0,02	
40+	0,04	-0,03	0,10	-0,02	-0,10	0,05	

Table A1 (cont.) – Effect of maternal age on absolute education (left panel), and relative education (right panel), stratified by mothers' educational level.

Mothers with no degree or a primary level (N = 5953)	95% Confidence Interval		95% Confidence Interval	
	Coef.	Interval	Coef.	Interval
15-19	-0,01	-0,05 0,02	-0,01	-0,05 0,02
20-24	-0,02	-0,03 0,00	0,00	-0,02 0,02
30-34	0,01	-0,01 0,03	-0,01	-0,03 0,01
35-39	0,00	-0,03 0,02	-0,02	-0,05 0,00
40+	0,05	0,01 0,08	0,01	-0,02 0,05

Notes: Own elaborations on FQP 2014-2015 data.

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