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THE BIRTH ORDER EFFECT: A MODERN PHENOMENON?

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NON-TECHNICAL SUMMARY

Studies on modern families in Europe and the U.S. find that higher birth order is associated with lower educational attainment and wages. In this study, we investigate the existence and the evolution of the 'birth order effect' in labour market outcomes in a historical setting using data from the 19th century Netherlands. Using historical family-linked administrative birth, death, and marriage records spanning more than 70 years, we analyze the role of family composition and socioeconomic status on occupational differences among siblings.

Consistent with findings in modern developed countries, we find a negative birth order effect in occupational rank in the mid-19th century Netherlands. That is, within the same family, latter-born children are less likely to be employed in a non-manual occupation and have a lower ranked occupation compared to their older siblings. This negative birth order effect is primarily driven by the number of male older siblings and a strong positive first-born effect. The birth order effect is more pronounced among urban, protestant, and socioeconomically advantaged families. Surprisingly, the size of the birth order effects remains relatively stable over a period a rapid economic growth in the Netherlands, with increasing first-born advantage over time in urban areas. Taken together, our findings suggest that differences in the direction of birth order effects observed between modern developed and developing countries may not be explained by economic growth.

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ABSTRACT

We study the existence and evolution of the birth order differences in labor market outcomes in the Netherlands over the 19th century. Using historical family-linked administrative birth, death, and marriage records, we analyze the role of family composition and socio-economic status on occupational differences among siblings. Consistent with findings in modern developed countries, we find a negative and significant birth order effect in occupational rank in the mid 19th century Netherlands. Within the same family, later-born siblings are less likely to be employed in a non-manual occupation and have a lower ranked occupation. This negative birth order effect is primarily driven by the number of male older siblings and a strong positive first-born effect. It is also more salient among urban, protestant, and socioeconomically advantaged families. Surprisingly, the magnitude of the birth order effects remains relatively stable over a period a rapid economic growth in the Netherlands and there is only an increasing first-born advantage over time in urban areas. Taken together, our findings suggest that differing patterns of birth order effects observed in developed and developing countries in modern times are not likely attributable to differences in economic growth.

Keywords: Birth order, first-born, The Netherlands, historical data

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1. Introduction

Family size and composition is recognized as one of the long-term determinants of human capital, labour market outcomes and overall socio-economic status. The negative effect of growing up in a large family seem to be partially explained by the "birth order effect", a well-known negative correlation between these outcomes and the number of older siblings, on average larger in larger families. While this effect is well documented, its causes and origins are still being investigated. In this paper, we use 19th century registry data to present evidence of an early form of birth order effect in the Netherlands. We document differences within family in adult occupational outcomes along with heterogeneity by family background that sheds light on the origin and evolution of the birth order effect.

Since the seminal work of Becker (1960) on the trade-off between quality and quantity of children, economists have largely documented the relationship between family size and educational and adult labor market outcomes. More recently, studies such as Black et al. (2005) that rely on Norwegian administrative data to study the role of birth order on educational attainment show that a substantial share of the differences between small and large families can be explained by differences in birth order. The relevance of the order of birth in determining adult economic outcomes has been reported now for a variety of developed countries, such as the US (Behrman and Taubman, 1986) or the UK (Booth and Kee, 2009). These differences are sizeable (up to one year of education in some cases), and its potential causes have been, and still are, profusely studied[1].

Interestingly, results have been mixed in developing countries. For instance, De Haan et al. (2014) find a positive birth order effect for the Ecuador and Ejrnæs and Pörtner (2004) report a similar result for Philippines[2]. Furthermore, little is known about whether these large differences by order of birth are a recent phenomenon, or tagged hand-in-hand with traditional primogeniture practices. Moreover, developing countries and historical settings have traditionally shown a more consistent family quantity-quality trade-off (Fernihough, 2017; Becker et al., 2010). This heterogeneity in results indicates that

[1] See, for instance, Brenøe and Molitor (2018), Buckles and Kolka (2014) or Lehmann et al. (2018) for evidence on the role of early life conditions and investments in the birth order effect; Black et al. (2011) for the role of birth weight or Price (2008) for the role of parental time allocation.

[2] While Ejrnæs and P¨ortner (2004) propose an optimal stopping point approach to the birth order effect that may explain the different results, De Haan et al. (2014) use a very similar estimation approach to the one used in this paper and elsewhere in the literature.

institutional and socio-economic circumstances affecting families are likely to be an important determinant in explaining this significant source of within-family inequality.

To shed further light on the origins of such a complex relationship, we study the birth order effect in a historical context among men born in the Netherlands between 1838 and 1922. To the best of our knowledge, this is the first paper to study the birth order effect in economic outcomes in a historical context under a rather different institutional context than nowadays and over a long span of time[3]. During this period, the Netherlands experienced a range of significant socio-economic changes such as rapid economic growth, changes to sectoral composition and a transition towards a modern fertility pattern. Stagnated after its 'Golden Age', the Netherlands was still a rich country that benefited relatively late from industrialization, with higher levels of GDP growth and manufacturing expansion in the last quarter of the nineteenth century. Population growth was also higher after 1880, with more children per woman and a lower incidence of child mortality. How the birth order effect reacts to these steep changes to the economy and to fertility is not only interesting on its own, but allows us to better understand the differences observed in more recent times, and to make more informed predictions about the evolution of the birth order effect as countries develop.

We employ a rich Dutch dataset linking families through birth, marriage, and death records, that includes information on individuals' occupations. We first measure the historical effect of birth order on the probability of having a non-manual occupation and occupational rank over almost a century. Second, we exploit family composition and socio-economic heterogeneity to investigate sources of variation in birth order effects. Consistent with previous literature in developed countries, we find that among Dutch men born between 1838 and 1922, there is an average negative birth order effect in occupational rank and the probability of holding a non-manual occupation. That is, within the same family, men born later are less likely to be employed in a non-manual occupation and have a higher occupational rank.

Furthermore, consistent with Black et al. (2018), we find that the gender of siblings exacerbates the birth order effect. The more male siblings are born earlier, the more negative the birth order effect. This indicates a stronger resource competition among male siblings. We also find that, consistent with modern

[3] Sociologists have also studied The Netherlands in the same historical period. Using a larger dataset of Dutch registry records, Knigge et al. (2014) examine the role of family background on siblings occupation attainment, while Knigge et al (2014b) study the evolution of occupational correlation between brothers over time. In their analysis, both papers abstract from the role of birth order.

birth order effects in India (Congdon Fors and Lindskog (2017); Jayachandran and Pande (2017)), most of this effect is driven by the firstborn boy. Children born to parents with higher occupational status, protestant families, or in urban areas are also more likely to experience a disadvantage with respect to their brothers if born later within the family. Finally, we do not find any evidence that, over the period of study, changes in economic conditions go hand by hand with changes in the average magnitude nor the sign of the average birth order effect nor that the first born effect is driven by inheritance rules. Nonetheless, we do find some evidence of an increasing first-born advantage over time in urban areas.

2. Historical Context

During the period we are considering, the Netherlands experienced a range of significant socio-economic changes such as a rapid economic growth, a fertility transition, and changes to sectoral composition. The Netherlands has been a relatively developed economy since the 'Dutch Golden Age', when trade and manufacturing accounted for a relatively large of share of the GDP that benefited greatly from Atlantic trade (Acemoglu et al., 2005) and had educational institutions promoting human capital accumulation (Akc¸omak et al., 2016). However, at least partially due to the high wages, the Netherlands was a late-comer to the industrial revolution, and lagged behind the UK and its neighbouring Belgium, both in time and intensity of industrialization. Nonetheless, economic growth was relatively widespread in Europe during the entire nineteenth century, even before the agreed-on start date of the Dutch industrialization around 1880 (Crafts, 1984). Thus, our sample covers a period of relative economic growth in which the Industrial Revolution was still having its effects in the Dutch economy. First, real GDP per capita doubled between 1840 and 1900.

These changes were accompanied by substantial population growth. The 1830 Dutch census recorded around 2.5 million inhabitants; the population reached 4 million by the 1880 census, and almost doubled by the 1930 census (see Figure A.2 in the Appendix presenting trends in the Dutch census population)[4]. The number of births per woman more than double over our sample period, particularly from the late nineteenth century. At the same time, infant mortality more than halved from an average of over 19 deaths by 1,000 births in the 1860s to 8.7 by the start of the 20th century (Van Poppel and Beekink, 2002).

[4] Dutch census http://www.volkstellingen.nl [last accessed July 12th, 2021]

The Dutch education system was already quite developed at the beginning of our sample period. Although schooling was only made compulsory for children aged 6-12 in 1900, enrolment in primary school increased steadily over the second half of the nineteenth century to reach an overwhelming majority of children, with very low illiteracy rates[5]. Child labour was forbade in 1874, but the *Kinderwetje* (Children's little law) did not include home or agricultural work.

Economic development, as in many European countries at the time, was unequally distributed in the Netherlands. Some areas were highly developed since early on, particularly those who benefited from the Atlantic trade. We classify the at the time 11 provinces of the Netherlands in three groups, following Wintle (2000)[6]. The northern provinces of Noord-Holland and Zuid-Holland concentrate the majority of the economic activity along with the most important ports for the Dutch trade. In our analysis, we will consider these two provinces as 'industrial', noting its higher level of development and urbanization. The southern part of the country, on the other hand, is characterized by an economy based on agriculture. However, some areas show a modern, market-focus agriculture, while others were closer to a subsistence approach to agriculture. The provinces of Zeeland in the west and Groningen and Friesland in the east would be classified as 'modern agricultural' provinces, while the remaining provinces (Drenthe, Gelderland, Overijsse, Utrecht, Noord-Braband and Limburg) will be classified as 'rural'. Figure 1 presents a map of the Netherlands differentiating these three regions.

Even with the differences noted above, the Netherlands has been quite urbanized from relatively early on. In the early nineteenth century, the Netherlands was one of the most urbanized countries of Europe, with almost 25% of its population living in municipalities with over 20,000 inhabitants, and Amsterdam having over 200,000 inhabitants at the time. Urbanization stagnated in the first part of the nineteenth century, but increased slowly in the second part of the century, partially driven by industrialization, with some of the industrialization-driven growing municipalities were found in predominantly rural areas, as it is the case of Maastricht in the south of Limburg or Eindhoven in Noord-Brabant. Hence, while migration to urban areas was in no case as fast as in the United Kingdom, which by this time was more urbanized, it was still higher than in neighbouring countries such as France or Germany.

[5] 62% of boys and 47% of girls were enrolled in primary school in 1826, reaching 90% for both genders by 1900 (Wintle, 2000).
[6] A 12th province, Flevoland, was established in 1986. The majority of the territory belonging to Flevoland was reclaimed to the Zuiderzee over the 1950s and 1960s.

Figure 1: Dutch provinces in 1830. Provinces in dark grey are considered industrial, provinces in medium grey are considered modern agricultural and lighter regions are rural traditional

It is finally worth noting the Dutch religion divide, presented in Figure 2. Due to historical political events, the Netherlands was (and still is to this day) predominantly catholic in the area south to the Rhine and predominantly protestant in the region north to the river. The revolt against the Habsburgs in the late 16th century originated in the north, that converted rapidly to protestantism, while the south part of the country stayed under Habsburg rule until the Spanish War of Succession in early 18th century. Consistent with the evidence that protestant areas experienced a higher relatively economic growth than their catholic counterparts in other European countries (Becker and Woessmann, 2009) the north of the Netherlands experienced a higher economic growth than the south.

3. Data

Historic Sample of the Netherlands The *Centrum voor Familiegeschiedenis* (Center for Family History) has digitized Dutch registry records, such as birth, marital and death records of deceased individuals, from as early as the 17th century but mostly focused on the 19th and early 20th century. Records include information on the individuals involved in the particular event, including name, date and place of living or event, religion when declared, and, most importantly, occupation. For instance, in a marriage record, in addition to date

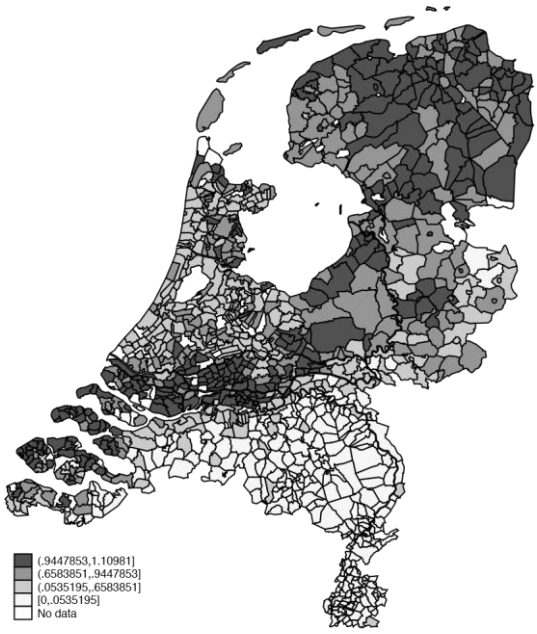

Figure 2: Share of protestants by municipality, 1849 Dutch Census

and location of the event, information is recorded for not only the bride and groom but also their parents and witnesses, if available. Similarly, when a birth was recorded, information on the parents' occupation was also included.

In our analysis, we use the *Historical Sample of the Netherlands* (hereafter HSN), *Data Set Life Courses Release 2010.01* (International Institute for Social History, 2010), a representative sample constructed using those records by the International Institute for Social History. The HSN includes around 85,500 individuals born in the Netherlands between 1812 and 1922. It selects a representative sample of "research persons", and links each to their relatives, including parents, siblings, or spouses.[7] Hence, we can observe reconstructed families across more than one generation, with individuals linked to their parents and siblings. Furthermore, individuals often appear more than once in the registries; they may appear in their own birth certificate (including place and date of birth), in one or more marriage and separation/divorce certificates, and in their children's births and marriage certificates. This allows us to

[7] To maintain consistent cohort sizes, the HSN includes as research individuals 0.75% of all births for the period 1812-1872 and 0.5% for the 1873-1922 period. Out of the full sample, around 30% of the records belong to the research individual.

compare adult outcomes (occupations, in this case) across siblings, over time and by family background. Unfortunately, death records are frequently missing in this sample.[8]

Occupational Classifications Dutch registry records contain information on self-reported occupations for individuals involved in the life event. Occupation wording in our sample has been matched with occupation classifications and rankings frequently used in the historical and sociological literature by Mandemakers et al. (2018). We employ this information to develop two measures of occupational quality.

First, we use the International Historical Class Scheme (hereafter HISCLASS), developed by Van Leeuwen and Maas (2011), that divides occupations in this period in the Netherlands into 13 categories. The most coarse occupation division used to construct this ranking divides occupations between manual and non-manual[9]. We use this manual/non-manual categories as a measure of occupational quality for which our results have a clear and intuitive interpretation.

Because this simplification misses much of the variation that may be occurring within a family, we also take advantage of the Historical CAMSIS (Cambridge Social Interaction and Stratification Scales), hereafter HISCAM, to construct an ordinal measure of occupational rank.[10] Using the ordinality of this ranking, we assign a percentile rank to each occupation within each cohort of birth, indicating the share of individuals of the same cohort (individuals born 10 years before and after) with an lower ranked occupation according to the HISCAM classification. To ensure representativeness, this ranking is constructed using only and all representative persons with a valid HISCAM occupation, and then matched at which the occupation/year of birth level with our sample.

[8] While it would be very interesting to analyse the effect of birth order on longevity, death records have only been digitised for around 4,000 individuals.

[9] The original 13 categories are higher managers, higher professionals, lower managers, lower professionals and higher and middle clerical and sales personnel, lower clerical and sales personnel, foremen, medium skilled workers, farmers and fishermen, low skilled workers, low skilled farm workers, unskilled farm or unspecified workers. The first six categories are considered non-manual.

[10] CAMSIS uses pairs of occupations linked by different social interactions (marriage, parent-child or friendship) and social proximity to extract a hierarchical component of social stratification using correspondence analysis. Lambert et al. (2013) apply this methodology to 12 different historical datasets, including Dutch registry data to construct HISCAM, an ordinal index of occupational rank. Further details can be found on the CAMSIS project website www.camsis.stir.ac.uk (last accessed 12th April 2019).

Finally, note that the HSN records can include a multiplicity of occupations if the individual appears in multiple records as adult (for instance, their marriage record, their children's birth records and their children's marriage records).For these individuals, we keep the highest ranked occupation available[11]. We include dummies for the year in which occupation was measured to control for measurement at different ages.

Sample restrictions We restrict our analysis to men. Although women are included in the dataset, more than half do not report having an occupation, and those who do may be not be randomly selected from the population. For instance, Van Nederveen Meerkerk and Paping (2014) highlight the prevalence of under-recording of work of women in agriculture because it was usually irregular and deemed undesirable for them. Unfortunately, it is not possible to use husband's occupation as our outcome variable for women because family relationships are defined with respect to the initial research or focus individual, and it is often not possible to reconstruct marriages for their family members.

Individuals in our sample may marry several times due to separation or death of the spouse, and have children with more than one partner. Hence, siblings may share one or both parents. For our analysis, our variable of interest, order of birth, is constructed within father, as, considering the period of study, this may represent better the available resources to share among siblings. Hence, our sample is restricted to individuals for which we can identify their father and at least one of his brothers. Since our outcome variable is occupation, we also require that the individual, his father, and at least one brother have a meaningful occupation.[12] Nevertheless, our measure of birth order is constructed taking all siblings into account (both brothers and sisters regardless of their occupation status). We present results exploring different effects of brothers and sisters.

Descriptive statistics Table 1 presents the descriptive statistics for our estimating sample of 27,714 men. Individuals were born between 1838, the year of the enaction of the Dutch Civil Code, and 1922, the last

[11] Our results are robust to alternatively using their median occupation instead.

[12] Note that we only observe occupations for a subsample of the HSN. Individuals may be missing if (i) they died before reaching adulthood, (ii) they never appeared in registry records as adults (i.e., never married or never fathered a child), or (iii) their records do not report an occupation or this is not adequately matched to an occupational classification (due to, for instance, misspelling). On a sample of all men with a valid order of birth, having an observed occupation is negatively related with order of birth. Under the reasonable assumption that not being observed is negatively (or at least not positively) correlated with adult outcomes, our estimates should be interpreted as, if anything, a lower bound for the effect.

year for which we have at least a hundred births in our sample[13]. Average family size was above 8 children per family, accounting both for children passing away during childhood and those reaching adulthood, with or without a valid occupation. As aforementioned, while our birth order measure uses all children born in the family regardless of gender, our analysis focuses on families with at least two brothers for whom we have a valid occupation as an outcome for both, as women were rarely recorded a valid occupation. Family size ranges widely between 2 and 15, and we observe 5 brothers or less for almost 95% of our families.

Our measure of birth order is capped at 10 for easiness of interpretation, which covers almost 95% of our observations. Hence, our results should be extended with caution to larger orders of birth. Number of older brothers is also capped at 6. On average, individuals have an average age gap of less than 2 years with their immediately precedent sibling, and almost 95% of our sample has an age gap of 4 years or less (capped at 5).

Regarding occupation, 19% of men report having a non-manual occupation, and on average, they lay on the 44th percentile of the occupational ranking. In regards to their background, 23% of their fathers' hold a non-manual occupation and have on average a 48th percentile occupational rank. At first glance, the 4% divergency might seem to indicate that fathers with non-manual occupations have more boys reaching adulthood. However, this is not a concern because we are comparing siblings within a family. Men with manual occupations are more likely to belong to the agricultural or manufacturing/service sectors. On average, 18% of our sample holds an agricultural occupation, with a decreasing trend over time.

Finally, we restrict our sample to individuals reporting a religion at any record in their lives. Over 95% of the Dutch population at the time (1849 Census) reports being either Protestant or Catholic, with salient geographical differences. Protestants are concentrated in the provinces located north to the Rhine, while Catholics are more prevalent in the south. Most of our sample (and of the Dutch population) lives in predominantly protestant provinces (80%), but around 45% reports being Protestant themselves.

[13] The 1838 Dutch Civil code (*Wetboek*) replaced the Napoleon code, but maintained the existent regulation regarding inheritance, according to which the estate was to be divided equally among all children and the surviving spouse. Some limited exceptions were allowed, and are addressed later in the paper.

The Netherlands was already a highly urbanized country at the beginning of our sample. On average, 35% of our sample lived in what the 1849 Dutch census considered as cities, with not a major increase over time. We observe individuals across all 11 provinces from the Netherlands at the time. There is variation in the economic condition across these provinces, and we will be dividing them in industrial, rural or modern agricultural, to explore how economic development may modulate the birth order effect.

Table 1: Descriptive Statistics

	Mean	SD	Min.	Max.
Birth order	4.168	2.576	1	10
Number of older brothers	1.737	1.596	0	6
Year of birth	1891.859	15.828	1838	1922
Family size	8.246	2.887	2	15
Age difference with precedent sibling	1.849	1.309	0	5
Age at best occupation	20.493	7.930	0	50
Born in a city	0.347	0.476	0	1
Protestant	0.446	0.497	0	1
Catholic	0.367	0.482	0	1
Occupation				
Non-manual occupation	0.194	0.395	0	1
Occupation percentile	0.440	0.273	0	1
Father's occupation				
Father non-manual occupation	0.235	0.424	0	1
Father occupation percentile	0.473	0.261	0	0.998
Region by majority religion Protestant region	0.808	0.394	0	1
Catholic region	0.192	0.394	0	1
Region by economic development				
Industrial region	0.411	0.492	0	1
Modern agricultural region	0.138	0.345	0	1
Rural region	0.451	0.498	0	1
Observations	27389			

SD stands for Standard Deviation.

4. Results

We take advantage of the linked nature of the HSN to exploit within family variation in occupational outcomes by order of birth. In our main specification, we estimate the following equation:

$$Y_{ifrc} = \alpha + \beta \text{Birth order}_{ifrc} + \gamma X_{ifrc} + \mu_f + \eta_r + \delta_c + \varepsilon_{ifrc} \quad (1)$$

where Y_{ifrc} is our outcome of interest for individual i from family (father) f born in region r in cohort c; Birth order$_{ifrc}$ is a variable measuring the individual's order of birth capped at 10. We first include a linear trend on birth order, and then move to more flexible specifications, allowing different effects for each order of birth (including a series of ten dummies), for the first and last born (including a first born and a last born dummy), or for brothers and sisters (including separate trends for older brothers and older sisters). Given the evidence that age difference can exacerbate birth order differences (Buckles and Munnich, 2012), X_{ifrc} includes the age gap between the individual and his immediately-preceding brother or sister, as well as the age at which occupation was measured. Finally, μ_f, η_r and δ_c are family, region (province) and cohort (year of birth) fixed-effects. Baseline results also present OLS specifications without father fixed effects. Standard errors are clustered at the family level to allow for within-family correlation.

4.1 Birth order effect and family composition

Table 2 presents our baseline results. Columns (1) and (3) present the OLS results while columns (2) and (4) present our father-fixed effects results, our preferred specification. Consistent with previous birth order literature, we do not observe large differences between the OLS and the fixed-effects estimates. Hence, thereafter only fixed-effects results will be presented.[14] Panel A presents the results of our linear baseline specification, with the coefficient representing the change in occupation quality associated with having one additional older sibling. Panels B and C present more flexible specifications on the order of birth.

Columns (1) and (2) present the results for the probability of holding a non-manual occupation. Being born later in the family is correlated with lower occupation quality, even when all time-invariant family unobservables are controlled for. The size of the effect is, although significant, limited. One additional older sibling is correlated with a 0.7 percentage points lower probability of holding a non-manual occupation, compared with an average probability of 19%. Although the effect is small (a 3.6% reduction per older sibling), the consequences for one's lifetime income of holding a non-manual occupation during this time could be substantial. Columns (3) and (4) present the results for our occupation rank outcome. Unlike the probability of holding a non-manual occupation, this measure may capture small changes

[14] OLS results are available upon request.

occurring to families along the entire distribution of occupations and not only at the extensive margin of the manual/non-manual cut-off. In this case, the effect is still strongly significant but small in size. Having an additional older sibling decreases the rank of the individual occupation within their own cohort of birth by 0.6 percentiles, again when controlling for father fixed-effects. To put these numbers in context, using our estimating sample, these are similar the effect of a decrease of two percentiles in the father occupation in an OLS specification controlling for region and year of birth.

Table 2: Birth order and occupation quality

	P(Non-manual occupation)		Occupation percentile	
	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)
Panel A				
Birth order	-0.003***	-0.007**	-0.002***	-0.006***
	(0.001)	(0.003)	(0.001)	(0.002)
N	27389	27389	27389	27389
F-stat	8.114	4.237	17.554	6.482
Panel B				
No. older brothers	-0.003	-0.010***	-0.003*	-0.008***
	(0.002)	(0.004)	(0.001)	(0.002)
No. older sisters	-0.004*	-0.004	-0.002	-0.003
	(0.002)	(0.004)	(0.001)	(0.003)
N	27389	27389	27389	27389
F-stat	8.064	4.227	17.448	6.480
Panel C				
First born child	0.017*	0.022**	0.006	0.010*
	(0.009)	(0.009)	(0.006)	(0.006)
Birth order	-0.004***	-0.004	-0.003***	-0.004*
	(0.001)	(0.003)	(0.001)	(0.002)
Last born	0.056***	0.009	0.050***	0.011**
	(0.009)	(0.009)	(0.005)	(0.005)
N	27389	27389	27389	27389
F-stat	8.295	4.238	18.081	6.431

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies. Fixed-effects regressions control for family (father) dummies.

Given the time period we are studying, it may be the case that parents devote differential investments (either during childhood or later in life) to children depending on their gender. Hence, having an additional older brother may have a different effect than an additional older sister. Panel B presents the results

when we allow the birth order effect to vary by the gender composition of the siblings. We regress our occupational quality measures on the number of older brothers and older sisters, ceteris paribus. Unlike results for modern birth order effect in developed countries, we observe significant differences by gender of the siblings.

The probability of holding a non-manual occupation decreases by 1 percentage point per additional older brother, but only by 0.2 percentage points per older sister. Similarly, the occupational rank decreases in 0.8 percentiles per additional older brother, but only by 0.3 by additional older sister. Both results for older sisters are not significantly different from 0, but significantly different than the coefficient for older brothers for occupational percentile[15]. Interestingly, these results are in line with the findings of Jayachandran and Pande (2017) or Congdon Fors and Lindskog (2017) for India, reporting a lower impact of older daughters in, respectively, height and education of sons, particularly those without older brothers[16].

The aforementioned results impose a linear birth order effect, in which the difference with the precedent sibling (or brother, in the second case) is the same regardless of how many siblings are ahead. This restrictive specifications allow us to find precise estimates even within family, but it may conceal strong non-linearities in the birth order effect. Figure 3 presents the results for a more flexible specification of our baseline estimation equation, in which the effect of an additional sibling is allowed to be different for different orders of birth, all other controls unchanged. In this case, each point estimate (presented with 95% confidence intervals) represents the difference by order of birth with a first born brother, for the probability of holding a non-manual occupation and the percentile rank. While this very flexible specification is likely to be too demanding from our data to allow us to perform analysis over time or by family type, a first born effect is apparent for both the probability of holding a non-manual occupation or the share of individuals in the same cohort holding lower quality occupations.

In view of these results, models in Panel C in Table 2 include a first born child dummy. For completeness, we also include a last born dummy, as last borns may benefit as well from a smaller household size while growing up, particularly if the age gap with the older siblings is large. As expected from Figure 3, both for

[15] In the case of the probability of holding a non-manual occupation, the p-value is 0.11.

[16] It is worth noting that Spears et al. (2019) argues that these results may be driven by an imperfect control for family size. This is less of a concern for us, as we only examine completed families and adult outcomes. Regardless, we address the role of family size next.

our OLS and fixed-effect specifications present a strong first born effect. Being a first born increases the probability of holding a nonmanual occupation by 2.2 percentage points (almost a 15% increase), while the coefficient for order of birth halves its size and loses its significance. On the other hand, the last born advantage is about half of the size of that of the first born and, for the probability of holding a non-manual occupation, insignificant.

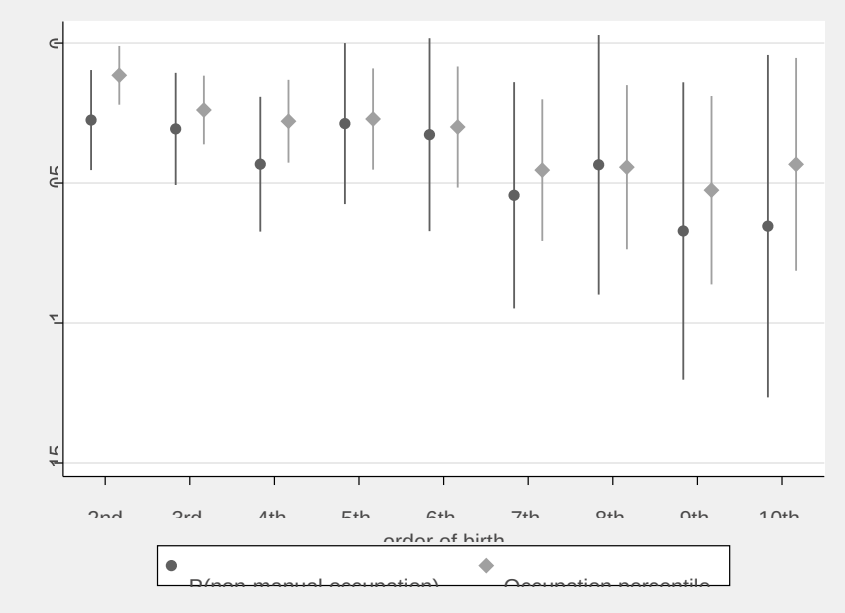

Figure 3: Birth order effect on occupation quality.

Our measure of occupational rank presents a very similar relationship: the first born child has, on average, an occupation ranked 1 percentile point higher. While the birth order effect is smaller once controlled for first born that has a similar magnitude to being last born, birth order still remains significantly different from zero. Although a non-linear birth order specification might fit our data better, it is more demanding and renders imprecise results, as can be seen in Figure 3. Therefore, we will present results for both birth order linear trends alone and including first and last born dummies for the remaining of the paper.

One hypothesis explaining the large first-born effect would be that first-born might be receiving the largest part of the inheritance. However, our entire sample period is covered by the inheritance regulation included in the Dutch Civil code of 1838, according to which the estate was to be divided equally among all children and the surviving spouse in case of death without a will (De Haan and Hoppenbrouwers, 1998). Hence, while parents may choose to divide their estate unequally, the social norm, as far as reflected by this rule, was for all children to have a share of the estate rather than to operate a primogeniture system.

Nonetheless, the 1838 Civil code allowed Saxon inheritance laws and customs in certain regions located in eastern Netherlands[17]. Around 10% of our sample lives in one of these regions, but in order to make sure they are not driving our results, we perform our estimation dropping families living in that region. Our results are robust to excluding Saxon regions as seen by our baseline results presented in Table A3 in the Appendix. It might be also the case that part of state was not indivisible and that first-borns were more likely to inherit such goods. To test this hypothesis we analyse birth order effects separately for farmers who were self-employed and their counterparts and do not find any differential effects among this group (results are available upon request).

Our analysis uses adult outcomes and hence is unaffected by censoring due to incomplete fertility, family size is one key aspect in which our period of study changes over time. Hence, we explore the role of completed family size on occupational outcomes by birth order. We consider a family small if they have five or less children, including those who died in early infancy. While at first glance this figure may seem rather large, less than 20% of our sample grew up in a family with five or fewer children. Table 3 present the results for our different specifications. Our results are robust to different definitions of small family and for the vast part, it does not seem to shape the way order of birth is correlated with adult outcomes[18].

Summing up, our results show consistent evidence of a negative, albeit small, birth order effect, much in line with results for developed countries in recent times. When differences between the first born and younger brothers are considered, the different is considerably larger, and there is some evidence of advantages of being the last born in the family. Furthermore, we observe significant differences, particularly regarding gender of the older siblings, with a much more negative effect of having an older

[17] In particular, Achterhoek, in the Gelderland province, and Tweente and Salland, in Overijssel, (see Figure A.5) allowed one child to inherit the land undivided. Compensation for siblings was regulated, but it is unclear whether it was enforced.

[18] Spears et al. (2019) have emphasised recently the relevance of allowing the birth order effect to change by completed family size to disentangling it from the effect of number of children. Although dividing the sample substantially reduces our precision, Table A1 in the Appendix presents the results for families whose completed family size is below 5, between 5 and 7, 7 to 10, and above 10. As expected from the presence of a first born effect, our results when this is not included are stronger for smaller families, but this difference is not present for our extended specification. Table A2 shows results robust to the birth order index ($\frac{\text{birth}}{(N+1)}\frac{\text{order}}{/2}$, where N is completed family size) developed by Booth and Kee (2009), a preferred measure of birth order when the children of higher birth orders are observed more often due to larger family sizes in fixed effects models.

brother versus an older sister. These differences are in line with some recent results for developing countries, such as India.

4.2 Birth order effect and socio-economic background

To further explore the role of the socio-economic background in modulating or exacerbating the birth order effect we now move to explore heterogeneity in characteristics beyond family composition. In the previous section, we report some results that are overall consistent with results for developed countries, while some others are more in line with recent research for emerging countries such as India. In this section, we aim to disentangle further external factors that may be driving such differences. We present results by parental background (father's occupation, in our case), location (both type of province by main productive force and by whether the municipality was considered a city) and religion, as previous literature has reported significant differences in investments along this dimension[19].

Table 3: Birth order effect on occupation quality by family size (FE specification)

	P(Non-manual occupation)	Occupation percentile
	(1)	(2)
Panel A		
Birth order	-0.007**	-0.006***
	(0.003)	(0.002)
Birth order*small family	0.003	0.001
	(0.004)	(0.002)
N	27389	27389
F-stat	4.206	6.434
Panel B		
No. older brothers	-0.010***	-0.008***
	(0.004)	(0.002)
No. older brothers*small familiy	0.002	0.006
	(0.007)	(0.004)
No. older sisters	-0.003	-0.001
	(0.004)	(0.003)

[19] Becker and Woessmann (2009) show that in late 19th Prussia, Protestants had higher literacy rates due to Luther's request for Christians to be able to independently read the Gospel.

No. older sisters*small family	0.017	-0.014*
	(0.014)	(0.008)
N	27389	27389
F-stat	4.238	6.421
Panel C		
First born child	0.025**	0.013**
	(0.010)	(0.006)
First born*small family	0.022	-0.018
	(0.027)	(0.015)
Birth order	-0.003	-0.004*
	(0.003)	(0.002)
Birth order*small family	0.015	-0.004
	(0.009)	(0.005)
Last born	0.011	0.011*
	(0.011)	(0.007)
Last born*small family	-0.026	-0.000
	(0.022)	(0.012)
N	27389	27389
F-stat	4.168	6.297

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies. Fixed effects regressions control for family (father) dummies. A family is considered small if they had five or less children.

4.2.1 Parental background

Table 4 presents the baseline results by socio-economic background proxied by the quality of father's occupation. As in our previous results, the top panel presents our baseline specification, the middle panel allows for a different effect by gender of the siblings and the bottom panel allows for a first-born effect. Column (1) presents the results for the probability of holding a non-manual occupation, with the birth order variables interacted with a dummy that takes value one if the father held a non-manual occupation. Column (2) presents the results for occupational percentile, and the birth order variables are interacted with the occupational percentile of the father's occupation taking values between zero and one.

We observe a stronger negative birth order effect among families with a better socioeconomic status as captured by father's occupation. Having an additional older sibling is correlated with a 0.6 percentage points lower probability of holding a manual occupation for children of men with non-manual occupations, but this effect is twice as large for sons of nonmanual workers. A similar pattern is observed for occupational percentile, with, for instance, the effect being 0.32 for families with fathers in the 20th

percentile of the distribution, 0.55 for sons of fathers with an median occupation, and 0.7 for sons of a father with an occupation in the 70th percentile.

When we allow for a different effect by gender of the older siblings, we find no evidence of a negative effect of having an older sister among any type of family. Older brothers explain the pattern observed for the linear birth order: having an additional older brother is correlated with a probability of holding a manual occupation of 0.8 percentage points for children of manual workers, but a 1.9 percentage points for children of non-manual fathers.

A similar phenomenon is observed for our occupation rank measure. Hence, on this respect, it does not appear like richer families are departing from a son-preference behaviour.

Table 4: Birth order by parental background (FE specification)

	P(Non-manual occupation)	Occupation percentile
	(1)	(2)
Birth order	-0.006*	-0.002
	(0.003)	(0.002)
Birth order*Non-manual father	-0.007**	
	(0.003)	
Birth order*Father occupation percentile		-0.008***
		(0.003)
N	27389	27389
F-stat	4.285	6.491
No. older brothers	-0.008**	-0.002
	(0.004)	(0.003)
No. older brothers*Non-manual father	-0.010*	
	(0.006)	
No. older sisters	-0.003	-0.002
	(0.004)	(0.004)
No. older sisters*Non-manual father	-0.002	
	(0.009)	
No. older brothers*Father occupation percentile		-0.012**
		(0.005)
No. older sisters*Father occupation percentile		-0.002
		(0.008)
N	27389	27389
F-stat	4.243	6.450
First born child	0.022**	-0.008
	(0.009)	(0.009)

First born*Non-manual father	0.000	
	(0.020)	
Birth order	-0.002	-0.003
	(0.003)	(0.003)
Birth order*Non-manual father	-0.007*	
	(0.004)	
Last born	0.010	0.035***
	(0.010)	(0.011)
Last born*Non-manual father	-0.003	
	(0.023)	
First born*Father occupation percentile		0.036**
		(0.016)
Birth order*Father occupation percentile		-0.002
		(0.003)
Last born*Father occupation percentile		-0.048**
		(0.019)
N	27389	27389
F-stat	4.228	6.451

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies.
Fixed-effects regressions control for family (father) dummies.

When we allow for first born and last born effects, we still observe a stronger and significant birth order effect for those families of better socio-economic background as proxied by the father's occupation. The first-born effect does not seem to be heterogeneous in the probability of holding a non-manual occupation by whether the father held a manual or non-manual occupation. However, when looking to a more nuanced measure, such as occupation rank, most of the first born effect appears to be driven by families at the top of the occupational distribution. Although the interaction effect just fails below the usual levels of significance, the first born effect is significant at the top of the distribution. Figure 4 presents this result by percentile of father's occupation. Interestingly, the positive last born effect seems to be concentrated among those siblings with a lower ranked father.

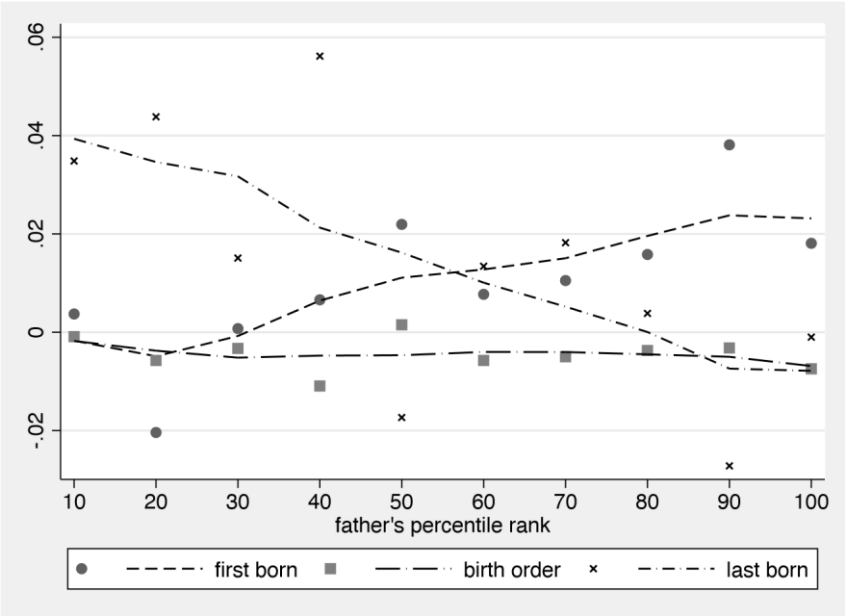

Figure 4: Birth order effect on occupational percentile by family background

In sum, we find that in historical Netherlands, occupational outcomes are even more unequal for latter-born male siblings among more socio-economically advantaged families, exacerbating birth order differences.

4.2.2 Intergenerational transmission of occupation

We briefly addressed the role of inheritance above; however, the stronger first-born effect among more affluent families suggest that the birth order effect could be driven by investments that were made more frequently among fathers holding better occupations themselves. Hence, first born sons could inherit intangible assets such as knowledge related to the father's occupation that may make give them an advantage in the occupational ranking. Although our data do not include information on any type of investments or assets, we do know whether the sons and father share a similar occupation.

Our self-reported occupations are coded into the HISCO classification up to a 5-digit level. We construct a variable that takes value 1 if father and son share the same occupation at that level of detail[20]. The top panel at Table 5 replicate the results for the birth order effect. For conciseness, only specifications with

[20] 27% of the individuals in our sample hold the same occupation as their father. We perform a robustness check where our dependent variable takes value 1 if the occupation is shared at 3-digit level, and our results are unchanged (available upon request).

father-fixed effects are reported here. Column (1) includes a linear order of birth, column (2) allows for the effect to be different by gender of the older siblings and column (3) includes first and last borns dummies in addition to the linear trend in order of birth. We observe a very similar relation between the probability of having the same occupation as one's father and order of birth as we observed with our measures of occupational quality. Birth order is negatively correlated with holding the same occupation as your father, with a strong first born effect, and working exclusively through older brothers. Being a last born, as could be expected, has no effect on the probability of holding the same occupation as one's father.

Inheriting one's father occupation is obviously more beneficial for those earlier born children from more affluent families, while it is not clear it would be helpful for those born to fathers with low ranked occupations. Hence, the bottom panel of Table 5 allows for the relation between the probability of holding the same occupation of one's father and our different order of birth specifications to vary by family background. For easiness of presentation, we include here interactions with a dummy variable that takes value 1 if the father holds a non-manual occupation, but our results look similar if we include interactions with the father's rank percentile (available upon request). Quite surprising, the increased probability of holding the same occupation as one's father is concentrated among families of less advantaged socio-economic background as proxied by father's occupation. This is particularly clear for the case of first born children, making it unlikely that this increased probability of holding the same occupation of one's father can explain the advantage firstborns presented in their own occupation over their younger brothers. While these could be interpreted as "bad-controls", adding flexible controls for holding the same occupation as one's father does not affect our results in tables 2 and 4.

Table 5: Order of birth and probability of same occupation as one's father (FE specifications)

	(1)	(2)	(3)
Birth order	-0.012***		-0.009**
	(0.004)		(0.004)
No. older brothers		-0.017***	
		(0.004)	
No. older sisters		-0.006	
		(0.004)	
First born child			0.019**
			(0.009)
Last born			0.001
			(0.008)

N	27389	27389	27389
F-stat	2.766	2.756	2.762
Birth order	-0.014***		-0.011***
	(0.004)		(0.004)
Birth order*Non-manual father	0.007***		0.004
	(0.002)		(0.003)
No. older brothers		-0.020***	
		(0.005)	
No. older brothers*Non-manual father		0.012***	
		(0.005)	
No. older sisters		-0.005	
		(0.005)	
No. older sisters*Non-manual father		-0.002	
		(0.007)	
First born child			0.025**
			(0.010)
First born*Non-manual father			-0.023
			(0.016)
Last born			-0.003
			(0.010)
Last born*Non-manual father			0.015
			(0.017)
N	27389	27389	27389
F-stat	2.755	2.729	2.726

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies.
Fixed-effects regressions control for family (father) dummies.

4.2.3 Geographical Context

Despite the Netherlands being a relative a small European country, it presents interesting geographic variation over our period of study allowing to gain insights into the drivers of the historical birth order relationship. Unlike its neighbouring Belgium, the Netherlands did not industrialize as fast during the 19th century, and our sample period still saw predominantly agricultural provinces. We follow one of the most used division of the Dutch territory as described by Drukker and Tassenaar (1997) in three differentiated areas: industrial, modern agricultural and rural traditional. The first group, formed by Noord-Holland and ZuidHolland, was the most developed with large towns, some of which had been important ports or urban industry centres during the seventeenth century. Zeeland in the south and Groningen and Friesland in the north were at this time mostly agricultural provinces, but, thanks to its more advantageous natural conditions for production, were characterized by a marketoriented agriculture and farming. Finally, the

remaining provinces of Drenthe, Overijssel, Gelderland, Utrecht, Noord-Brabant and Limburg are considered rural traditional. Figure 1 presents the regional divisions[21].

Panel A of Table 6 presents our baseline fixed-effects results when allowed to vary by type of province[22]. The linear birth order effect appears consistently across different provinces, but a more flexible specification shows interesting differences, particularly in the first-born advantage, that seems to be concentrated among the richest regions, those with a high level of urbanization (and, in the case of the probability of holding a non-manual occupation, also in regions with a modern agricultural sector). Since these are the areas with the lowest concentration of farmers, this points towards the first born effect not being driven by agricultural transitions, in which farmers aim to not divide their land[23].

The Netherlands presents interesting variation within regions. Even in the most agricultural areas, cities had been long present (e.g., cities such as Maastricht or Utrecht are located in rural provinces). The Netherlands has been a quite urbanized country from early on, and we do not observe large movements of population to cities over time. In the 1849 Census, over 35% of the population was living in cities, with this share going up to 45% by 1920.

Table 6: Birth Order Effect and Regional Variation

	P(Non-manual occupation)		Occupation percentile	
	(1)	(2)	(3)	(4)
Panel A: Type of region Birth order	-0.010***	-0.005	-0.006***	-0.003
	(0.003)	(0.004)	(0.002)	(0.002)
Birth order*Modern agricultural	0.000	0.002	0.000	-0.003
	(0.003)	(0.005)	(0.002)	(0.003)
Birth order*Rural region	0.004*	0.003	0.000	-0.001
	(0.002)	(0.003)	(0.001)	(0.002)
First born child		0.027*		0.024***

[21] A quick analysis of our data supports this division. For instance, on average, 12% of individuals are self-employed farmers. In industrial provinces, this share is only 5.7%, while it is almost 20% in rural provinces.

[22] We do not find any significant regional differences when we allow the effect to vary by gender of the

[23] We do not observe any difference either when we allow for a different birth order and first born effect for self-employed farmers (landowners). Results available upon request.

		(0.014)		(0.008)
First born*Modern agricultural		0.027		-0.026*
		(0.027)		(0.015)
First born*Rural region		-0.014		-0.024**
		(0.017)		(0.010)
Last born		-0.000		0.013
		(0.015)		(0.008)
Last born*Modern agricultural		0.035		0.007
		(0.028)		(0.016)
Last born*Rural region		0.012		-0.007
		(0.018)		(0.011)
N	27389	27389	27389	27389
F-stat	4.206	4.128	6.388	6.208
Panel B: City Birth order	-0.008**	-0.004	-0.006***	-0.004*
	(0.003)	(0.004)	(0.002)	(0.002)
Birth order*City	0.000	0.000	-0.001	-0.000
	(0.002)	(0.003)	(0.001)	(0.002)
First born child		0.024**		0.007
		(0.010)		(0.006)
First born*City		-0.004		0.008
		(0.016)		(0.009)
Last born		0.011		0.012*
		(0.010)		(0.006)
Last born*City		-0.005		-0.002
		(0.019)		(0.011)
N	27389	27389	27389	27389
F-stat	4.207	4.154	6.434	6.309

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies, and family (father)

dummies. Regression in Panel B controls for whether the location was considered a city in the first 1849 Dutch census.

Panel B of Table 6 includes interactions with whether the location of birth was considered a city in the 1849 census. It classifies 87 municipalities as cities, with an average population of over twelve thousand inhabitants. The results are consistent with more developed, less agricultural areas showing a stronger effect for first born when occupation percentiles are considered. These results taken together suggest that the birth order effect (particularly the first born advantage) may be driven by more developed areas, at least movements within manual or non-manual occupations.

4.2.4 Religion

The Netherlands presents a sharp geographical division and variation in its religious distribution. Over 96% of the population, according to the 1849 Dutch census, report being either protestant or catholic. Given the evidence of an increased human capital investment by protestants (Becker and Woessmann, 2009), we explore birth order effects by both the majority religion in the region and the family's declared religion.

The religious composition of the Netherlands is strongly determined by history and geography. Figure 2 presents the share of protestant population in each municipality in the 1849 Dutch Census. The southern provinces of Limburg and Noord-Brabant are predominantly catholic, while the highest concentration of protestants can be seen in the so-called Bible Belt. The north of the country is more mixed but still predominantly protestant. Note that while catholic regions tend to be agricultural, protestant areas include all type of provinces. Furthermore, this religious composition allows us to examine separately the effect of the majority religion and the individual's own reported religion[24]. For the purpose of this analysis, we will consider Limburg and Noord-Brabant as the catholic region and the rest, except Gelderland, as the protestant region[25]. As shown in Table 1, while 80% of our sample live in the protestant area, only around 45% of the sample declare being protestant.

[24] Unfortunately religion was voluntary reported and marriages were all civil ceremonies, therefore this variable might suffer from measurement error. We do not see a reason why religious reporting should be systematically related to birth order.

[25] Gelderland, the region right above Noord-Brabant, includes Catholic and Protestant areas. We perform robustness checks in which Gelderland is considered catholic or protestant. Results are robust to either specification.

Table 7 presents the birth order effect by religion. Panel A divides the sample by whether the individual reports being Protestant or Catholic in odd and even columns, respectively. Panel B presents our results by the majority religion in the region they were born in. We observe evidence of a differential effect, particularly for our more informative measure, occupational percentile. The majority religion, Protestants appear to have stronger differences by order of birth, with first borns enjoying a 1.8 percentiles higher occupational than their counterparts. This results hold in Panel B where we use the main religion in the region individuals where born.

Table 7: Birth Order Effect and Religion

	P(Non-manual occupation)		Occupation percentile	
	(1)	(2)	(3)	(4)
	Protestants	Catholics	Protestants	Catholics
Panel A: Religion by individual				
First born child	0.028**	0.015	0.018**	-0.006
	(0.013)	(0.015)	(0.007)	(0.009)
Birth order	-0.006	-0.003	-0.005	-0.005
	(0.005)	(0.005)	(0.003)	(0.004)
Last born	0.018	-0.005	0.010	0.004
	(0.012)	(0.014)	(0.007)	(0.009)
N	16896	9846	16896	9846
F-stat	3.324	2.029	4.734	3.237
Panel B: Religion by region First born child	0.026**	0.004	0.015**	-0.008
	(0.011)	(0.017)	(0.007)	(0.011)
Birth order	-0.007	-0.002	-0.005*	-0.002
	(0.004)	(0.006)	(0.003)	(0.004)
Last born	0.008	0.015	0.010	0.008
	(0.011)	(0.019)	(0.006)	(0.011)
N	21590	5152	21590	5152
F-stat	4.288	8.42e+10	5.705	1.32e+08

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for age difference with immediately older sibling, year of birth dummies, region of birth dummies and family (father) dummies. To ensure a sufficient number of observations per year, particularly in catholic regions, the sample is restricted to individuals born after 1855. We drop 646 observations, with only 96 of them coming from catholic regions.

Becker and Woessmann (2009) show that in late 19th Prussia, Protestants had higher literacy rates due to Luther's request for Christians to be able to independently read the Gospel. Consistently, in our data, Catholics have, on average, larger families (8.1 children, compared to 7.3 for protestants). Fathers are less likely to hold non-manual occupations (20 v. 25.6%), but only around half of this difference is explained by differences in location (region). When looking at occupation rank, catholic fathers have 1 percentile lower occupation rank and this difference decreases to 0.5 percentiles when controlling for location.

Therefore, taken together our heterogeneous results are consistent with the findings of birth order inequalities being higher among families coming from more socio-economically advantaged background.

4.3 Birth Order Effects over Time

We have seen a range of socio and family composition sources that exacerbated within-family inequalities back in the 19th century. However, the sharpest changes in the Netherlands occurred over time, with substantial increases in GDP per capita or decreases in the agricultural share. Hence, we now turn to the analysis of the evolution over time of the differences between children of the same family.

We run our preferred specifications allowing our measures of order of birth to vary over time. Since our sample is limited in size, we group observations by groups of five years.

$$\begin{aligned} y_{ifcr} =& \alpha + \sum_{j=1860}^{1920} \beta_j \text{first born} * 1 * (\text{lustrum of birth=j}) \\ &+ \sum_{j=1860}^{1920} \theta_j \text{order of birth} * 1 * (\text{lustrum of birth=j}) \\ &+ \gamma X_{ifcr} + \mu_f + \delta_c + \nu_r + \varepsilon_{ifcr} \end{aligned} \tag{2}$$

For easiness of presentation, Figure 5 presents the evolution over time, in 5 year intervals, of our baseline fixed-effect estimates of the birth order effect. Note that, as in our baseline results, this estimation includes year of birth dummies to control for changes that may be occurring over time and that naturally affect sistematically differently children born later in time and therefore with a higher birth order in the

family. Hence, changes captured here identify only changes over in the relationship between birth order effect and adult outcomes.

We observe a decrease on the negative effect over time, particularly in the first part of the period, before the 1880s. From then, the birth order effect appears quite stable, and substantially smaller than during the first period. Both the probability of holding a nonmanual occupation and the occupation percentile appear to follow a very similar pattern. Interestingly, while the overall evolution of Dutch growth, as shown in Figure A.1, does not map the evolution of the birth order effect.

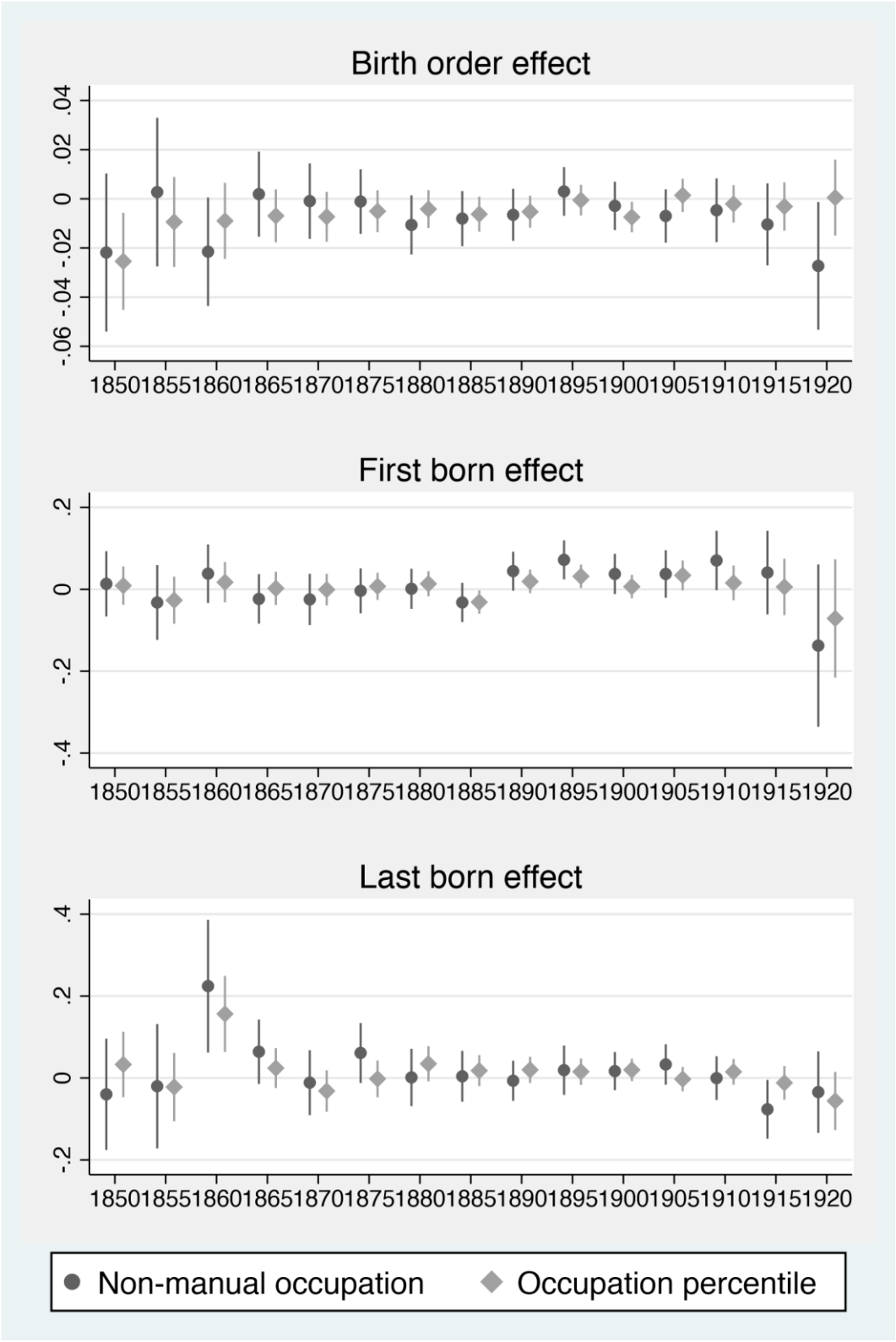

Figure 5: Birth Order effect for men's probability of non-manual occupation and occupation percentile by year of birth (five year groups)

We summarise the evolution of the birth effect by looking at the linear coefficient of year. We follow Donald and Lang (2007) to correct the standard errors by first estimating the birth order effect yearly instead of 5-year effects in Equation 2 separately by location type and second, the coefficients of interest in equations 3 and 4 of the interactions of years with first-born and order of birth, respectively.

$$\hat{\theta}_j = \pi_0 + \pi_1 \text{year of birth}_j + \epsilon_j \tag{3}$$

$$\hat{\lambda}_j = \phi_0 + \phi_1 \text{year of birth}_j + u_j \tag{4}$$

Table 8 presents the results of the second stage for the entire sample, by type of region and by urban/rural location. The first panel presents our baseline specification with the whole sample and the remainder of the rows present results by subsamples born in different geographical types of areas. We focus on the broad distinction of rural versus urban definition because only 14% of the sample belongs to a modern agricultural area and city versus not in a city. Consistent with previous results, first-borns boys are benefiting more over time of their lowest order of birth (Panel A).

Table 8: Birth Order Effect over Time: Second Stage

	P(Non-manual occupation)			Occupation percentile		
	First born	*Birth order*	*Last born*	*First born*	*Birth order*	*Last born*
Panel A: entire sample						
Year of birth	0.0007	0.0000	-0.0018***	-0.0002	0.0002***	-0.0006
	(0.0006)	(0.0001)	(0.0007)	(0.0005)	(0.0000)	(0.0005)
N	61	61	61	61	61	61
Panel B: urban regions						
Year of birth	0.0040***	0.0001	-0.0021	-0.0002	0.0001	-0.0018*
	(0.0015)	(0.0002)	(0.0017)	(0.0008)	(0.0002)	(0.0010)
N	61	61	61	61	61	61
Panel C: non-urban regions						
Year of birth	0.0007	-0.0001	-0.0019**	0.0002	0.0001*	-0.0003
	(0.0010)	(0.0002)	(0.0009)	(0.0006)	(0.0001)	(0.0006)
N	61	61	61	61	61	61

Panel D: cities						
Year of birth	0.0026**	0.0002	-0.0020	-0.0001	0.0001	-0.0005
	(0.0012)	(0.0002)	(0.0016)	(0.0012)	(0.0001)	(0.0009)
N	61	61	61	61	61	61
Panel E: not in cities						
Year of birth	0.0000	0.0000	-0.0011	-0.0000	0.0001*	-0.0007
	(0.0009)	(0.0002)	(0.0011)	(0.0006)	(0.0001)	(0.0007)
N	61	61	61	61	61	61

Note: Second stage estimates of linear yearly effects. Corrected standard errors in parentheses following Donald & Lang (2007).

Interestingly, over time, the first-born advantage seems to be growing faster among urban regions and cities, where the industrial sector was located and where most of the economic growth in the Netherlands was coming coming from over the period of study (Griffiths and de Jong, 2002). This result can help understand the differences found in previous literature in birth order effects between developed and developing countries.

5. Discussion

We have studied the existence of the birth order effect in a historical context, namely, 19th and early 20th century Netherlands, to learn if the large within-families differences observed by order of birth are a modern phenomenon. Further, we highlight the role of family composition and socio-economic circumstances in modulating birth order differences, and the evolution of this source of family inequality as a country develops to discern its possible drivers.

Taking advantage of a quite unique dataset of family-linked administrative records including information on occupation covering from 1838 to 1922, we report a persistent relationship between occupation quality and order of birth. Men born later in the family show a higher probability of holding a manual occupation or a lower ranked one and the more male siblings, the larger the negative effect. This is line with the result from previous results in developed countries. One result, however, is consistent with heterogeneous effects in developed countries. The first born son, appears to concentrate most of this advantage, with much smaller differences between younger brothers. This first son preference has been reported in the birth order literature for developing countries like India, suggesting an evolving nature of this relationship.

Furthermore, results by family composition and socio-economic circumstances reveal informative heterogeneous patterns. We find stronger birth order effects among children with fathers with a better occupation themselves, and in areas that are more economically developed, particularly more urban provinces (North and South Holland) and cities.

Over time, the Netherlands experienced sharp economic growth, so the evolution of the differences by order of birth over time during our period of study may also be informative of the relationship between economic growth and this source of within-family differences. Interestingly, we observe a trend towards a stronger first born effect on urban areas more intense industry, the main driver of economic growth over the period.

These results taken together suggest that, on the one hand, economic growth does not to explain differences in birth order effects between developed and emerging countries. On the other hand, more advantaged families located with more male children, in richer areas and with more resources, might make even more differences among their children and exacerbate birth order effects in adult economic outcomes of younger generations.

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Appendix

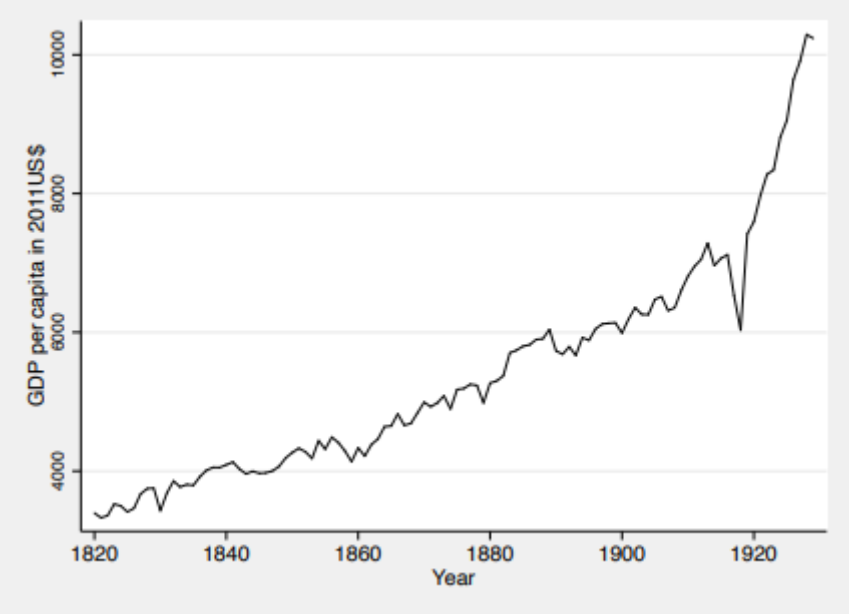

Figure A.1: Dutch GDP per capita over time (Maddison Data Project)

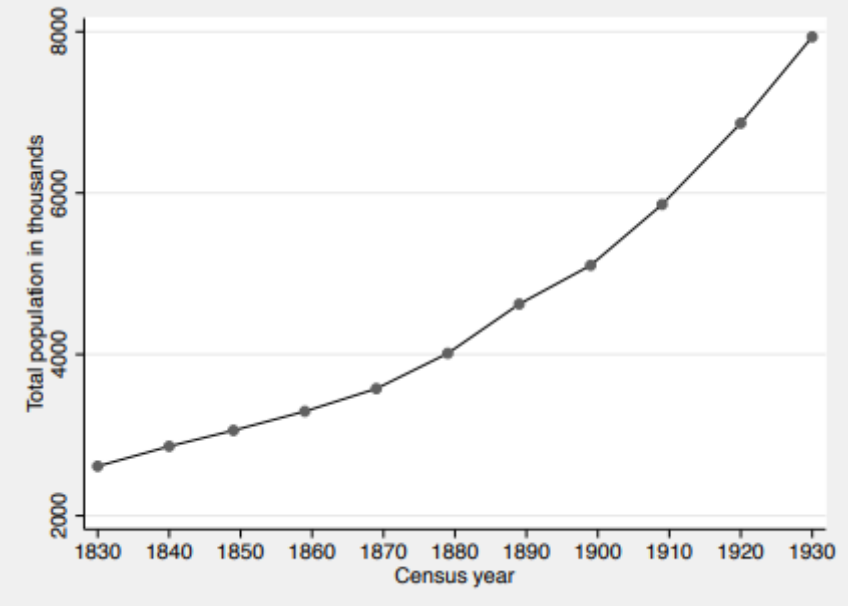

Figure A.2: Dutch population over time (Dutch Census)

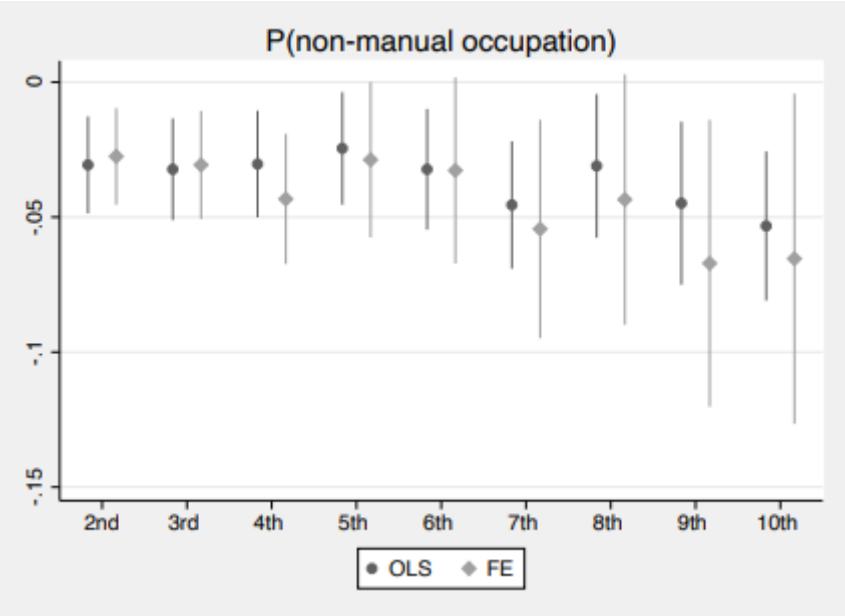

Figure A.3: Differences by order of birth on the probability of holding a non-manual occupation

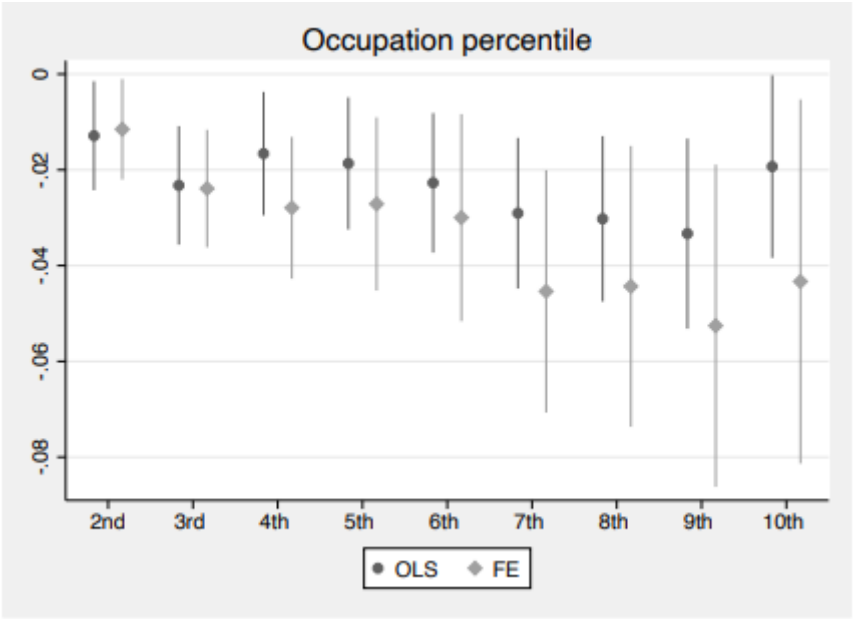

Figure A.4: Differences by order of birth on the occupation percentile rank

Figure A.5: Municipalities under a modified Saxon inheritance rule

Table A1: Birth Order Effect by Family Size

	Less than 5	Between 5 and 7	Between 7 and 10	More than 10
	(1)	(2)	(3)	(4)
Birth order	-0.016	-0.001	-0.004	-0.003
	(0.011)	(0.008)	(0.007)	(0.005)
N	5116	6197	6871	9205
F-stat	1.655	2.094	2.194	2.493
Birth order	-0.016***	-0.004	-0.001	-0.006*
	(0.006)	(0.005)	(0.004)	(0.003)
N	5116	6197	6871	9205
F-stat	2.287	2.167	2.725	3.099
First born child	0.018	0.048**	0.014	0.007
	(0.024)	(0.020)	(0.018)	(0.013)
Birth order	-0.010	0.010	-0.002	-0.003
	(0.013)	(0.009)	(0.007)	(0.005)
N	5116	6197	6871	9202
F-stat	1.617	.	.	.

First born child	-0.009	0.020	0.015	0.012
	(0.014)	(0.012)	(0.011)	(0.009)
Birth order	-0.019**	0.001	0.002	-0.005
	(0.008)	(0.006)	(0.005)	(0.003)
N	5116	6197	6871	9202
F-stat	6.353	.	.	.

Table A2: Birth Order Effect using Booth and Kee Index (2009)

	P(Non-manual occupation)	Occupation percentile
	(1)	(2)
Table A: Birth order index Birth order index	-0.011	-0.020**
	(0.014)	(0.009)
N	27389	27389
F-stat	4.225	6.423
Panel B: Parental occupation interactions		
Birth order index	-0.002	0.006
	(0.014)	(0.011)
Birth order index*Non-manual father	-0.032**	
	(0.014)	
Birth order index*Father occupation percentile		-0.050***
		(0.013)
N	27389	27389
F-stat	4.269	6.485
Panel C: Type of region interactions Birth order index*Urban	-0.027*	-0.025**
	(0.016)	(0.010)
Birth order index*Rural	-0.002	-0.021**
	(0.015)	(0.009)
Birth order index*Modern Agricultural	-0.014	-0.019
	(0.020)	(0.012)
N	27229	27229
F-stat	3.412	5.074

Note: Robust standard errors clustered at the father level in parentheses. All regressions control for age difference with immediately older sibling, region of birth dummies, and family (father) fixed effects.

Table A3: Birth Order Effect by Parental Background, excluding Saxon regions.

	P(Non-manual occupation)		Occupation percentile	
	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)
Birth order	-0.003**	-0.008**	-0.002***	-0.006***
	(0.001)	(0.003)	(0.001)	(0.002)
N	24247	24247	24247	24247
F-stat	9.303	3.263	9.178	4.883
No. older brothers	-0.001	-0.011***	-0.002	-0.008***
	(0.002)	(0.004)	(0.001)	(0.003)
No. older sisters	-0.004*	-0.003	-0.003*	-0.002
	(0.002)	(0.005)	(0.002)	(0.003)
N	24247	24247	24247	24247
F-stat	9.211	3.259	9.104	4.888
First born child	0.003	0.016**	0.004	0.011**
	(0.008)	(0.008)	(0.005)	(0.005)
Birth order	-0.002*	-0.007**	-0.002**	-0.006**
	(0.001)	(0.003)	(0.001)	(0.002)
N	24247	24247	24247	24247
F-stat	9.270	3.275	9.108	4.881

Note: Robust standard errors clustered at the father level are included in parentheses. All regressions control for year of birth dummies, region of birth dummies. Fixed-effects regressions control for family (father) dummies.