# Socioeconomic consequences of the fertility transition: sibling exposure and intergenerational social mobility in Stockholm 1878 – 1926.

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ABSTRACT

Using a longitudinal register for Stockholm during its fertility transition, this paper examines how sibling exposure was associated with child quality via social mobility over time and across socioeconomic groups. This is a greatly under-researched topic for this period, which is surprising considering the prominent role of intergenerational transfers in several theories of fertility decline (e.g. Becker and Lewis 1973; Caldwell 1976). This study has found that there was virtually no mobility penalty for children born into larger families during the earliest phases of the fertility decline. It was only for children born in last decade of the nineteenth century that the relationship emerged, and only for individuals with more than two surviving siblings. Furthermore, children from lower socioeconomic classes suffered a greater mobility penalty than those from higher classes. This study suggests that this relationship emerged as the demand for education increased due to the Stockholm's continued economic growth.

## Introduction

The interaction of child quality and quantity has a prominent role in both historical and contemporary fertility research. As described by Becker & Lewis (1973) and Becker & Tomes (1976), this mechanism suggests that decreases in a family's number of children should increase parental investment per child, thus raising child quality. As such, it provides a way to understand both individual fertility decisions and children's later-life outcomes. The negative association between family size and children's outcomes has been repeatedly shown in a wide variety of contexts in modern times. Children from larger families have been shown to receive smaller human capital investments (Cáceres-Delpiano, 2006; Downey, 1995; Hongbin, Junsen, & Yi, 2008; Rosenzweig & Wolpin, 1980), have worse educational outcomes (Ponczek & Souza, 2012) , and receive diminished financial transfers from their parents (Emery, 2013), though the strength of some of these relationships has been questioned (Angrist, Lavy, & Schlosser, 2010; Ferrari & Zuanna, 2010; Fitzsimons & Malde, 2014).

Despite widespread academic interest in the topic, few studies have taken a historical perspective to identify its existence in the past (e.g., Bras, Kok, & Mandemakers, 2010; Hatton & Martin, 2010; van Bavel, 2006; van Bavel, Moreels, van de Putte, & Matthijs, 2011). In particular, the interaction of family size and child outcomes during the fertility transition has received surprisingly little attention considering the contentiousness of the debate regarding the transition's causes (see Guinnane, 2011). This paper will contribute to the limited research on the subject by utilizing a longitudinal register from Stockholm, Sweden during its fertility transition. Specifically, it will examine the association of the intensity of sibling exposure and one's probability of intergenerational social mobility.

The study contributes to the existing historical literature in several ways. First, it considers a large, industrializing capital city during its fertility transition using longitudinal micro-data with detailed occupational information. Despite the dataset's impressive scope and depth, it has rarely been used for demographic research (see Molitoris & Dribe 2015a; Molitoris & Dribe 2015b). Because it has been widely accepted that the historical fertility declines of Europe and its offshoots largely began within urban areas (Dribe, 2009; Haines, 1989; Livi-Bacci, 1986; Mosk, 1980; Sharlin, 1986), examining the evolution of the relationship between child quantity and quality in Stockholm may provide us with a glimpse into factors contributing to the city's forerunner status. Such detailed population information can also yield important findings for modern populations experiencing rapidly changing family size and can inform policy makers on the potential unanticipated effects of fertility decline.

Second, the paper approaches sibship size in a unique way. In addition to defining exposure as the number of siblings surviving by age 15, I further restrict the definition by treating sibling exposure as a continuous measure of shared-person years. This measure has several advantages over the traditional standards. First, it addresses the fact that siblings will dilute the resource pool to differing degrees based on the amount of time they share together during childhood, which may vary based on child survivorship, birth spacing, and the timing of siblings leaving the home. Second, it allows for the contribution of exposure from siblings who are born and die before recording the net siblings at a given age. This point is highly relevant in populations where child mortality is high, as siblings may dilute family resources for several years before dying, but would fail to be represented in a measure of net sibship. Third, because this measure was calculated for the same time span of all individuals at risk (i.e. from birth until age 15), it represents a measure of the intensity of sibling exposure during childhood.

Using these two measures of sibling exposure, I estimate multinomial logistic regression models to identify whether there was an association between sibling exposure and one's probability of upward and downward mobility relative to one's father's class. Regardless of how sibling exposure is defined the results indicate that greater exposure reduced one's probability of upward mobility and shared no statistically significant relationship with downward mobility. This association appears to have been present in all socioeconomic groups, but its strength was inversely related to one's origin class. Furthermore, sibling exposure appeared to have had no significant association with intergenerational social mobility for cohorts born during the early phases of the fertility transition, a finding that has important implications for research on the causes of the fertility transition.

## Historical Background

The period under consideration for this study (1878 – 1926) was one of extensive economic and demographic change in Stockholm. During much of the nineteenth century Stockholm's economy was in a state of stagnation, and it appeared that the industrialization process would stall early on. In the first decade of the century the proportion of workers employed in manufacturing declined by about 25% and some industries, like the silk industry, almost completely vanished from the city (Söderberg, 1987). The city's disappointing economic growth persisted until around the middle of the century when real wages began to increase almost continuously (Christer Lundh, Schön, & Svensson, 2004). It was only at the start of this study's period of observation when the purchasing power of workers in Stockholm began to outpace the national average. The growth of wages continued throughout the period, and by 1926 unskilled industrial workers' real wages had increased more than threefold.

The city had secured its place not only as a leader of Swedish industry, but also of trade and administration already by the 1880s. According to official statistics, 16% of workers were employed in the public sector in 1900 while just over half of all individuals worked in the manufacturing sector and about a third were involved with trade. As the country's capital, public employment naturally made up a larger share of the occupational structure than in other industrial cities in Sweden. This, combined with a substantial private administrative workforce involved in trade and commerce, resulted in a fairly large segment of the labor force working in white collar jobs and, in turn, bolstered the general demand for human capital, which could be supplied by the city's relatively progressive educational system and large number of rural-urban migrants.

During this period Swedish education was still in its infancy in much of the country. Despite significant school reforms in 1842 that made primary schooling compulsory, school attendance varied in scope and in duration in many places until well into the twentieth century (Statistics Sweden, 1974). The reform required the availability of teachers in all school districts in the country, but in many cases this was merely satisfied through ambulatory schools. In sparsely populated areas, for instance, teachers would travel between several municipalities to provide lessons, which was partially responsible for many rural children only attending school on a part-time basis. Furthermore, the duration of compulsory schooling was inconsistent throughout the country until the *Riksdag* passed a mandatory seven-year curriculum in 1936 that was to be in full force by 1948 following a twelve-year transition period. Stockholm was ahead of its time in this sense as most children had already been attending primary school for seven years by the late nineteenth century and on a full-time basis. Tuition was free for all students at this time but parents were responsible for purchasing any school supplies and clothing for their children. It was possible for parents to receive financial support from the government even for these basic goods, but only when parents were physically or mentally incapable of working (Holmlund, 2013). Already in 1882 school attendance was high in the city. Among school-age children (age 7 – 14) about 90% were enrolled in full-time education and attendance fluctuated around this figure until the late 1890s (see figure 1). After that point, the percentage of children enrolled in primary school began to rise dramatically and by the First World War was approaching complete enrollment of the school-age population. Despite Sweden's neutrality in the war, neither the country nor the city was immune to its effects. Between 1915 and 1919 inflation increased tremendously in Stockholm, leading to a nearly fourfold increase in consumer prices, and this had a devastating impact on children's education presumably due, at least partially, to increases in child labor to offset rising prices. By the end of the war, school attendance had plummeted to around 90%, the same level as nearly four decades prior. As prices fell and real wages arrived at their pre-war trajectory in the early 1920s, school attendance rebounded and once again approached 100% enrollment.

Figure 1 here

The economic and educational changes in the city were also coupled with a transforming demographic regime. The attractiveness of city life and high wages led to heavy flows of migrants from the countryside and induced rapid population growth. Between 1880 and 1930, the city's population grew from about 176,000 to over half a million. At the same time and in spite of severe urban crowding, mortality began its descent. Life expectancy at birth for men increased from 26 years in 1871-1880 to 57 years in 1921-1930 and the rise was almost entirely due to dramatic improvements in child survival. In the

1870s, the probability of dying before age five ($_5q_0$) hovered around 0.4 in Stockholm compared to about 0.2 in Sweden as a whole. Childhood mortality improved rapidly throughout the coming decades and eventually would be on par with Swedish levels by the 1920s when $_5q_0$ was about 0.08. But despite improvements in survivorship, there was tremendous variation across socioeconomic groups. At the start of observation the children of the unskilled working classes were two to three times as likely to die in the first years of life compared to those of the upper classes (Burström et al., 2005; Molitoris & Dribe 2015b). Although infant and child mortality declined for all socioeconomic groups throughout the demographic transition, the relative differences between them hardly changed.

As migrants continued to flood the city and mortality started to decline, fertility also began to decrease. Stockholm's fertility transition began in earnest during the early 1880s. Total marital fertility from age 20 to 49 (TMFR20) was near eight births per woman in 1878 and fell to just over three births per woman by 1925. This was largely a result of increased 'stopping' behavior at lower parities. For cohorts born between 1858 and 1886, for example, the mean age at last birth declined from almost 35 years old to 30 years old and the largest decreases in parity progression ratios occurred for the transition from two to three children and three to four children. The decline of fertility in Stockholm took on a particularly clear socioeconomic pattern in which upper class women had lower levels of fertility already from the outset of the transition and also were the first to begin limiting their fertility compared to the working classes (see figure 2) (see Molitoris & Dribe, 2015b). It was only thereafter that the working classes would lower their fertility and begin to converge with the elite groups. These trends are consistent with the socioeconomic patterns of infant and child mortality, which also varied inversely with class. As the transition proceeded, the cross-sectional variation of both fertility and child mortality between classes diminished considerably.

Figure 2 here

The economic and demographic changes of the late-nineteenth and early-twentieth centuries certainly had momentous influence on living standards, but the connections between them are less clear. One of the connections critical to understanding the fertility decline is whether or not small families were economically beneficial for children, especially during a time in which wages and educational opportunities were increasing for all. This paper attempts to shed light on the relationship between parents' fertility and children's later-life economic performance by analyzing how individuals' socioeconomic mobility relative to their fathers was associated with sibling exposure during a period when fertility varied widely in the cross-section and over time.

## Theory and Previous Research

Becker and Lewis (1973) formulated a theoretical mechanism to explain how changes in the economy, specifically prices or income, should impact couples' demand for children. Fundamentally, they view couples as agents who strive to maximize a utility function by combining a mixture of child quantity, child quality, and the consumption of all other commodities. In their framework, a familial budget constraint exists, such that:

$$I = n\pi_n + nq\pi + q\pi_q + yp_y$$

where $I$ is full income, $n$ is the number of children, $q$ is the level of child quality, $\pi$ is the price of the interaction of $n$ and $q$, $y$ is the rate of consumption of other commodities, and $p_y$ is the marginal cost of consuming other commodities.

Among the implications of their mechanism is that an increase in the price of child quantity, which could be induced by improvements in contraception, would lead to a reduction in the number of children desired by a couple. Furthermore, this would reduce the price of child quality and would lead to a substitution of child quality for quantity. Likewise, if the price of quality fell due to, say, increases in parental education, this would lead to greater investments in child quality and a reduction in the numbers of children. Galor and Moav (2002) argue that the tradeoff between quantity and quality of children is a fundamental natural relationship between fertility and resources. Galor (2011) expanded on this and argued that the optimal number of children should decline if, among other things, the technological environment changes more rapidly. This is particularly the case if technologies emerge that are skill-biased rather than skill-saving, as they will raise the returns to human capital and push parents towards investing in their children's education (Galor & Weil, 2000). de la Croix and Doepke (2009) show theoretically that parents who choose private versus public schooling for their children will have a lower fertility rate arising from the higher costs of educated associated with satisfiying their demand for higher quality education. While private education only made up a small proportion of all schooling during the period of observation, participation in public non-compulsory higher education may be viewed as analogous to this as it required a greater investment of parental income and other resources. Furthermore, it has been argued that better educated or higher skilled parents should have a comparative advantage in raising educated children as education, and therefore child quality, incurs a “resource cost”, while the basic cost of child quantity is a “time cost” (Moav, 2005; de la Croix & Doepke, 2009). Taken together, there are several theoretical implications from the literature. First, children from larger families should be particularly disadvantaged during times of increasing demand for human capital. Second, higher skilled parents should be more likely to produce higher skilled children. In other words, the relationship between family size and children’s education should be weaker for children with higher skilled parents.

In the last two decades researchers have explored this relationship in detail, using data from a host of modern populations at different phases in their economic development. Employing a variety of control strategies, several studies have identified a tradeoff between family size and children’s educational outcomes (Cáceres-Delpiano, 2006; Hongbin et al., 2008; Maralani, 2008; Ponczek & Souza, 2012; Rosenzweig & Wolpin, 1980). Despite these findings, however, others have found a weak to non-existent relationship between the variables (Angrist et al., 2010; Anh, Knodel, Lam, & Friedman, 1998; Black, Devereux, & Salvanes, 2005; Blake, 1981; Downey, 1995; Ferrari & Zuanna, 2010; Fitzsimons & Malde, 2014). Furthermore, there is evidence that even if there is a relationship between family size and children’s outcomes, it is highly dependent on levels of economic development and local conditions, with the tradeoff being stronger in times and places with worse educational infrastructure and lower demand for human capital (Hongbin et al., 2008; Maralani, 2008; Ponczek & Souza, 2012).

Our knowledge of the relationship between family size and children’s outcomes in the past is even more nebulous than for modern times, being limited to only a handful of studies. Few have examined this relationship during the fertility transition, and even fewer have done so prior to the transition. In a study of

26 English parishes between the sixteenth and eighteenth centuries it was shown that men born into socioeconomic groups with higher fertility tended to be downwardly mobile (Boberg-Fazlic, Sharp, & Weisdorf, 2011). For pre-transitional Prussia it has been shown that counties with higher child-woman ratios tended to have substantially lower primary school enrollment, and that the level of a county's education in 1849 predicts the rate of fertility decline at the end of the nineteenth century (Becker, Cinnirella, & Woessmann, 2010). While these studies suggest that there was already a quality-quantity tradeoff before the fertility transition, the size of the English sample compared to its timespan and the aggregation of the Prussian data at the county level makes it difficult to be entirely convinced by these results.

In recent years, several researchers have examined the relationship between children's outcomes and family size using individual-level data during the fertility decline. Two studies of Belgian cities during their respective fertility transitions indicate an association between family size and socioeconomic mobility, yet with slightly different implications. For the city of Leuven, evidence indicates that children with more siblings tended to have both reduced odds of upward mobility and increased odds of downward mobility and this association did not vary based on an individual's socioeconomic background (van Bavel, 2006). In the larger city of Antwerp, an association was also found, but smaller families were only effective in reducing one's odds of downward mobility but showed no relation to upward mobility (van Bavel et al., 2011). In contrast to Leuven, however, children from higher socioeconomic groups tended to be more greatly impacted by family size than those from working-class families. Research of the Dutch fertility transition has revealed considerable heterogeneity in this relationship, as has also been shown in modern populations (Bras et al., 2010). Depending on local characteristics, such as being from a rural area or originating from an area where tight-knit kin networks proliferate, sibship size could even *increase* one's odds of being upwardly mobile. They also document that there was a fundamental shift over time, in which the negative relationship with sibship size and social status emerged during economic development. Children's exposure to siblings has not only been found to be associated with intergenerational socioeconomic mobility, but also with other indicators such as heights and mortality. A study of British children's heights between 1886 and 1938 found a negative association between height and the number of siblings as well as a positive relationship between household income and height, and these associations strengthened after the turn of the twentieth century (Hatton & Martin, 2010). The negative association between fertility and heights has also been documented during the early years of the French fertility decline (Weir, 1993). During Stockholm's fertility transition it has been shown that children with larger numbers of siblings had significantly elevated risks of succumbing to measles (Burström, Diderichsen, & Smedman, 1999).

This study contributes to the historical body of research by analyzing the association between sibling exposure and intergenerational socioeconomic mobility during Stockholm's fertility transition. The advantage of using this outcome is that occupational information is readily available in many historical datasets and serves as a good proxy for inferring parental investments in their children, as children's later-life occupational outcomes should, on average, be a reasonable reflection of their education and health during childhood. As such, this paper aims to test several hypotheses.

The primary hypothesis is concerned with the evolution of the quality-quantity tradeoff during Stockholm's fertility decline. Specifically, I expect there to have been a weak to non-existent relationship between sibling exposure and socioeconomic mobility earlier in the transition, but that this relationship should strengthen for later-born cohorts. This expectation is based on the historical trends of education in Stockholm during the late-nineteenth and early-twentieth centuries. Elementary school attendance increased substantially in the late 1890s, leading to nearly full enrollment of the school-age population by 1910. Data is less readily available for non-compulsory schooling, though there is evidence that enrollment in secondary schools increased markedly around the first decade of the twentieth century in Sweden, indicating a greater demand for human capital beyond requisite levels (Statistics Sweden 1977). Furthermore, this would be in line with the theoretical expectation that if the returns to human capital are greater parents will invest more heavily in child quality versus child quantity, thus penalizing children from larger families (Galor, 2011). As this demand for children's human capital increased and pressure mounted for parents to finance more years of their children's education, individuals from larger families should show decreased odds of upward mobility and increased odds of downward mobility.

The second, and related, hypothesis is that the strength of this relationship should vary inversely with the socioeconomic status of parents. If per capita investments in education are the mechanism through which differential mobility outcomes materialize, one would expect that educational investments of wealthier parents should be less sensitive to larger family sizes. Children born into the working classes should have a larger mobility penalty as sibling exposure increases compared to the middle class. This difference should stem from differences in not only parental income, but also assets and social capital. Even if wealthier parents with larger families do not invest as heavily in human capital as wealthy parents with smaller families, they should have been able to at least partially offset downward mobility through bequeaths and their social networks. Therefore, working-class children's mobility should be disproportionately negatively associated with sibling exposure, while middle-class children should show no or only a modest negative association between the two.

## Data

The data used for this study come from the Roteman Database, a population register kept for Stockholm, Sweden between 1878 and 1926. The Roteman System was established in order to improve the quality of record keeping for the municipality. As migration increasingly expanded Stockholm's borders and density, traditional record keepers (i.e. parish priests) experienced difficulty in recording all vital events and movements within their respective parishes. This led to the establishment of the Roteman System by the city government on January 1, 1878 (Geschwind & Fogelvik, 2000).

The longitudinal register contains all individuals ever residing in the city during this period. The extraction used for this study is based on all women ever present in the city and any person linked to them (i.e. children, husbands/partners, lodgers, employees). This amounts to 3.7 million observations of about 970,000 unique individuals over the 48 year period. It has detailed information on migration, occupation, fertility and mortality. Each individual's records were updated upon births, deaths and movements within or outside of the city and also annually at the time of census registration, allowing for the observation of individual variation in a host of features over time. The structure of the data is spell-based with information explaining how each spell begins and ends. For instance, it is known if a spell began with a birth and ended with out-migration.

A great advantage of these data is that they offer detailed information on occupations of individuals over time, and this is the basis of this paper. With this information one can test various hypotheses that demand a socioeconomic dimension. Occupations were pre-coded using the Historical International Standard Classification of Occupations (HISCO) (Marco van Leeuwen, Maas, & Miles, 2002). Using the HISCO information, a socioeconomic class variable was created using HISCLASS, which generates a 12-category classification scheme based on required skill level, degree of supervision, manual or non-manual character of work, and whether it is an urban or rural position (van Leeuwen & Maas, 2011). These 12 categories were then aggregated up to five categories plus a category with no stated occupation to avoid problems of small numbers.[1] Nevertheless, the new categorization maintains the spirit of the original classification.

## Sample Selection

The requirements of being included in the final analysis sample were fairly restrictive, and this naturally came at the cost of reducing the sample size. The first criterion for inclusion was being born in Stockholm. This was done to ensure that exposure to siblings could be observed completely from birth. If a mother had any children who were born and died prior to those born in Stockholm, they would contribute nothing to sibling exposure. If this criterion was not included, there would be no way of being sure of the sibling exposure experienced in the first years of life.

Second, the children used in the analysis are male. This decision is one based on interpretability of results rather than data availability. It is possible to follow women over time as well, but most left the

[1] The socioeconomic groups were classified as follows (HISCLASS codes in parentheses): Higher Occupations (1, 2), Lower Managers (3, 4, 5), Skilled Workers (6, 7, 8), Lower Skilled Workers (9, 10), Unskilled Workers (11, 12).

formal labor market upon marriage. Those who could be followed and observed as working would therefore be a highly unrepresentative group. Alternatively, if one were to assign a husband's occupation to women to estimate their socioeconomic status, the mechanisms linking family size and this outcome become less clear. To argue that sibling exposure should be associated with women's marriage partners would require not only that those from smaller families tended to be better educated, but also that they would be successful in marrying a man with higher education as well. This is complicated by the fact that during the period of observation there was very little heterogeneity in terms of education among women as an extremely low number of women attended secondary school at this time. In 1900, for example, only 1% of girls extended their schooling beyond the compulsory seven years compared to 11% of boys (Stockholms Stads Statistiska Kontor, 1905). For these reasons, this study focuses exclusively on male children.

Third, individuals must be followed up until they were *at least* 30 years old. This was chosen to take into account the fact that age is correlated with occupational mobility. It could be argued that observing someone until age 30 does not fully resolve the problem, but this is a compromise between introducing more selection bias and correctly identifying occupational mobility. Restricting the sample even more greatly reduces the number of individuals who can be observed.

Fourth, the children must come from a home with a father present. Without this information, it would be impossible to get any idea of intergenerational mobility, because, as already mentioned, so few women had recorded occupations beyond their mid-20s. Those that did were almost exclusively working in low skilled positions, such as maids and seamstresses. This requirement does not, however, preclude illegitimate children from being included in the analysis. The data indicate whether a child was born out of wedlock and also identifies whether an illegitimate child belonged to the father's household or was born outside of the household. Thus there is no requirement that the parents must have been married.

Fifth, both the father and son must have had non-missing occupational information. Using the aforementioned five-class scheme, each individual was assigned the maximum socioeconomic class that was attained by their father before they were age 15. This forms their childhood class variable. Sons' adult class was defined as the maximum socioeconomic class they achieved at or above age 30. The transition between the two or lack thereof represents the outcome of interest for this study. Table 1 reveals a simple cross-tabulation of father's and son's classes. It becomes quickly apparent that children born into the higher occupations and lower managers groups tended to replicate their father's class more than children born into the lower classes. Furthermore, about a third of those born to the lower managers group experienced downward mobility, though these moves were mostly into the adjacent skilled workers category. On the other hand, children born into the lower skilled and unskilled groups tended to be upwardly mobile despite the fact that these were classes with very high levels of fertility during this time, as could be seen in figure 2.

Table 1 here

The above restrictions amount to a total of over 7,200 males who can be observed between birth and age 30. Of the 42,460 male births observed between 1878 and 1896, this amounts to about 17% of all those born in the city. Of course, not all of the lack of follow-up is due to selective out-migration. Some of it is simply due to mortality. After adjusting for the number of *observed* deaths of these cohorts (i.e. those dying in Stockholm prior to age 30) the percentage of survivors that can be followed increases to about 25%. It is unclear how many of the out-migrants died before age 30, but the percentage of the cohort survivors that can be followed will nevertheless be even higher.

When imposing so many restrictions on the sample, there is obviously a concern about introducing selection bias into the analysis. The primary questions that come to mind are: who are the individuals that remain in the same place for 30 years or more? And how do they differ from those that leave? To address this, a logistic regression was used to estimate predicted probabilities of remaining under observation for the analysis. The dependent variable was whether a male met all of the above criteria for inclusion and the dependent variables were characteristics assigned from birth. The results may be found in table 2. There were no large differences between classes, though the higher occupations and lower managers groups were slightly more likely to be included in the final sample. The class differences in inclusion probabilities appear to have been primarily driven by differential childhood mortality. For the higher occupations group, about 15% of those not included in the sample had died before age 30, whereas for the unskilled groups this figure was 38%.[2] For those individuals surviving until at least age 30, there were no significant differences in the proportion remaining based on class. For all socioeconomic groups about one third of survivors remained in Stockholm while the remainder migrated out of the city.

Table 2 here

## Method

To analyze how sibling exposure was associated with socioeconomic mobility, multinomial logistic regressions are employed. The categorical dependent variable could take on three values representing upward mobility, non-mobility and downward mobility with non-mobility serving as the reference outcome. The main independent variable of interest is the number of living siblings within the household at age 15. This cutoff point was chosen because during this time significant proportions of children left home already by the mid- to late-teens and, presumably, became net producers rather than net consumers within the household thereafter, thus becoming less dependent on parental investments in human capital (see Dribe & Stanfors, 2005; Guinnane, 1992; Pooley & Turnbull, 1997). The model controls for one's birth order, illegitimacy status, cohort, mother's age at birth, age at recording of maximum socioeconomic class and father's maximum achieved socioeconomic class. Additionally, in order to control for changes in employment structure over time, a control variable is included which measures the relative size of one's origin class in the year in which an individual reaches their maximum occupational status. The descriptive statistics may be found in table 3. To account for correlation between brothers, standard errors were clustered at the family level. Because not all sons could be upwardly or downwardly mobile due to their fathers' coming from the highest and lowest socioeconomic groups, the models only consider the sons originating in the middle three groups. In order to test the aforementioned hypotheses, interactions between origin class and sibling exposure, as well as birth cohort and sibling

[2] The corresponding shares of children not observed until age 30 due to mortality for the remaining groups were: 27% for lower managers, 32% for skilled workers, and 32% for lower skilled workers.

exposure are included in an extended version of the model. These models are then used to calculate predicted probabilities to evaluate the strength of the association between the variables.

Table 3 here

In addition to the above models, this study will also seek to refine sibship size to more precisely identify the intensity of sibling exposure. Although one's number of siblings is certainly a discrete variable, the exposure to those siblings is not. For instance, an individual with two siblings at age 15 could, on the one hand, share little of his childhood with them if he had been born to a young mother. On the other extreme, he could have been born as a triplet and share the entirety of his childhood with these siblings. Children's expected endowments are often treated as the quotient of tangible and intangible parental resources divided by an unweighted number of siblings. But the above example shows that this may be misleading and that there is a need to somehow adjust for both the age distribution of siblings as well as child mortality. In a low mortality population with fairly constant birth intervals, it may well be sufficient to simply weight each sibling's exposure by their age to account for disproportionate exposure to siblings (see Öberg, 2015), though this still may underestimate exposure depending on, for example, the normative age of leaving the household.

Figure 3 demonstrates how this measure better approximates exposure. First, we may consider a child who, upon reaching a given age *x*, was recorded as having zero siblings. In family A, the child truly had no other siblings born before that age. In family B, however, the child had a sibling who was born and died prior to the recording of sibship size. Clearly, simply summing the number of siblings at a given age underestimates the true exposure this individual experienced. By the same token, if we were to instead define sibling exposure as the gross number of siblings born, we would be overestimating the exposure contributed by that sibling. The same could be said for issues of birth spacing. In family C, two siblings are born as twins and therefore contribute full exposure throughout childhood. These individuals would be recorded as having one sibling at age *x*. But family D shows two children who were spaced very far apart. The standard discrete measure would still assign one sibling to child 1, despite the fact that he was only marginally exposed during childhood. And, assuming family D has no more children, child 2 would be recorded as having zero siblings at age *x*, despite the fact that they were partially exposed to their older sibling during infancy. Using person-years as a measure of sibling exposure ensures all of this information is not discarded.

Figure 3 here

With these considerations in mind and to complement the standard discrete measure, I have defined a sibling exposure as a continuous measure, the number of person-years an individual shared with his siblings until age 15. This definition accounts for differential exposure contributed by siblings due to child mortality as well as birth spacing, two fundamental demographic aspects that were changing drastically during the period, and therefore better captures the amount of exposure contributing to the dilution of parental resources.

## Results

During this period, intergenerational mobility appears to have been shifting towards greater upward mobility and less downward mobility, though the percentage of individuals replicating their fathers' class appears to have remained virtually unchanged (table 4). For the earliest born cohort (1878 – 1883), non-mobility was the most common outcome, followed closely by upward mobility. For the cohort born between 1891-1896 upward mobility had become increasingly common and downward mobility much less so. In this way Stockholm differs from previous research on rural Sweden, which showed that downward mobility was becoming the norm as the nineteenth century progressed (Dribe & Svensson, 2008; Lundh, 1999). This is unsurprising as improvements in agricultural and industrial technology likely increased the demand for human capital in cities while simultaneously allowing for a concentration of land and physical capital among wealthy rural landholders; this may have been due to increases in the price of land following the relinquishment of royal properties to the market (Dribe & Svensson, 2008).

Table 5 reveals that total intergenerational mobility was fairly constant across cohorts for individuals born into any class other than the higher occupations group. For that group, total mobility fell drastically, revealing a trend in which fathers became more successful at transferring their own status to their sons over time. In the latest-born cohort, nearly 60% of their sons retained their origin class, while among the lower classes only slightly more than 20% would replicate the status of their father. The stagnation of total mobility reported in tables 4 and 5 reflect similar findings for Sundsvall, an industrial city in northern Sweden. There it has been reported that total intergenerational mobility increased during industrialization until about the end of the nineteenth century, when the trend stalled (Maas & Van Leeuwen, 2002).

Tables 4 and 5 here

When comparing levels of sibling exposure across types of mobility, it becomes clear that mean sibling exposure tended to be lower for upwardly mobile sons (table 6). Whether measured continuously or discretely this finding remains consistent. Furthermore, differences in mean exposure appear to have grown for later-born cohorts, while there was less variation in exposure between outcomes for the earlier-born cohorts. To explore this relationship in more detail multinomial logistic regression models are used. The results of the models (table 7) indicate a statistically significant negative association between sibling exposure and upward socioeconomic mobility holding all other variables constant. Regardless of whether exposure is defined as a discrete or continuous measure, the association holds and is significant at the 1% level. When using the discrete measure, exposure was also associated with a decrease in the relative risk of downward socioeconomic mobility and this was significant at the 10% level. Using the more precise measure of shared person-years, however, did not reproduce this result.

Table 6 here

An interaction term of one's origin class and its relative size when an individual reached his maximum class was included. This allows for interpreting the base effect of origin class as its effect when the size of all other classes is equal. The base effects tell that there was a substantial difference in the probability of upwardly mobile that was purely due to the socioeconomic stratum in which an individual was born. The results indicate that children originating in the lower skilled group had substantially higher odds of being upwardly mobile and lower odds of being downwardly mobile when compared to the children of lower managers. These coefficients were both statistically significant at the 5% level. The odds of mobility in any direction for children of the skilled were not statistically different from the reference group.

Table 7 here

There was also a strong negative effect of birth cohort on upward mobility. Because the data coverage ends in 1926, it is possible that this association is purely being driven by the fact that older cohorts can be observed longer and that individuals typically reach their maximum occupation later than their early thirties. To test this, I restricted the sample to only individuals who reached their maximum class at or prior to age 30, which makes up about two-thirds of the sample (not shown). The results remained robust to this specification.

In order to test how the association between sibling exposure evolved over time and across groups, a further model was run which included two interaction terms between exposure and origin class as well as between exposure and birth cohort. As in the previous model, no statistically significant association between downward mobility and sibling exposure could be detected. This result held both over time and across socioeconomic origins. From these models, predicted the probabilities of upward mobility were generated at increasing levels of sibling exposure. Figure 4 depicts contrasts in predicted probabilities of upward mobility for both exposure variables. In both cases, a clear trend emerges in which children born earlier in the transition faced little to no upward mobility penalty with regard to sibling exposure. Regardless of whether one came from a small or large family, one's probability of upward mobility was primarily due to other factors, such as one's origin class. One's origin class was important for all birth cohorts in determining odds of mobility, but it was not until the cohorts born at the end of the nineteenth century that heterogeneity associated with sibling exposure emerged. For those cohorts, children with more than two surviving siblings showed lower probabilities of upward mobility, while the probabilities of those with two or fewer were not statistically different from previous cohorts. This finding is particularly interesting because it suggests the emergence of a tradeoff between child quantity and quality and indicates that this relationship may not have been a constant mechanism affecting parents' fertility choices in the past, as argued by Galor and Moav (2002). Furthermore, that this association only became relevant for families with more than three children suggests that a fundamental shift in optimal family sizes may have occurred and helped to spur on the decline of fertility in Stockholm. It seems plausible that this association arose as the demand for education increased and parents were confronted with a conflict between educating many children poorly or a few children well.

Figure 4 here

The interaction of socioeconomic status and sibling exposure across cohorts supports this interpretation. If larger families made it more difficult for parents to finance their children's education thereby diminishing their odds of upward mobility, we would expect that children originating from wealthier socioeconomic groups would be less impacted by greater sibling exposure. Figure 5 shows how the probabilities of upward mobility for children originating from each class differed across cohorts at different levels of exposure. All classes exhibited similar patterns in terms of the shift across cohorts, with the latest born cohort being most sensitive to sibling exposure and the previous cohorts showing no association whatsoever. Yet the change in this association was most pronounced for individuals originating in poorer classes. Children born into the lower skilled workers group had a decrease in the probability of upward mobility that was about twice as large as children born into the lower managers group. This finding offers some support to the hypothesis that wealthier families should have been able to at least dampen the effects of resource dilution through other means, such as through intergenerational asset transfers or class-specific social capital.

Figure 5 here

## Conclusion

Using a longitudinal register for Stockholm during its fertility transition, this paper has examined how sibling exposure was associated with intergenerational social mobility across cohorts and socioeconomic groups to better understand the relationship between family size and parental investments in their children. This is a greatly under-researched topic for this period, which is surprising considering the prominent role of intergenerational transfers in several theories of fertility decline (see Becker &

Lewis, 1973; Caldwell, 1976; Easterlin 1975). This study has found that there was virtually no mobility penalty for children born into larger families during the early phases of the fertility decline. It was only for children born in last decade of the nineteenth century that relationship emerged, and only for families with more than three surviving children. These findings have several important implications for studying the fertility transition.

First, this study has shown that child quantity was not associated with children's mobility outcomes later in life for those born at the start or just prior to the fertility transition. The association between the two only emerged for those born about a decade after period rates began to decline. For each cohort under analysis, the decline of period fertility had accelerated, with the final cohort (1891-1896) being born in a period with the largest decreases in period fertility up to that point. While the decline had begun in earnest around 1885, it was only children born during the periods with the most rapid fertility decline that displayed a mobility penalty for being born into larger families. This pattern suggests a possible explanatory role for a gradual shift towards child quality away from quantity in the fertility transition. Those born between 1884 and 1890 showed no association between sibling exposure and mobility outcomes, despite the fact that fertility had begun to decline during those years. Yet it may be that child quality had been improving in more fundamental ways that were not measured here and may not be as closely related with socioeconomic mobility, such as via improvements in survival probabilities and general health. A promising avenue of future research would be to test if this indeed was the case. A scenario that seems most plausible, however, is that by the end of the nineteenth century, as both primary and secondary education became increasingly important, parents with fewer children were able to finance their children's human capital attainment better than those with more children, and this in turn led to a negative association between family size and upward mobility. As current and future parents took notice of this pattern, they may have become more likely to take steps towards regulating fertility, thereby reinforcing and accelerating the fertility decline.

A second and related implication of this study is that there is some evidence of a shift towards a new range of optimal family sizes during the fertility transition. While the latest born cohort was the only one to reveal a mobility penalty associated with family size, it was only for children with three or more siblings. There was no statistical difference in one's probability of upward mobility between birth cohorts for those born in smaller families. This implies that there was a substantial change in parent's abilities to invest in children's economically relevant human capital during the early stages of fertility decline. Because individual social mobility was becoming more dependent on education beyond requisite levels, it became unfeasible to have many children and ensure that human capital investments would be large enough to give them a better lot in life. This led to a downward shift in the optimal family size and also in the variance of family size over time.

The results presented here confirm some of the details that have been presented in previous research on the topic and contribute to illuminating the murky picture of this relationship during the fertility transition. As was found in Belgium (van Bavel, 2006; van Bavel et al., 2011), a negative association between social mobility and sibship size has been identified during the fertility decline. This study has also found that the association strengthened over time, as was reported for the Netherlands (Bras et al., 2010) and England (Hatton & Martin, 2010). This paper has contributed to this body of literature by using longitudinal data for a European capital city to follow individuals over time and to more precisely specify sibling exposure during childhood. Furthermore, it has been able to show that a socioeconomic gradient existed in which wealthier families were better able to insulate their children from the negative effects of greater sibling exposure than poorer families. Viewing these results in light of previous research paints the following picture.

Prior to the fertility transition, it appears that there was a weaker penalty to child quality associated with larger family sizes. For the most part, this penalty probably became manifest primarily in the form of health, but not in human capital attainment. It was only as the fertility transition gained steam that children born into larger families began to pay a larger price in the form of worse occupational outcomes. This likely was a result of the greater demands for human capital beyond compulsory levels that emerged during later phases of industrial development. Because wealthier families could subsidize their children's education through assets, access to capital markets, and personal income, their children were less susceptible, though not immune, to the negative effects of family size on their occupational outcomes. Children from poorer families, on the other hand, paid a larger price for their parents' fertility. This may be why working-class families in Stockholm decreased their fertility so dramatically following the turn of the twentieth century to a point in which they had the lowest fertility rates of all socioeconomic groups by 1926.

These findings provide important details for a largely unexplored aspect of the fertility transition, yet the study is not without its shortcomings. The most substantive weakness lies in the study's inability to prove a causal connection between intergenerational mobility and sibling exposure. This would require an exogenous increase in sibling size, which is difficult to come by. Modern economic literature has widely employed multiple births or sibling sex composition in order to instrument exogenous increases in family size, but these are not easily implemented in this study. First, there are simply too few multiple birth events for those individuals that meet all of the inclusion criteria. Second, there is no clear indication that there was a culturally embedded demand for children's sex composition within families. As a result, these commonly employed strategies are not realistic in the context of this study.

A second shortcoming stems from the dependent variable of interest. Studying any outcome presumed to be associated with child quality is difficult. The causal chain from sibship size to educational outcomes and health to intergenerational social mobility becomes less well-defined as we progress further from the origin. While there are clearly theoretical reasons to expect an influence of sibling exposure on occupational attainment, there are many intervening factors that occur along the way, which may be largely unrelated to sibling exposure and may not be randomly distributed across individuals. This outcome also makes it difficult to assess the impact of sibling exposure on women's outcomes, thereby omitting half of the story. This study is conscious of this and has been careful in emphasizing that the findings represent an association between the two variables.

Finally, the issue of selection is one that is difficult to assess. At least 25% of the births born between 1878 and 1895 were followed until age 30 or later. How these individuals differ from those that migrated out of the city is not always clear. The selection model shown in table 2 revealed that individuals who remained in the city for this amount of time were more likely to be from the upper classes, illegitimately born, had a mother born in Stockholm, and were born in certain parts of the city, but the difference in probabilities was usually not very large between any categories after taking mortality into account. There were certainly many unobservable reasons for which a certain proportion remained in the city, but any explanation for this would be merely speculative. Despite these limitations, this study's findings contribute to a growing historical literature that finds little impact on children's outcomes stemming from family size early in the fertility transition and only emerging later on.

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# APPENDIX

**Table 1.**
Comparison of fathers' and sons' social class.

| Father's Class | Son's Class: Higher Occupations | Lower Managers | Skilled | Lower Skilled | Unskilled | Number of Fathers |
|---|---|---|---|---|---|---|
| Higher Occupations | 55.7 | 21.4 | 19.5 | 2.5 | 1.0 | 406 |
| Lower Managers | 18.9 | 48.0 | 18.5 | 7.4 | 7.2 | 1734 |
| Skilled | 8.0 | 29.0 | 35.7 | 14.5 | 12.9 | 2193 |
| Low Skilled | 4.5 | 26.6 | 31.1 | 22.9 | 14.9 | 1593 |
| Unskilled | 2.3 | 26.4 | 29.3 | 20.2 | 21.8 | 1323 |
| Number of Sons | 830 | 2329 | 2067 | 1087 | 936 | |

*Note:* All rows sum to 100%. Shaded boxes in the diagonal indicate the percentage of sons who replicated their father's class. Figures refer to all males observed from birth until at least age 30 in Stockholm.

*Source*: See Data and Sample Selection sections.

**Table 2.**
Predicted probabilities of being included in analysis sample by characteristics at birth.

| Variable | Predicted Probability | Variable | Predicted Probability |
|---|---|---|---|
| Mother's Age at Birth: | | Father's Socioeconomic Group: | |
| 15 to 19 | 0.275 | Higher Occupations | 0.293 |
| 20 to 24 | 0.261 | Lower Managers | 0.295 |
| 25 to 29 | 0.256 | Skilled | 0.250 |
| 30 to 34 | 0.256 | Lower Skilled | 0.253 |
| 35 to 39 | 0.258 | Unskilled | 0.229 |
| 40 to 44 | 0.261 | Legitimacy: | |
| 45 to 49 | 0.269 | Born within Wedlock | 0.253 |
| Birth District: | | Born outside Wedlock | 0.347 |
| Gamla Stan | 0.296 | Birth order: | |
| Norrmalm | 0.251 | 1 | 0.266 |
| Kungsholmen | 0.233 | 2 | 0.259 |
| Östermalm | 0.234 | 3 | 0.257 |
| Södermalm-East | 0.271 | 4 | 0.255 |
| Södermalm-West | 0.283 | 5 | 0.254 |
| Mother's Birth Place: | | 6 | 0.251 |
| Stockholm City | 0.261 | 7 | 0.248 |
| Stockholm County | 0.085 | 8 | 0.246 |
| Other Sweden | 0.075 | 9 | 0.246 |
| Outside Sweden | 0.119 | 10+ | 0.246 |
| Undefined | 0.220 | | |

*Note*: The above predicted probabilities were taken from a logistic regression, where the dependent variable was equal to one if a male could be observed from birth until age 30. Neither females nor individuals with missing socioeconomic information were included in this model.
*Source*: See Data and Sample Selection sections.

**Table 3.**
Descriptive statistics of analysis sample.

| | N | % | Min | Max | Mean | SD |
|---|---|---|---|---|---|---|
| Mobility | | | | | | |
| Upward | 2120 | 38.66 | | | | |
| None | 1965 | 35.84 | | | | |
| Downward | 1398 | 25.50 | | | | |
| Cohort | | | | | | |
| 1878-1883 | 1693 | 30.88 | | | | |
| 1884-1890 | 2450 | 44.68 | | | | |
| 1891-1896 | 1340 | 24.44 | | | | |
| Born out of Wedlock | 351 | 6.40 | | | | |
| Father's Class | | | | | | |
| Lower Managers | 1725 | 31.46 | | | | |
| Skilled | 2177 | 39.70 | | | | |
| Lower Skilled | 1581 | 28.83 | | | | |
| Net Siblings at age 15 | 5483 | | 0 | 13 | 3.12 | 2.19 |
| Shared Person-Years | 5483 | | 0 | 136.65 | 30.76 | 20.54 |
| Birth Order | 5483 | | 1 | 13 | 3.18 | 2.15 |
| Mother's Age at Birth | 5483 | | 17 | 49 | 30.44 | 5.87 |
| Year of Status Attainment | 5483 | | 1896 | 1926 | 1915.51 | 6.51 |
| Proportion of Father's Class in Year of Status Attainment | 5483 | | 17.32 | 30.22 | 23.95 | 4.30 |

*Source:* See Data section.

**Table 4.**
Distribution of intergenerational social mobility by birth cohort.

| | Distribution of Mobility | | |
|---|---|---|---|
| | Upward | None | Downward |
| 1878-1883 | 35.4 | 36.7 | 27.9 |
| 1884-1890 | 39.6 | 35.6 | 24.9 |
| 1891-1896 | 41.9 | 34.8 | 23.3 |

*Source:* See Data section.

**Table 5.**
Total mobility across origin class by birth cohort.

| | Higher Occupations | Lower Managers | Skilled | Low Skilled | Unskilled |
|---|---|---|---|---|---|
| 1878-1883 | 51.7 | 52.5 | 65.6 | 74.9 | 78.4 |
| 1884-1890 | 39.4 | 52.9 | 63.2 | 78.5 | 77.4 |
| 1891-1896 | 41.1 | 48.8 | 64.6 | 77.2 | 79.2 |

*Note*: Figures refer to the percentage of individuals being either upwardly or downwardly mobile relative to their father's class within each birth cohort.

*Source:* See Data section.

**Table 6.**
Mean sibling exposure for outcomes of intergenerational mobility by birth cohort.

| | Mean Surviving Siblings at age 15 | | | Mean Shared Person-Years until age 15 | | |
|---|---|---|---|---|---|---|
| | Upward | None | Downward | Upward | None | Downward |
| 1878-1883 | 4.3 | 4.3 | 4.4 | 29.5 | 31.1 | 30.9 |
| 1884-1890 | 4.3 | 4.6 | 4.6 | 30.1 | 32.2 | 31.5 |
| 1891-1896 | 4.3 | 4.7 | 4.8 | 27.4 | 31.9 | 32.3 |

*Source:* See Data section.

**Table 7.**
Multinomial logistic regression of sibling exposure on intergenerational social mobility.

| | Sibling Exposure= Net Siblings at age 15 | | | | | | Sibling Exposure= Cumulative Person-Years by age 15 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Y= Upward Mobility | | | Y= Downward Mobility | | | Y= Upward Mobility | | | Y= Downward Mobility | | |
| | RRR | SE | p | RRR | SE | p | RRR | SE | p | RRR | SE | p |
| Sibling Exposure | 0.93 | 0.022 | 0.001 | 0.95 | 0.023 | 0.053 | 0.99 | 0.002 | 0.001 | 1.00 | 0.002 | 0.147 |
| Birth Order | 1.00 | 0.027 | 0.852 | 1.07 | 0.029 | 0.016 | 0.98 | 0.022 | 0.339 | 1.04 | 0.023 | 0.046 |
| Mother's Age at Birth | 1.01 | 0.007 | 0.106 | 1.00 | 0.007 | 0.588 | 1.01 | 0.007 | 0.129 | 1.00 | 0.007 | 0.533 |
| Born Out of Wedlock | 0.68 | 0.095 | 0.005 | 1.20 | 0.176 | 0.224 | 0.66 | 0.093 | 0.003 | 1.18 | 0.174 | 0.253 |
| Year of Class Attainment | 1.05 | 0.010 | 0.000 | 0.98 | 0.009 | 0.014 | 1.05 | 0.009 | 0.000 | 0.98 | 0.009 | 0.013 |
| Size of Father's Class during Adulthood | 1.05 | 0.060 | 0.351 | 1.05 | 0.058 | 0.423 | 1.05 | 0.060 | 0.359 | 1.05 | 0.058 | 0.423 |
| Father's Class | | | | | | | | | | | | |
| Lower Managers (ref.) | 1.00 | - | - | 1.00 | - | - | 1.00 | - | - | 1.00 | - | - |
| Skilled Workers | 1.59 | 1.529 | 0.629 | 0.65 | 0.573 | 0.623 | 1.65 | 1.586 | 0.602 | 0.65 | 0.575 | 0.626 |
| Lower Skilled | 4.61 | 3.489 | 0.043 | 0.13 | 0.123 | 0.034 | 4.66 | 3.526 | 0.042 | 0.13 | 0.124 | 0.034 |
| …. x Size of Father's Class | | | | | | | | | | | | |
| Skilled | 1.06 | 0.247 | 0.805 | 1.05 | 0.231 | 0.811 | 1.05 | 0.245 | 0.827 | 1.05 | 0.230 | 0.816 |
| Lower Skilled | 0.86 | 0.142 | 0.374 | 0.67 | 0.134 | 0.044 | 0.87 | 0.142 | 0.383 | 0.67 | 0.134 | 0.044 |
| Cohort | | | | | | | | | | | | |
| 1878-1883 (ref.) | 1.00 | - | - | 1.00 | - | - | 1.00 | - | - | 1.00 | - | - |
| 1884-1890 | 0.86 | 0.073 | 0.083 | 1.01 | 0.091 | 0.869 | 0.86 | 0.073 | 0.081 | 1.02 | 0.091 | 0.864 |
| 1891-1896 | 0.65 | 0.070 | 0.000 | 1.02 | 0.121 | 0.843 | 0.65 | 0.069 | 0.000 | 1.02 | 0.121 | 0.854 |
| Constant | 0.40 | 0.090 | 0.000 | 0.59 | 0.135 | 0.021 | 0.43 | 0.099 | 0.000 | 0.59 | 0.139 | 0.024 |
| Observations | 5483 | | | | | | 5483 | | | | | |
| Chi2 | 709.5 | | | | | | 706.8 | | | | | |
| McFadden's R2 | 0.076 | | | | | | 0.074 | | | | | |

*Note*: Coeficients reported as relative risk ratios (RRR). Standard errors were clustered by family. Size of father’s class was centered around 20 while the year of class attainment was centered around the mean.
*Source*: See Data and Method sections.

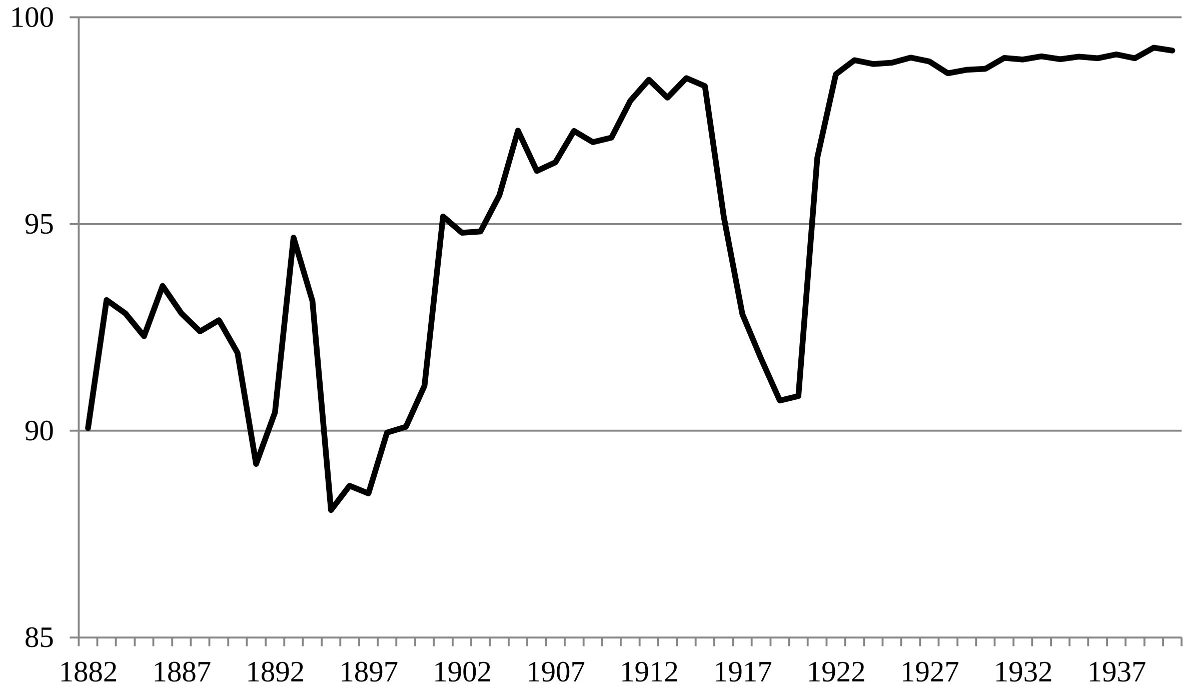


**Figure 1**. Percentage of school-age children (age 7 – 14) enrolled in primary education in Stockholm 1882 – 1940.

*Notes*: These figures refer to the percentage of all children, which includes those unable to attend school due to health or other reasons.

*Source*: For the years 1882 – 1899, the data come from *Bidrag till Sveriges Officiela Statistik, P.)Undervisningsväsendet*. For the years 1900 – 1940, the data were taken from *Statistisk Årsbok för Stockholms Stad* for the respective years.

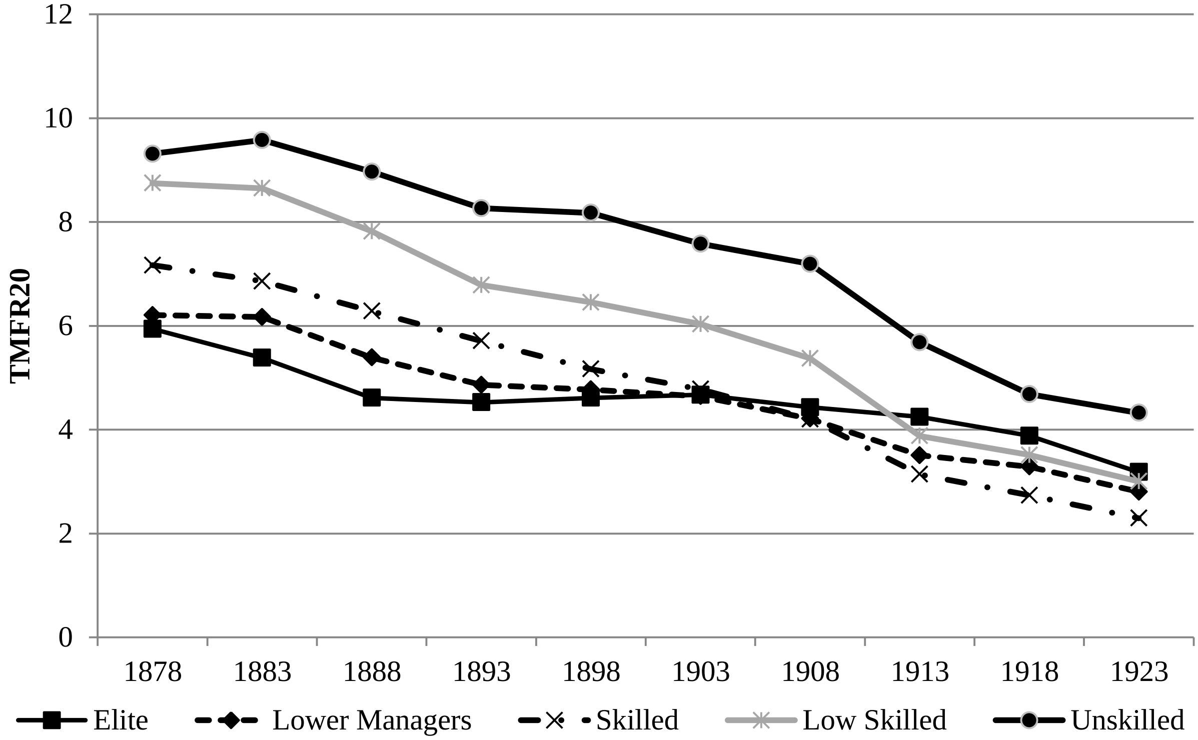


**Figure 2**. TMFR20 by socioeconomic class, 1878 – 1926.

*Notes*: TMFR20 refers to the hypothetical number of children a married woman would have if she were to be exposed to the same age specific rates throughout her childbearing years.

*Source*: See Data section.

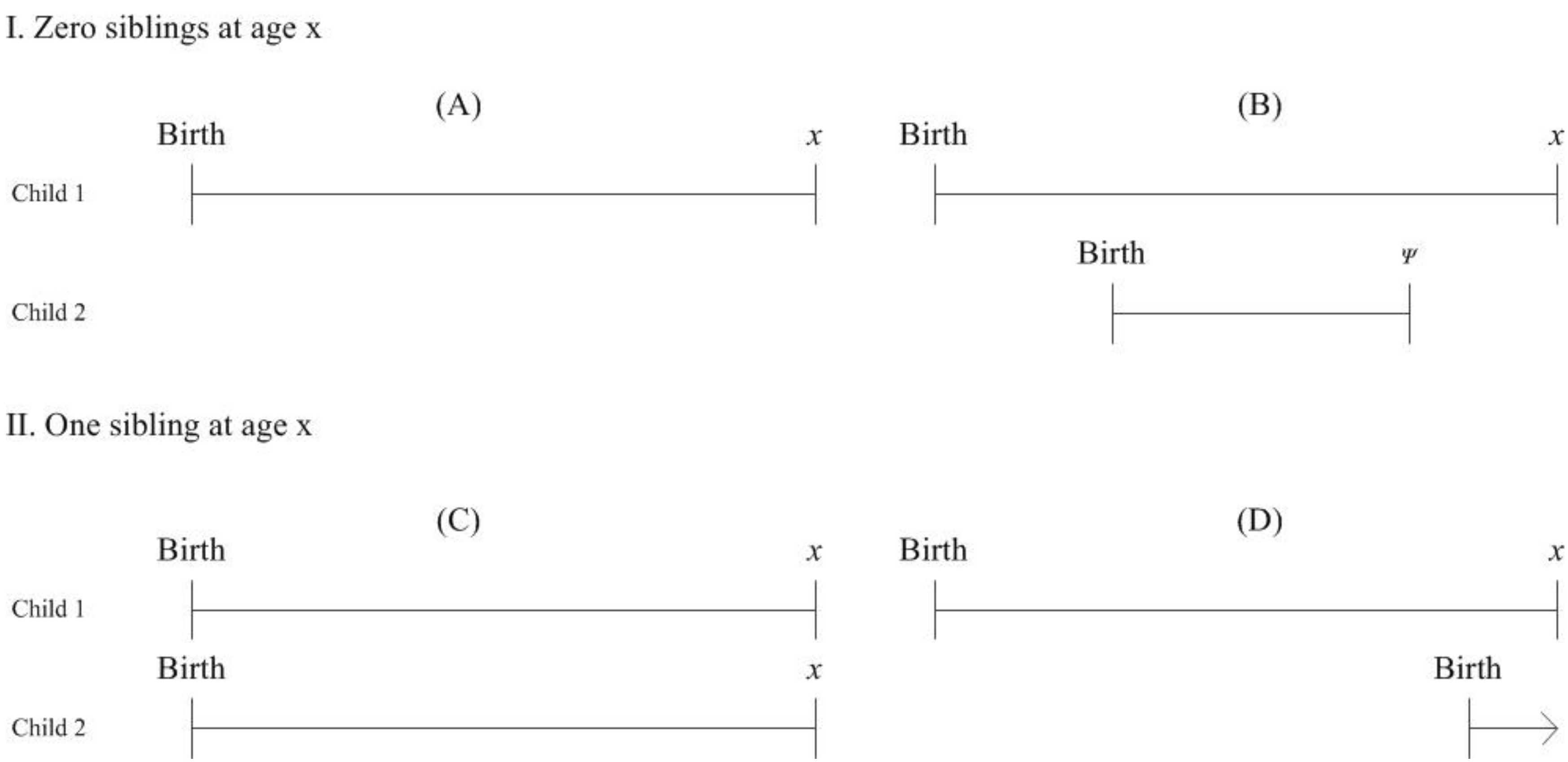


**Figure 3.** Stylized representation of variable sibling exposure with respect to observed living siblings at age *x*.

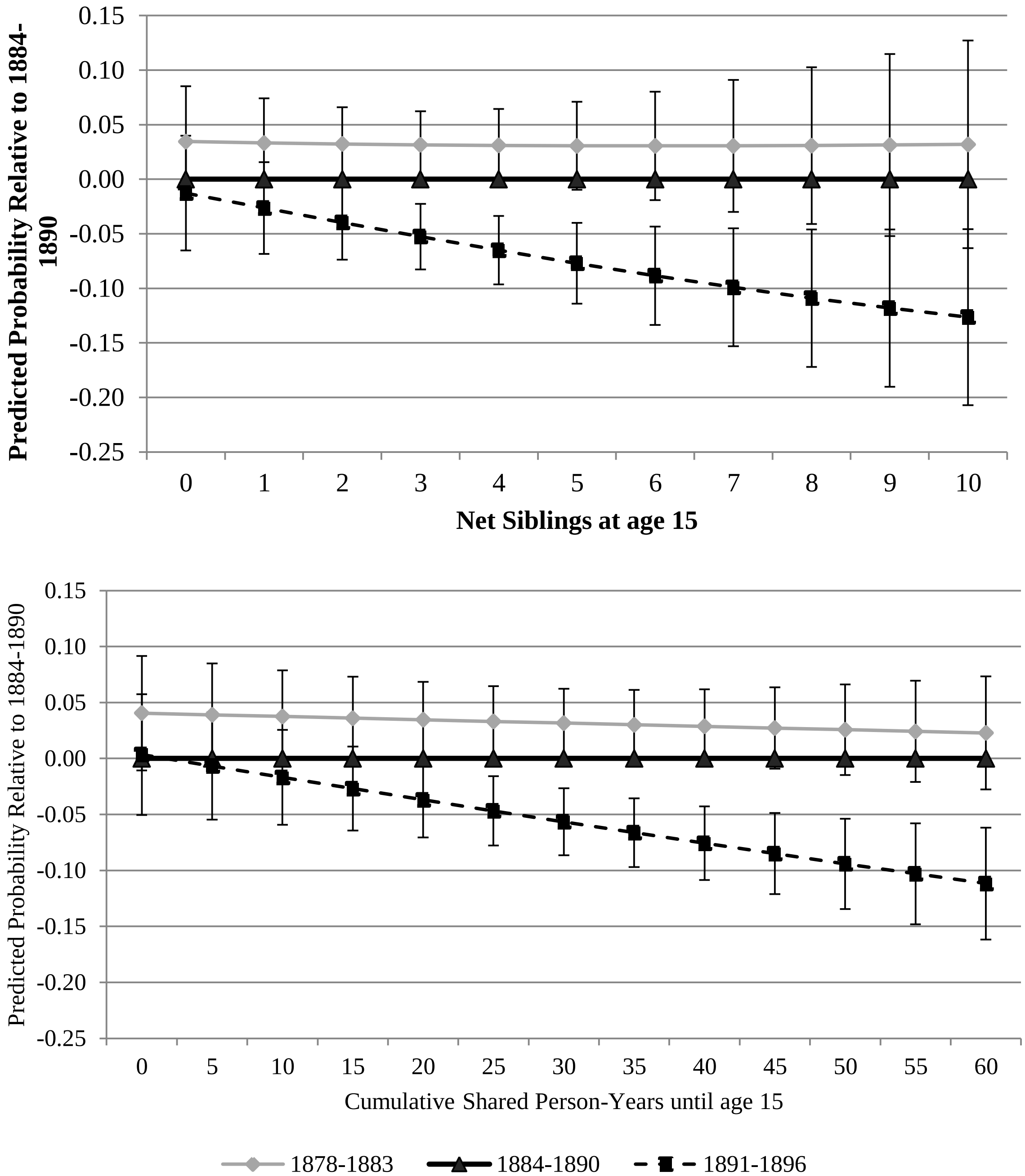


**Figure 4**. Contrasts of predicted probabilities of upward mobility by sibling exposure across birth cohorts.

*Note:* Contrasts refer to the difference in predicted probability of upward mobility at values of sibling exposure between cohorts and the reference group (i.e. 1884-1890). 95% confidence intervals presented.

*Source*: See Results section.

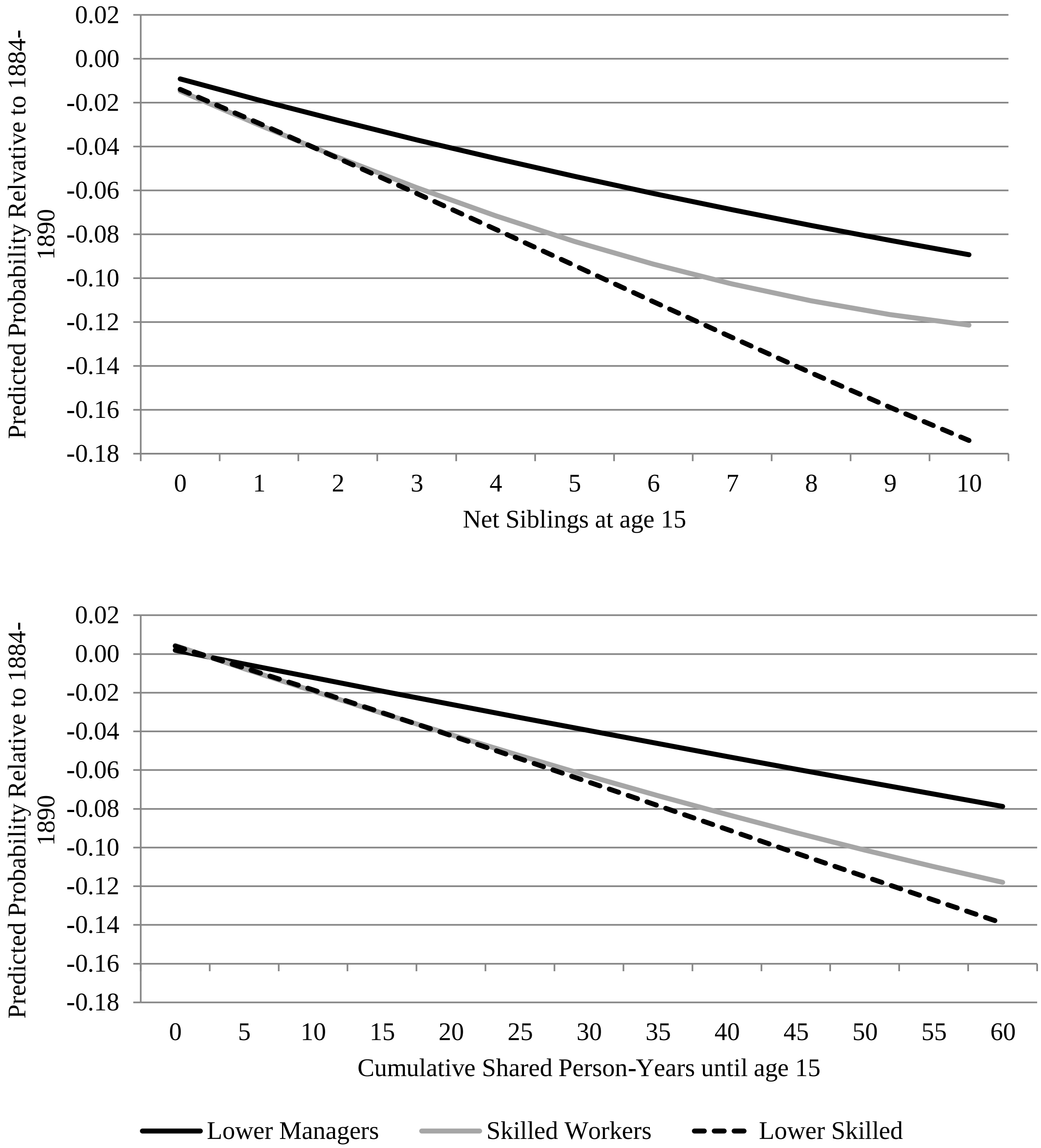


**Figure 5.** Contrasts of predicted probabilities of upward mobility for cohorts born between 1884-1890 and 1891-1896 by level of sibling exposure across origin classes.

*Note*: Each line should be interpreted as a comparison within origin class and between birth cohorts. Confidence intervals omitted for legibility.

*Source*: See Results section.