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Parental migrant status and health inequalities at birth:

The role of immigrant educational selectivity

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Abstract

Immigrants tend to exhibit better health than natives despite immigrants' more disadvantaged socioeconomic status. This paradox has often been attributed to immigrants' pre-migration selectivity. However, most empirical studies investigating the role of selectivity have focused on adult health; less attention has been paid to children's birth outcomes outside the U.S. context. Using data from the Etude Longitudinale Française depuis l'Enfance (ELFE), a nationally representative sample of over 18000 births in France in 2011, we investigate the role of immigrant parents' educational selectivity in shaping four birth outcomes: birthweight, low birthweight, prematurity, and being born small for gestational age. Results from linear and logistic regressions confirm a health advantage for children of immigrants compared to natives despite lower parental socioeconomic status, mainly among children of Middle Eastern and North African parents. Immigrant parents' positive pre-migration educational selectivity explains most of this health advantage, predominantly among children with two immigrant parents. Further, mediation analyses indicate that the effect of educational selectivity is partially mediated by parental health behaviors, particularly smoking during pregnancy. Furthermore, analyses suggest that selectivity improves birth outcomes only for children of recent arrivals, with less than five years of residence in France. The beneficial effect of selectivity declines with length of residence, suggesting that a process of "unhealthy assimilation," coupled with the cumulative exposure to health risks and disadvantaged living conditions, may lead to the erosion of the protective effect of immigrant selectivity.

Key words: Birth outcomes, France, immigrant generation, immigrant selectivity, health inequality, unhealthy assimilation.

1. Introduction

A vast literature has identified an immigrant health advantage in developed countries, expressed in lower morbidity and mortality among immigrants compared to the native population (Boulogne et al. 2012; Palloni and Arias 2004; Rubalcava et al. 2008; Wallace 2016). This advantage stands out given that immigrants are on average socioeconomically disadvantaged, a phenomenon known as the “immigrant health paradox” (Fenelon 2013; Khlal and Guillot 2017; Palloni and Arias 2004). This health advantage has often been attributed to immigrants’ positive pre-migration selectivity in health and socioeconomic status (Akresh and Frank 2008; Chiswick et al. 2008; Giuntella 2016; Palloni and Arias 2004), yet, this hypothesis has not been sufficiently tested empirically. Most of the evidence on selectivity has come from studies on adult health and mortality (Akresh and Frank 2008; Palloni and Arias 2004; Riosmena et al. 2017; Solé-Auró and Crimmins 2008), while children’s health outcomes have received less attention. Yet, early health plays a pivotal role as a determinant of subsequent health trajectories, affecting morbidity and mortality in adulthood (Myrskylä et al. 2014). Studies in the U.S. have found better birth outcomes among children of immigrants (Giuntella 2016; Jasso et al. 2004; Palloni and Morenoff 2001), providing indirect evidence of a protective effect of selectivity. However, outside the U.S. context this phenomenon has received little attention, with a notable exception comparing low birthweight among immigrants in the U.S. to two other Anglo-Saxon settings, the UK and Australia (Martinson et al. 2017). Our study addresses these issues investigating the role of immigrant educational selectivity on children’s birth outcomes in France, a major immigrant destination in Europe (INSEE 2020; Saurel-Cubizolles et al. 2012).

Scholars have argued that immigrants are not representative of their sending populations, but a selected group, often better educated, in better health, or better suited for

work than their nonimmigrant counterparts (Feliciano 2005; Jasso et al. 2004; Palloni and Morenoff 2001). Characteristics linked to these selection processes may also encourage migrants to engage in better health practices (Baker et al. 2015; El-Khoury Lesueur et al. 2018; Fenelon 2013; Riosmena et al. 2017). Nonetheless, immigrant's initial health advantage tends to deteriorate over time (Giuntella 2017; Jasso et al. 2004; Mendoza 2009), including when birth outcomes are examined (Giuntella 2016, 2017). One explanation is that as immigrants acculturate, they tend to adopt riskier health behaviors, such as drinking and smoking (Chiswick et al. 2008; Mendoza 2009; Palloni and Morenoff 2001; Teitler et al. 2017). Another explanation is that although immigrants may be self-selected on health, their health status regresses to the mean over time (Jasso et al. 2004). Yet, there is a lack of direct evidence on whether the protective effect of selectivity fades out over time and whether health practices mediate the effect of selectivity on birth outcomes, especially in the European context.

We use recent data from the French longitudinal study from infancy (ELFE), a nationally representative cohort of children born in France in 2011, to investigate whether health at birth differs by parental migrant status, and whether parents' educational selectivity can explain this variation. We use four different indicators of health at birth, namely birthweight, the probability of low birthweight, premature birth, and being small for gestational age. This study addresses four major gaps. First, we provide novel evidence of an immigrant health advantage in birth outcomes in France. Second, we show that immigrants' pre-migration educational selectivity partly explains this health advantage. Third, we investigate the mediating role of parental health behaviors, such as smoking and alcohol consumption during pregnancy, as a potential mechanism through which selectivity may affect children's birth outcomes. Fourth, in contrast to studies that assume a uniform, static, average effect of selectivity (Akresh and Frank 2008; Feliciano and Lanuza 2017; Ichou

2014), we use a dynamic approach, investigating whether the impact of educational selectivity fades out as immigrants become longer settled (Chiswick et al. 2008; Ichou and Wallace 2019; Mendoza 2009; Urquia et al. 2012). We build on prior research, measuring selectivity using individuals' pre-migration educational rank, which positions individuals within the educational distribution of individuals of the same sex, born the same year in their countries of origin (Ichou 2014). This study provides unique evidence on the intergenerational health effects of immigrant educational selectivity, the potential mechanisms through which they operate, and their dynamics over time.

2. Background

The prenatal period is a crucial developmental phase shaping health outcomes later in life. Studies have shown that early life health is linked to adult health (Myrskylä et al. 2014). The wider literature on child inequality indicates that parental investments, largely determined by parental social, economic and cultural resources, and health practices are key predictors of children's health (Baker et al. 2015; Datar et al. 2010; Panico et al. 2015). Children in socio-economically disadvantaged families exhibit worse health outcomes, including a higher probability of low birthweight (Baker et al. 2015; Giuntella 2016; Myrskylä et al. 2014; Panico et al. 2015; Teitler et al. 2017). Children's health can also be affected by their parents' migration status (Baker et al. 2015; Castañeda et al. 2015). Immigrant parents may be better or worse able to invest in their children depending on their post-migration and pre-migration resources (Hamilton et al. 2011; McMillan 2019). Thus, it is important to study the interplay between parental migrant status, socioeconomic resources, health behaviors, and children's early health outcomes. For this purpose, we test four related hypotheses presented below.

2.1. The health paradox and immigrant selectivity

The “immigrant health paradox” refers to immigrants’ advantage in health outcomes consistently observed in developed countries, despite immigrants’ relatively disadvantaged socioeconomic position (Mendoza 2009; Palloni and Arias 2004; Riosmena et al. 2017). Studies in the U.S. have suggested a health advantage in birth outcomes among children of Hispanic immigrants (Giuntella 2016, 2017; Jasso et al. 2004; Mendoza 2009). However, evidence for the European context remains scarce. Prior research has found that the immigrant health advantage is present in adults in France (Ichou and Wallace 2019; Khlal and Guillot 2017; Solé-Auró and Crimmins 2008), yet whether it extends to children’s outcomes needs further research. Based on the literature,

H1: We expect to find a health advantage in immigrants’ children’s birth outcomes in France.

According to the selectivity hypothesis, immigrants are selected favorably on observable and unobservable characteristics than their non-migrant peers (Chiswick et al. 2008). Selectivity can occur in different dimensions, including socioeconomic features and health, which are often correlated (Chiswick et al. 2008). Migrants self-select in health because good health is essential for successful migration. Several studies have found evidence of a health selectivity (Akresh and Frank 2008; Chiswick et al. 2008; Giuntella 2017; Jasso et al. 2004; Palloni and Morenoff 2001). Socioeconomic selectivity has been less explored. Most studies on health inequality adjust for immigrants’ post-migration socioeconomic characteristics (Akresh and Frank 2008; Auger et al. 2008; Giuntella 2016; Palloni and Arias 2004). Yet, this strategy cannot adequately capture pre-migration socioeconomic selectivity because it compares

immigrants with the population in the host country, rather than with the sending population (Chiswick et al. 2008; Feliciano 2005; Ichou 2014).

Socioeconomic selectivity may imply having more education, financial or social resources (Feliciano 2005; Palloni and Morenoff 2001). Education constitutes a crucial determinant of health (Auger et al. 2008; Ichou 2014; Myrskylä et al. 2014) by providing knowledge to improve health status, and indirectly by enhancing socioeconomic resources and promoting better health practices (Ichou and Wallace 2019; Panico et al. 2015). We hypothesize that:

H2: Parental educational selectivity has a protective effect on immigrants' children's birth outcomes resulting in a health advantage relative to children of natives.

2.2. Parental health behaviors and children's health outcomes

Parental health practices are important determinants of children's birth outcomes. Immigrant parents, particularly mothers, exhibit healthier behaviors associated with better birth outcomes (Baker et al. 2015; Hamilton et al. 2011) such as lower consumption of alcohol and tobacco, than native-born mothers (El-Khoury Lesueur et al. 2018; Fenelon 2013; Harley and Eskenazi 2006; Melchior et al. 2015; Wanner et al. 1995). Given that education influences health practices, we hypothesize that:

H3: The effect of educational selectivity on children's birth health outcomes will be partially mediated by parental health behaviors during pregnancy.

2.3. Unhealthy assimilation

Prior research has indicated that the immigrant health advantage deteriorates with time in the host country (Giuntella 2016; Hamilton et al. 2011; Jusot et al. 2009; Palloni and Arias 2004; Rubalcava et al. 2008). Scholars have proposed different explanations. Unhealthy assimilation is a major argument that states that as immigrants become longer settled, they adopt the – often less healthy – behaviors and lifestyles prevalent in the host society (Gordon-Larsen et al. 2003; Harley and Eskenazi 2006; Khlal and Guillot 2017; Urquia et al. 2012). Studies have found evidence indicating that physical activity among immigrants decreases with length of residence, while their rates of smoking, drinking, and drug use increase (Baker et al. 2015; Fenelon 2013; Gordon-Larsen et al. 2003; Harley and Eskenazi 2006; Mendoza 2009). Another argument is that immigrants’ health deteriorates through a natural process of regression to the mean, converging to the average health status in the host society (Jasso et al. 2004). Another mechanism is the increasing exposure to risk factors that immigrants experience over time, resulting in a growing cumulative health burden (Gordon-Larsen et al. 2003; Hamilton et al. 2011). The evidence indicates that immigrants experience discrimination, harsher work and living conditions, limited access to and lower quality of health care, undermining their health over time (Chiswick et al. 2008).

Given what is known about the French context, we suspect that the mechanisms observed in the international literature will apply to immigrants in France. Notably, we expect a relative decline in immigrants’ health as they settle in France because of their harsher work conditions relative to natives (Berchet and Jusot 2012; Jusot et al. 2009), their poorer living conditions (Castillo Rico et al. 2019), and their higher exposure to discrimination (Cognet et al. 2012; Rivenbark and Ichou 2020). Although, scholars have hypothesized that the deterioration of the immigrant advantage may also be related to the erosion of the protective effect of selectivity over time (Chiswick et al. 2008; Feliciano 2005), to our knowledge, no prior study has provided empirical evidence. We hypothesize that:

H4: Selectivity will have a stronger influence for children of recent arrivals, and a smaller or null impact for children of longer settled immigrants.

2.4. The French context

France is one of the major immigrant destinations in Europe, hosting 6.5 million immigrants who represent 10% of the country's population (INSEE 2020). Immigrants in France primarily come from Africa (both North and Sub-Saharan Africa) and Europe, and to a lesser extent the Middle East (especially Turkey) and Southeast Asia. France's restrictive immigration policies, as well as the costs associated with international migration, explain why immigrants in France – like in many other destination countries (Feliciano 2020) – appear positively selected (Ichou et al. 2017), i.e. more educated and with more resources than their non-migrant counterparts in their origin country. At the same time, as in many other developed countries, immigrants and their children constitute a relatively vulnerable population, not only because they tend to be socioeconomically disadvantaged relative to natives, but also because they are exposed to a greater number of health risk factors (Boulogne et al. 2012; Jusot et al. 2009; Khlal and Guillot 2017). Immigrants also have difficulties accessing health services due to lack of eligibility, language barriers, or unfamiliarity with the French health system (Berchet and Jusot 2012; Saurel-Cubizolles et al. 2012). Less is known about how children's birth outcomes relate to parents' migration status, their pre-migration socioeconomic resources, and their health behaviors.

Much knowledge about immigrants' health comes from studies of adults in the U.S., focusing on few well-established migrant communities, primarily Hispanics (Akresh and Frank 2008; Giuntella 2016; Hamilton et al. 2011; Mendoza 2009; Palloni and Arias 2004; Riosmena et al. 2017). Although some studies have also investigated immigrant adult health

(Auger et al. 2008; Chiswick et al. 2008; Solé-Auró and Crimmins 2008; Wallace 2016), and, more sparsely, birth health (Martinson et al. 2017) in the U.K., Canada, Australia, and some European countries, these countries have specific patterns of migration, social stratification, and health care systems. Thus, these findings may not be generalizable to other contexts. Studies investigating the health of infants born to immigrant parents in France are scarce, and have provided ambiguous results.

On the one hand, studies have shown that migrant women in France, particularly from North Africa, have overall lower level of tobacco and alcohol consumption than French-born women (Saurel-Cubizolles et al. 2012; Wanner et al. 1995). Yet, other studies have found more perinatal health risks among immigrant mothers. For example, the maternal mortality rate in France between 1998 and 2007 was higher for foreign-born women than for native-born women (Saurel-Cubizolles et al. 2012), and more pre-existing health problems and complications during pregnancy have been reported for immigrant women (El-Khoury Lesueur et al. 2018). Foreign-born women, particularly those from sub-Saharan countries, have higher rates of stillbirths, premature births, and low birthweight babies (Saurel-Cubizolles et al. 2012). Thus, it is important to investigate disparities in birth outcomes by parental migrant status in recent cohorts in France and whether pre-migration educational selectivity may play a role shaping these outcomes.

2.5. Contributions of the present study

Understanding early health in children of immigrants is scientifically and politically important, yet it has remained an under-researched area. This study investigates the role of educational selectivity explaining differences between natives and immigrants in four birth outcomes: birthweight, the probabilities of low birthweight, premature birth, and being small

for gestational age. This study moves the field forward by using a measure of selectivity that more closely represents migrants' pre-migration status than traditional measures of socioeconomic status that compare immigrants to the host country population. We apply the methodology developed by Ichou (2014), and followed by Feliciano & Lanuza (2017) and Ichou & Wallace (2019), to estimate individuals' percentile of educational attainment in their country of origin. This strategy provides a measure of individuals' relative education or contextual attainment that better captures educational selectivity prior to migration. We evaluate four hypotheses that have rarely been tested, including whether children of immigrants in France exhibit a health advantage at birth, whether educational selectivity can explain this advantage, whether parental health behaviors during pregnancy, such as smoking and alcohol consumption, mediate the effect of selectivity, and whether the impact of selectivity wanes with length of residence in France. By doing so, this study provides new evidence on the role of parental educational selectivity in children's early health outcomes.

3. Data, Measures, and Methods

3.1. Data and sample

This paper uses the *Etude Longitudinale Française depuis l'Enfance* (Elfe), France's first large scale nationally representative birth cohort study, following 18,329 births in 2011 to mothers aged 18 and over covering 341 maternity wards in continental France (see Charles et al., 2019 for an in-depth description of the Elfe study). The Elfe study includes single and twin births from parents planning to live in France for at least 3 years. Because children from twin births are more likely to be born with low weight and prematurely, we focus on singleton births. Including twin births in analyses did not substantively change our key findings. To

avoid overlap with a concurrent national survey of very premature children, Elfe includes only babies born at 33 weeks of gestation or later. Data were collected at birth, 2 months, 1 year, 2 years, 3.5 years and at 5.5 years post-birth. The present study uses the first two waves. The first wave was conducted in the maternity ward shortly after birth, and collected information on mother and child's health at birth, including birthweight and gestational age, taken directly from the mother's medical records. A short face-to-face questionnaire was also administered to mothers by trained mid-wives. The second wave was conducted about 2 months following the birth via a telephone interview with both parents. This wave collected data on demographic and socio-economic characteristics, including marital status, living arrangements, parental education, family income, and parental health behaviors, among other variables.

We include all singleton births, excluding 558 twin births, and 481 observations without valid data on birth outcomes. We include children whose parents responded to both waves, excluding 1,574 cases that did not participate in the second wave, and an additional 447 with unknown parental migration status. Because we are interested in the role of immigrant pre-migration educational selectivity, we exclude 1,004 children whose parents have missing data on parental education (801 natives and 203 immigrants), and 1,079 immigrant parents who completed their schooling in France, leaving a remaining 13,186 eligible sample. An analysis of the sample of immigrants excluded for having completed their education in France or because of missing education data showed that these groups did not systematically differ from those retained in the analytical sample, except that, as expected, immigrants who completed their education in France were more educated, more likely to be in civil unions, and to drink alcohol during pregnancy compared to immigrants who completed their education in their country of origin. Given these expected differences, and because we cannot measure their pre-migration educational selectivity, we excluded migrants who

completed their education in France. An additional 138 cases are lost due to missing data in other covariates. The final analytical sample is composed of 13,048 observations, including 11,448 children of natives, 574 children with two immigrant parents (second generation), and 1,026 children with one immigrant parent and one native parent (2.5 generation).

3.2. Measures

3.2.1. Dependent variables

Birthweight is an outcome resulting from two processes (Kramer 1987): duration of gestation, and fetal growth (which can result in intrauterine growth restriction, IUGR). Gestational duration is linked to genital tract infections, multiple births, low pre-pregnancy maternal BMI, heavy physical work, and, to a smaller extent than for IUGR, cigarette smoking. Causes of IUGR include smoking, congenital anomalies, high alcohol consumption, and the use of drugs during pregnancy. Stress also appears to be implicated in both processes. Examining a variety of indicators of health at birth allows us to better capture these different processes. We therefore look at four indicators of child health at birth: (1) a continuous variable indicating *birthweight* measured in grams, (2) a dichotomous variable indicating *low birthweight*, which taking the value of 1 for children weighing less than 2500 grams at birth, and 0 otherwise, (3) a dichotomous variable indicating *premature birth*, defined as being born before 37 weeks of gestation, and (4) a dichotomous variable for being born *small for gestational age* (SGA). SGA is a proxy for intrauterine growth restriction, defined as having a birthweight below the 10th percentile for a given gestational age. To calculate it, we use the reference guidelines proposed by Mikolajczyk et al. (2011) based on fetal weight.

3.2.2. Independent variables

Migration status. We classify children according to their parents' migrant status into *natives*: children with both parents born in France; *second generation*: children with both parents born abroad, and *2.5 generation*: children with one immigrant parent and one French-born parent.

Basic child controls at birth include *child's sex*, measured with a binary variable taking the value of 1 for females, a binary indicator for whether the child is a *first-born*, and dummies for *season of birth*.

Demographic and socioeconomic characteristics include a continuous measure of *mother's age at birth* of the focal child; a categorical variable indicating *parental union status* at birth – married, in a civil union, cohabiting, or single parent; and a continuous variable measuring the number of *years of education*. We followed conventional criteria favoring the value for the most educated parent (Feliciano and Lanuza 2017; Ichou and Wallace 2019). Sensitivity analyses using the mother's education yielded similar results (see Appendix 1), yet this approach prevented us from measuring educational selectivity among children with an immigrant father and native-born mother.

To measure *relative education* – or *country-contextual attainment* (Feliciano and Lanuza 2017) – we created a dataset that contains the educational distribution of 188 countries for individuals born between 1895 and 1994, by combining the Barro-Lee dataset (Barro and Lee 2013) and the Wittgenstein Centre dataset (Goujon et al. 2016). Using this dataset, we estimate each individual's percentile in the educational distribution in their country of origin, by gender and birth year. This value indicates the percentage of individuals from the same country, gender, and birth cohort who have a lower level of education than oneself, plus half of those with the same level of education (Ichou 2014). This variable measures individuals' relative education, capturing immigrants' educational selectivity prior

to migration (Feliciano and Lanuza 2017; Ichou and Wallace 2019). In the analyses, we divide this variable by 10 to obtain the effect of a decile increase in relative education. As previously mentioned, we use the value corresponding to the parent with the highest relative education. For children with one native and one immigrant parent, the value for the immigrant parent is favored.

Region of origin. We construct a categorical variable identifying five broad regions of parents' country of origin: (1) France (the reference group), (2) Europe, which includes immigrants from Western, Central, and Eastern European countries, except France, (3) Middle East and North Africa, the largest immigrant group in France including immigrants from Turkey, Algeria, Morocco, and other North African countries, (4) Sub-Saharan Africa, the second largest immigrant group, including all Sub-Saharan African countries, and (5) Other countries, which comprise Asia, Oceania, and North, Central and South America, with samples too small to be included in a separate category. For children with one native and one immigrant parent, parental region of origin corresponds to that of the immigrant parent. For consistency, among children with two immigrant parents, we used the region of origin of the parent for whom we measure pre-migration educational selectivity. The relatively small sample sizes limited our analysis by country of origin, however, we note some patterns by region in the results section.

Years since migration at the child's birth are calculated using the year of arrival for the parent for whom we measure pre-migration educational selectivity.

Parental health behaviors include two dummy variables indicating whether the mother smoked and drank alcohol during pregnancy. Finally, *pregnancy complications* is measured with a dummy variable indicating whether the mother experienced any of the following during pregnancy: gestational diabetes, arterial hypertension, bleeding during the second or third trimester, premature membranes rupture, premature delivery threat, or abnormal fetal

weight during pregnancy. We do not include further data pertaining to prenatal care, as these variables did not vary significantly across migrant status and had high level of missingness across all groups.

3.3. Methods

First, we analyze the outcome variables and the characteristics of the sample by migration status using descriptive statistics (Table 1). Then, we use multivariate ordinary least square regressions to predict birthweight (in grams), and logistic regression models to predict the binary health outcomes: low birthweight, premature birth, and small for gestational age. A first series of nested models is estimated using the entire sample, presented in Table 2. Model 1 includes migration status – where the reference group is children of natives, the largest group – and basic child controls at birth, i.e., the child’s sex, twin status, whether the child is a first-born, and the season of birth. Model 2a adds traditional demographic and socioeconomic indicators, including, the mother’s age at birth of the child, parental marital status at birth (married, civil union, cohabiting, and single parent), and years of education for the most educated parent. Model 2b replaces the absolute measure of years of education with the measure of relative education. Finally, Model 3 adds controls for parental health behaviors during pregnancy, including whether the mother smoked, drank alcohol during pregnancy, and whether she experienced pregnancy complications. We graph the average marginal effects of migration status across models, including 95% confidence intervals (Figure 1).

We conduct a mediation analysis of relative education (Table 3) using the Karlson-Holm-Breen (KHB) method (Breen et al. 2013). By contrast to linear models in which the difference in the coefficients across models with and without mediator variables can be used to decompose the total effect of a variable into its direct and indirect effects, classic

decomposition methods cannot be directly applied to nonlinear probability models, such as logit and probit models. This issue arises because the coefficients across nonlinear models are subject to changes due to the rescaling of the variance in the underlying latent variable. In most cases, this might not pose a problem (Kuha and Mills 2020). Yet, the KHB method takes into consideration this potential issue, representing a more suitable alternative for mediation analysis (Breen et al. 2013). This method performs as well with nonlinear probability models as with linear models. Using the KHB method, we estimate the direct effect of parental relative education on children's birth outcomes and its indirect effect, mediated by parental behaviors and health complications during pregnancy.

A second set of regressions (Table 4) introduces an interaction between relative education and years in France to test whether the effect of immigrants' relative education varies with parental length of settlement. Consequently, the analysis here is restricted to children of immigrants. Figure 2 graphs the marginal effects of the interaction between relative education and length of settlement.

All descriptive and multivariate analyses are weighted to take into account the stratified nature of the sampling framework and attrition to ensure representative results.

4. Results

[Table 1 here]

Table 1 presents descriptive statistics for our analytical sample. Children of immigrants exhibit relatively similar health at birth compared with children of natives. Among the four birth outcomes studied, we only observe significant differences for birthweight: second generation children weigh on average 73 grams more than children of natives ($p < .01$), and 2.5 generation children weigh 44 grams more ($p < .05$). The prevalence of low birthweight,

premature birth, and small for gestational age was statistically undistinguishable across the three groups.

When education is measured in years (an absolute measure), the native group appears to be the most educated, with an average of 13.6 years of education; whereas parents of second generation children average 10.5 years, and those of 2.5 generation children 12.4 years. This finding reflects the well-known disadvantaged socioeconomic status of immigrants in France. However, in terms of relative education or contextual attainment, parents of second generation children were more highly ranked, being on average in the 72th percentile of the educational distribution in their country of origin, compared with natives at the 64th, and parents of 2.5 generation children at the 59th percentile. Nonetheless, we acknowledge that the level of relative education of immigrants' in France has been shown to be diverse both across countries of birth, but also among immigrants originating from the same country (Ichou et al. 2017).

Children of immigrants were also more likely to be born to a married co-resident couple, less likely to be born to an unmarried cohabiting couple or a registered civil union, but more likely to be born to a single parent. Children of immigrants had slightly older mothers. Table 1 also indicates healthier parental behaviors during pregnancy among immigrants, reflected by the lower rates of smoking and drinking among mothers of second generation children, followed by mothers of 2.5 generation children. Surprisingly, despite these differences, the incidence of pregnancy complications was similar across groups.

[Table 2 here]

[Figure 1 here]

Table 2 shows the coefficients of the multivariate analyses for the four birth outcomes. Fig. 1 illustrates the predicted marginal effects of immigrant generational status relative to natives, based on the models in Table 2. Model 1 (M1) includes basic child controls comprising

dummy variables for child's sex, first born, and season of birth (full tables with covariate coefficients available in the online Appendix 2). Net of basic child controls, children of immigrants (2nd and 2.5 generation) have slightly better or similar birth outcomes than children with two native French parents according to M1. Children of immigrants weigh more at birth than children of native-born parents, with a slightly larger advantage for second generation (61.2 grams) than 2.5 generation (35.8 grams) children (Fig. 1). The probabilities of low birthweight, premature birth, and being small for gestational age were not statistically significantly different across groups in Model 1.

Model 2a (M2a) adds traditional demographic and socioeconomic variables, namely mother's age, marital status, and years of parental education at birth. Controlling for demographic and socioeconomic factors in M2a magnifies the differences in birth outcomes by immigrant generational status, revealing statistically significantly better health outcomes for second generation children compared to children of natives across all four birth outcomes. In M2a, second generation children weigh 98.6 grams more at birth than children of French natives, and exhibit a significantly lower probability of low birthweight, premature birth, and being small for their gestational age. That is, the health paradox fully emerges once we take into consideration migrants' more disadvantaged socioeconomic status after migration. The advantage is smaller for 2.5 generation children, but still statistically significant for birthweight. These results provide evidence for the immigrant health paradox, as stated in Hypothesis 1.

Model 2b replaces the absolute measure of parental years of education with the measure of pre-migration relative education. First, we note that the coefficients for relative education are statistically significant for all outcomes, and similar in magnitude to those for years of education in Model 2a. The direction of the coefficients for relative education are in the expected direction: higher parental relative education is associated with better health at

birth. A 10% increase in the percentile of parental education is associated with a 12.4 grams increase in birthweight, a 0.46% reduction in the probability of low birthweight, a 0.49% reduction in the probability of premature birth, and a 0.48% decline in the probability of small gestational age. Second, we observe that the coefficients for migration status are greatly reduced in Model 2b compared with Model 2a. Most of the differences in birth health outcomes between second generation children and children of natives are significantly reduced or become non-significant when controlling for parental relative education, as illustrated in Fig. 1. Although the advantage in birthweight for second generation children remains marginally significant, it is reduced by 21% in Model 2b compared with Model 1. The advantage in low birthweight, prematurity, and small gestational age become non-significant. In other words, the health paradox for second generation children is mostly explained by immigrant parents' pre-migration educational selectivity. The health advantage in birthweight for 2.5 generation children is also reduced, but to a smaller extent. This finding provides support for Hypothesis 2, which posits that parental educational selectivity partly accounts for the health advantage among children of immigrants.

Model 3 adds parental behaviors and pregnancy complications to Model 2b. As we can observe, the coefficient for parental relative education is reduced for all outcomes, and becomes non-significant for prematurity. This finding provides evidence that parental health behaviors and complications during pregnancy may constitute a mechanism by which immigrant selectivity affects children's birth outcomes, as stated in Hypothesis 3.

[Table 3 here]

To further evaluate this hypothesis, we conducted a mediation analysis using the Karlson-Holm-Breen method (Breen et al. 2013) to decompose the total effect into direct and indirect effects. The results are shown in Table 3. The mediation analysis provided further evidence for Hypothesis 3. The results indicate that 58% of the effect of parental educational

selectivity on children's birthweight is mediated by parental health behaviors during pregnancy (smoking and alcohol consumption) and pregnancy complications. These variables also mediate 30.1% of the effect on low birthweight, 36.2% for prematurity, and 36.9% for small for gestational age. Most of these effects were mediated by smoking during pregnancy.

Although significant heterogeneity may exist by immigrant parents' country of origin, sample sizes prevent such an analysis. Nonetheless, we assess heterogeneity by broad regions of origin. The results by parents' region of origin are presented in the online Appendix 3. It is worth noting that the small sample sizes of certain groups reduced the statistical power of the models, rendering many coefficients not statistically significant. However, we observe that the direction of the coefficients follow a similar pattern in our main results. More specifically, the results for children of Middle East and North African immigrants, the largest immigrant group in France, are similar to those presented in Table 2. For most outcomes, the coefficients suggest a health advantage at birth, particularly for second generation children, which is magnified when adjusting for sociodemographic variables in Model 2a. These differences are reduced when controlling for our measure of educational selectivity in Model 2b, and parental health behaviors and complications during pregnancy in Model 3.

The pattern is similar, but less marked, for second generation children of European immigrants. By contrast, children of Sub-Saharan Africans, the second largest immigrant group in France, do not seem to be in better health at birth relative to children of natives. In fact, although not significant, some of the coefficients for second generation children run in the opposite direction (i.e. suggesting worse health), particularly low birthweight for second generation children of Sub-Saharan Africans. This finding suggests that healthier parental behaviors and the lower prevalence of pregnancy complications are particularly beneficial for these children; when these factors are controlled for, their health disadvantage becomes evident. This pattern is less clear for 2.5 generation children of Sub-Saharan Africans.

[Table 4 here]

[Figure 2 here]

Finally, we investigate whether the effect of immigrant educational selectivity varies with length of settlement. Because years since migration can only be measured for immigrants, this analysis is restricted to children with at least one immigrant parent (see Table 4). Model 1 shows the results net of child controls, mother's age, and educational selectivity, Model 2 adds years since migration to France as a continuous variable, and Model 3 introduces interaction terms between educational selectivity and years since migration (illustrated in Fig. 2). These interactions are statistically significant for two outcomes (birthweight and low birthweight); however the pattern is similar for all four outcomes. This finding reveals heterogeneity in the impact of immigrant educational selectivity according to length of settlement in the host country.

As Fig. 2 shows, educational selectivity has a significant beneficial effect on birth outcomes among children of recent arrivals, i.e. with fewer than five years in France. However, the effect is reduced and becomes non-significant for children of longer settled immigrants. Fig. 2 indicates that the protective effect of selectivity declines with years in France, in line with the literature suggesting a process of "unhealthy assimilation." Hypothesis 4 is supported; the results show that immigrant educational selectivity is mostly protective for the health of children of recent arrivals, but not for children of longer settled immigrants.

5. Discussion and Conclusion

Health inequality among children is a scientifically and politically relevant issue, particularly birth health outcomes, which are key determinants of future health trajectories (Myrskylä et

al. 2014). Overall, research has documented an immigrant health advantage compared with the native population despite immigrants' relatively disadvantaged socioeconomic position, a phenomenon referred to as the immigrant health paradox, which has been reported for adult (Giuntella 2016; Jasso et al. 2004; Riosmena et al. 2017; Rubalcava et al. 2008) and child outcomes such as birth health (Giuntella 2016, 2017; Martinson et al. 2017). This advantage has often been attributed to immigrants' positive selectivity (Akresh and Frank 2008; Giuntella 2016; Palloni and Arias 2004), yet, few studies have tested this hypothesis on health at birth, and evidence from European countries remains scarce. Using nationally representative data of children born in 2011 in France, a major immigrant destination in Europe, this study tested whether immigrant educational selectivity can explain the variation in four birth outcomes: birthweight, and the probability of low birthweight, prematurity, and being born small for gestational age, among children of natives, second generation children – with two immigrant parents – and 2.5 generation children – with one immigrant and one native parent.

Results showed that the immigrant health paradox clearly emerged for all four outcomes after adjusting for traditional demographic and socioeconomic indicators, supporting Hypothesis 1. In line with prior literature on immigrant adult health (Berchet and Jusot 2012; Giuntella 2016; Mendoza 2009; Rubalcava et al. 2008), and more specifically on birth outcomes (Giuntella 2016; Martinson et al. 2017), we found better birth outcomes when immigrants' disadvantaged socio-economic position in the host country was taken into account. We tested whether immigrant educational selectivity could explain these differences, using pre-migration relative education, measured by the parents' percentile rank in the educational distribution of individuals of the same gender and birth cohort in their country of origin. The results supported Hypothesis 2, showing that parents' positive educational selectivity accounts for most of the immigrant health advantage in birth outcomes, particularly

for second generation children. We conducted a mediation analysis to test Hypothesis 3, i.e. whether the intergenerational health benefits of immigrant selectivity were mediated by parental behaviors and health during pregnancy. The results supported this hypothesis, indicating that between 30 and 58% of the effect of educational selectivity was mediated by parental health behaviors and complications during pregnancy, notably mother's smoking during pregnancy.

The literature indicates that immigrants' health advantage deteriorates with time in the host country (Giuntella 2017; Jasso et al. 2004). This has also been found when examining birth outcomes across migrant groups (Giuntella 2016; Martinson et al. 2017). However, to our knowledge, none of the prior studies had tested whether this could be due to a deterioration of the protective effect of immigrant selectivity. We tested this hypothesis by interacting our measure of pre-migration relative education and years of residence in France. We show that educational selectivity has a protective effect on the birth outcomes of children of recent arrivals, with fewer than five years in France; however, this effect declines and becomes non-significant as years of residence in France increase. This phenomenon could be the result of a combination of different mechanisms. First, a process of "unhealthy assimilation" by which immigrants adopt the riskier behaviors and less healthy practices dominant in the host country (Baker et al. 2015; Gordon-Larsen et al. 2003; Mendoza 2009). This mechanism has also been suggested for birth health (Giuntella 2016, 2017). Second, this could be the result of the cumulative disadvantage that immigrants endure over time. Immigrants are often exposed to more health risks, worse living conditions, higher discrimination and limited access to quality health care than natives (Berchet and Jusot 2012; Jusot et al. 2009; Khlat and Guillot 2017). The accumulation of these exposures could offset the protective effect of pre-migration selectivity over time (Chiswick et al. 2008).

This study is not without limitations. First, we acknowledge that significant heterogeneity in health outcomes exists among immigrants from different countries (Boulogne et al. 2012; Riosmena et al. 2017). Unfortunately, the small sample sizes prevented us from conducting multivariate analyses by country of origin. However, we explored heterogeneity by broader regional areas. The general pattern of findings reflects the experiences of children of immigrants from Middle Eastern and North African countries, the largest immigrant group in France, and to a smaller extent of children of European immigrants. The experiences of children of Sub-Saharan African immigrants, the second largest immigrant group in France, is less clear; our results suggest that these children may not benefit from a health advantage, a finding that calls for further research.

Moreover, the ELFE study is limited to children born with at least 33 weeks of gestation, thus, very premature births are not captured. These births have a higher risk of neonatal mortality, but neonatal deaths are not included in our sample as mothers were first interviewed a few days after birth. This exclusion could bias our results in two possible ways: if immigrants have a lower risk of very preterm birth, the exclusion of very premature births might lead to the underestimation of the immigrant health advantage. If immigrants have a higher risk of very preterm births, we might overestimate the immigrant health advantage.

Data limitations also prevented us from examining alternative explanations for the immigrant health advantage, such as the effect of health selectivity, social networks, or ethnic enclaves. Although health selection may play a role, it is likely correlated with educational selectivity (Chiswick et al. 2008; Giuntella 2017; Jasso et al. 2004). A recent study suggests that high levels of social capital and ethnic cohesion, often found in ethnic enclaves, could also have a protective effect in immigrant health outcomes (Riosmena et al. 2017). This mechanism remains to be tested in the French context. Access to affordable and quality healthcare is not evaluated in this study either; this omission may result in an underestimation

of the immigrant health advantage. Finally, while we minimize reverse causality by using explanatory variables before birth, our analytical strategy cannot decisively ascertain causality.

Despite its limitations, the present study brings important contributions to the literature on immigrant health, showing that immigrant parents' pre-migration relative education is a more adequate measure to explain the immigrant health advantage in children's birth outcomes than post-migration measures of socioeconomic status. This study also shows that pre-migration educational selectivity has not only a significant direct effect on children's birth outcomes, but also an important indirect effect, shaping parental health behaviors during pregnancy, in particular through lower rates of maternal smoking. This protective effect, however, erodes over time. These findings have important policy implications, suggesting that measures to reduce immigrants' exposure to health risks, improve their living conditions and access to health care may be effective in preventing the erosion of the protective effect of educational selectivity on children's health.

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Table 1

Weighted descriptive statistics of the analytical ELFE sample.

	Native	2nd Gen	2.5 Gen
Birth outcomes			
Birthweight (in grams)	3325	3398 **	3369 *
Low birth weight	4.1%	3.4%	3.6%
Premature birth	4.3%	3.2%	4.3%
Small for gestational age	11.4%	9.5%	10.3%
Child characteristics			
Female	48.8%	48.4%	45.0%
First birth	44.2%	33.3% ***	41.6%
Parents' characteristics			
Region of origin (n)			
France	11,448		
Europe		55	216
Middle East/North Africa		235	445
Sub-Saharan Africa		207	180
Other		77	185
Mothers' age	30.3	32.0 ***	31.0 **
Parental marital status at birth			
Married	37.2%	69.2% ***	68.0% ***
Civil union	17.1%	0.3% ***	2.9% ***
Cohabiting	43.3%	17.3% ***	23.7% ***
Single parent	2.5%	13.2% ***	5.4% **
Years of education	13.6	10.5 ***	12.4 ***
Relative education, percentile	63.6	72.0 ***	59.3 ***
Parental health behaviors			
Smoked during pregnancy	23.9%	4.5% ***	19.5% **
Drank alcohol during pregnancy	20.3%	7.0% ***	11.4% ***
Pregnancy complications score	0.27	0.29	0.30
Years since migration to France		8.4	7.7
<i>N</i>	11,448	574	1,026

* $p < .05$, ** $p < .01$, *** $p < .001$. Test for differences relative to natives.

Source: Etude Longitudinale Française depuis l'Enfance (Elfe), 2011.

Note: Models account for survey design and control for wave collection.

Table 2

OLS and logistic regressions coefficients predicting birth outcomes by migration status

	M1	M2a	M2b	M3
Birth weight (OLS)	Child controls	Dem + SES	Relative educ.	P. Behv + Compl.
Migration status				
Natives (ref.)				
2nd Generation	61.2 *	98.6 ***	48.2 †	31.7
2.5 Generation	35.8 †	44.3 *	32.8	32.0
Parental education				
Years of education		13.307 ***		
Relative education (decile) ^a			12.355 ***	5.178 *
<i>N</i>	13048	13048	13048	13048
<i>R</i> ²	0.035	0.046	0.043	0.088
Low birth weight (logistic)	M1	M2a	M2b	M3
Migration status				
Natives (ref.)				
2nd Generation	-0.158	-0.659 *	-0.129	-0.004
2.5 Generation	-0.123	-0.276	-0.23	-0.221
Parental education				
Years of education		-0.111 ***		
Relative education (decile) ^a			-0.145 ***	-0.101 ***
<i>N</i>	13048	13048	13048	13048
Log likelihood	-101316	-99166	-99320	-89427
Premature birth (logistic)	M1	M2a	M2b	M3
Migration status				
Natives (ref.)				
2nd Generation	-0.315	-0.602 *	-0.37	-0.395
2.5 Generation	-0.003	-0.103	-0.066	-0.088
Parental education				
Years of education		-0.053 **		
Relative education (decile) ^a			-0.058 *	-0.038
<i>N</i>	13117	13117	13117	13117
Log likelihood	-107200	-106423	-106508	-97198
Small for gestational age (log.)	M1	M2a	M2b	M3
Migration status				
Natives (ref.)				
2nd Generation	-0.144	-0.432 *	-0.087	0.053
2.5 Generation	-0.078	-0.149	-0.097	-0.072
Parental education				
Years of education		-0.078 ***		
Relative education (decile) ^a			-0.086 ***	-0.053 **
<i>N</i>	12998	12998	12998	12998
Log likelihood	-206752	-204228	-204714	-199754

†*p* < .10, **p* < .05, ***p* < .01, ****p* < .001.

Note : M1 controls for child's sex and first born. M2a adds mother's age at birth, parental marital status, and years of education. M2b replaces years of education in M2a with relative education. M3 adds to M2b parental behaviors (smoking and drinking) and complications during pregnancy. All models account for survey design and wave season. See full table in ^aPercent of individuals from the same country, gender, and birth cohort with the same or lower level of education.

Source: Etude Longitudinale Française depuis l'Enfance (Elfe), 2011.

Table 3

KHB Mediation analysis: Total, direct, and indirect effects of educational selectivity on children's birth outcomes

Birth outcome	Total	Direct	Indirect	% Mediated*
Birth weight	12.4	5.2	7.2	58.1%
Prob. of low birth weight	-0.52%	-0.36%	-0.16%	30.1%
Prob. of premature birth	-0.22%	-0.14%	-0.08%	36.2%
Prob. of sga	-0.80%	-0.50%	-0.29%	36.9%

* Percent mediated by parental smoking and drinking behaviors and complications during pregnancy.

Note : An 10% (1 decile) increase in parents' relative education is associated with an increase of 12.4 grams in birth weight (total effect). 58.1% of this effect (i.e. 7.2 grams) is mediated by parental smoking, drinking and complications during pregnancy (indirect effect), while the rest corresponds to the direct effect of parents' relative education on birth weight that is not mediated by these variables. For the three dichotomous dependent variables (low birth weight, premature birth and small for gestational age), the effects are expressed in probabilities (as average partial effects).

Table 4

OLS and logistic regressions predicting birth outcomes assessing the interaction between educational selectivity and length of residence in France (coefficients).

Birth weight	M1	M2	M3
Relative education percentile	3.862	3.195	20.776 **
Years since migration (YSM)		-2.249	10.833 *
Relative education × YSM			-2.054 **
<i>N</i>	1489	1489	1489
<i>R</i> ²	0.05	0.051	0.059
Low birth weight	M1	M2	M3
Relative education percentile	-0.128 *	-0.125 *	-0.31 ***
Years since migration (YSM)		0.013	-0.123 **
Relative education × YSM			0.022 ***
<i>N</i>	1454	1454	1454
Log likelihood	-15942	-15928	-15376
Premature birth	M1	M2	M3
Relative education percentile	0.01	0.009	-0.03
Years since migration (YSM)		-0.005	-0.036
Relative education × YSM			0.005
<i>N</i>	1492	1492	1492
Log likelihood	-17695	-17693	-17674
Small for gestational age	M1	M2	M3
Relative education percentile	-0.068 *	-0.064 †	-0.142 **
Years since migration (YSM)		0.017	-0.038
Relative education × YSM			0.009 *
<i>N</i>	1482	1482	1482
Log likelihood	-32588	-32533	-32314

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Note : Sample restricted to children with at least one immigrant parent. All models account for basic child controls, mother's age, survey design, and wave season.

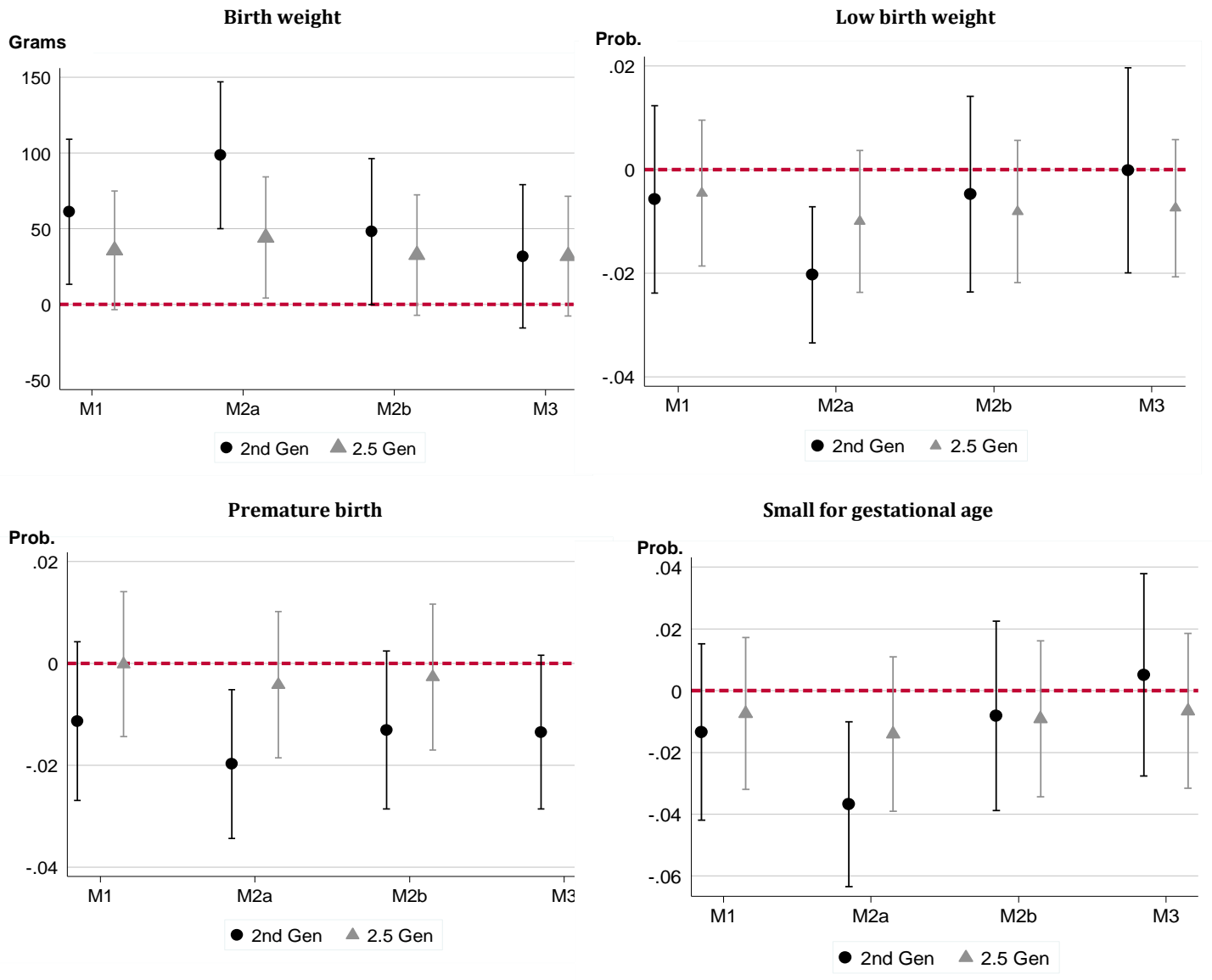


Fig. 1. Changes in the marginal effect of parental immigrant generation on children's birth outcomes across models

M1 controls for child's sex and first born. M2a adds mother's age at birth, parental marital status, and years of education. M2b replaces years of education in M2a with relative education. M3 adds to M2b parental behaviors (smoking and drinking) and complications during pregnancy. All models account for survey design and wave season.

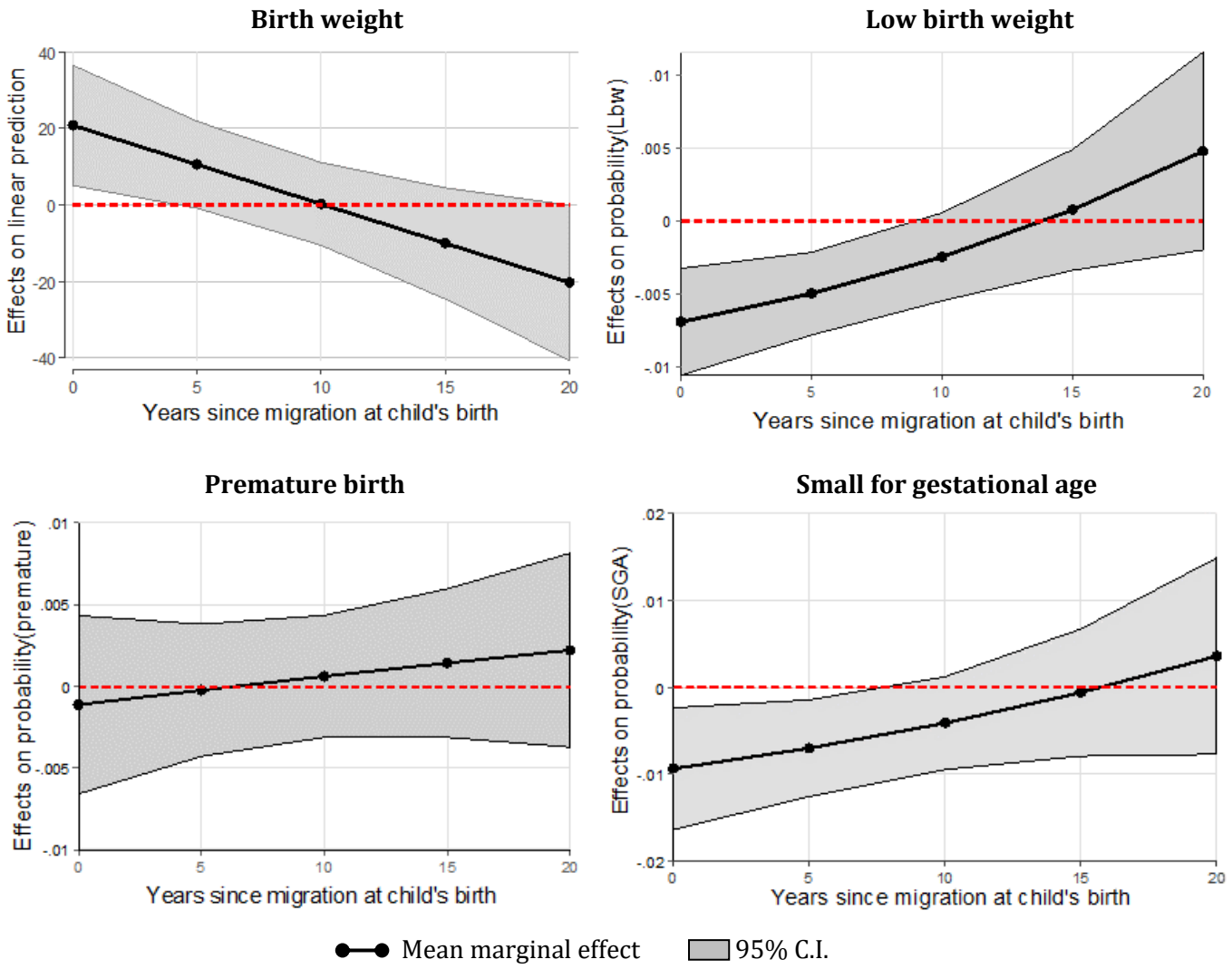


Fig. 2. Effects of immigrant educational selectivity on children's birth outcomes by parents' length of residence in France