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Abstract

Children early in the birth order get more parental care than later children. Does this significantly affect their life chances? An extensive genealogy of 428,280 English people 1680-2024, with substantial sets of complete families, suggests that birth order had little effect on social outcomes either for contemporary outcomes, or in earlier centuries. For a small group of elite families in the nineteenth century and earlier, the oldest son was advantaged in terms of wealth, education, and occupational status. But even in this elite group, among later sons, birth order had no effect. We consider in the paper how the absence of birth order effects in England can be reconciled with reports of substantial negative birth order effects for modern Nordic countries.

JEL Codes: J24, J62, N33, N34

Keywords: Human Capital Formation, Birth Order, Intergenerational Mobility

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There has been a long debate in psychology, and also in economics, initiated by Francis Galton in 1874, about whether birth order significantly affects psychological and social outcomes. Galton famously claimed that 48% of famous English scientists were the first-born son in their family, while by chance that number should be no more than 33%.[2]

There are clear signs that as birth order increases, parental attention per child diminishes. Buckles and Kolka, 2014, for example, show within families that mothers are more likely to seek prenatal care, take prenatal vitamins, and breast feed for children earlier in the birth order. Price, 2008, showed for the USA 2003-5, using time-use studies, that within families, higher order children got less parental time than those early in the birth order.[3]

Because of the potential confounding effects of birth year and parental age at birth on child outcomes, reliable studies on the effects of birth order have been believed to require data also on birth year and parental age. If the data is from a cross-section of families, there also has to be information on family size.

Thus the preferred estimation using data pooled across families which does not depend on having multiple child observations for the same family would be

$$y_{ij} = \alpha DFEM_{ij} + \sum_l \theta_l DSIZE_{il} + \sum_{ij} \beta_j DBORDER_{ij} + \sum_{ijk} \gamma_h DPARAGE_{ijh} + \sum_{ijk} \delta_k DBYR_k + e_{hijhk} \quad (1)$$

[2] Galton, 1874. Assuming average pre-industrial family size was 6, the eldest son would on average be one of 3 sons.

[3] Price, 2008, table 2. Notably the Price, 2008, data suggests that for a given birth order, children in larger families get more parental time. This presumably driven by differences

where *y* is a social outcome such as IQ, or years of education, or income, *DFEM* is an indictor for female, DSIZE are indicators for each family size, DBORDER are indicator for birth order, DPARAGE are indicators for average parent age at birth (in years), and DBYR are indicators for child year of birth. *i* indexes families, *j* indexes child order, *k* indexes birth year, and h indexes average parent age at birth in years.

Where we have multiple observations from the same family, we can also estimate, using family fixed effects,

$$y_{ij} = \alpha DFEM_{ij} + \sum_{ij} \beta_j DBORDER_{ij} + \sum_{ijk} \gamma_h DPARAGE_{ijh} + \sum_{ijk} \delta_k DBYR_k + e_{hijhk} \quad (2)$$

Such comprehensive data on birth order, birth date, family size, and parent ages has limited availability. Consequently high quality studies of birth order effects have largely been conducted only in Nordic countries with comprehensive population registers. Thus for IQ, the large scale, within family, studies of the effects of birth order come from Norway and Sweden (Barclay, 2015, Bjerkedal, et al., 2007, Black, Devereux and Salvanes, 2011), with additional smaller scale studies for England and the USA (Record, McKeown, and Edwards, 1969, Rohrer, Egloff, and Schmukle. 2015). For educational attainment the only large-scale studies are for Norway and Denmark (Black, Devereux and Salvanes, 2005, Kristensen and Bjerkedal, 2010, Bagger et al., 2021).

These studies consistently report negative birth order effects which are quantitatively and statistically significant.

between parents having small versus large families. But that would suggest in the modern era that we might even find a positive family size effect.

Here we are able, using a large-scale genealogical database with 428,280 individuals born 1600-2024, to study the effects of birth order in England for those born 1680-1999. We find, however, that implementing the estimations (1) and (2) frequently results in clearly spurious negative birth order effects. These birth order effects appear only where, for example, the estimated birth year effects are clearly impossible. Or they appear only with offsetting, positive parental age effects, so that the net effect of birth order is close to 0. If we instead de-trend the outcome data in advance, and restrict the estimation so that we estimate a net birth order effect that incorporates also any parent age effects, we find 0 birth order effects systematically.[4]

We conclude that not only is there little sign of birth order effects in England, but that there is significant possibility that the negative birth order effects estimated for modern Nordic countries, and also recently for the UK, are also artifacts.

Birth Order in England

There are few studies of the effects of birth order on modern social outcomes in England. Other than two modern IQ studies mentioned above the only other substantial work on birth order effects in England has been for the pre-industrial period. Patrick Wallis and Cliff Webb assembled a sample of 2,231 sons from gentry families born 1550-1699, where for 29% there is data on their education and training.[5] They find the oldest son has a significantly higher chance of attending Oxford or Cambridge, or of undertaking legal training at the Inns of Court (42% versus 21% for other sons). They find later sons are more likely to be apprenticed (14% versus 4% for the oldest son).[6]

Here we use a large scale of genealogy of English families 1680-2024, *Families of England* (FOE), to measure the effects of birth order on social outcomes. The genealogy was constructed by following every known individual in a set of English families with rare surnames. In the genealogy there are 180,758 individuals

[4] With an exception that for upper class families before WWII there does seem to be a positive oldest son effect. This we discuss more below.
[5] Wallis and Webb, 2011, table 1.
[6] Wallis and Webb, 2011, table 3.

where we know both their sibship size, and their birth order. Sibship size is measured here as the number of children a given father has.[7]

For the modern era, those born 1900 and later, we have four social outcomes. For those living until 1999-2024 we get their address if they are a registered voter. From this we can infer the average house value and the index of multiple deprivation (IMD) for their local area. We also have estimates of whether they ever enrolled at Oxford or Cambridge. Again for those living to 1999-2024 we observe whether they were ever a company director in this period.

For house value and IMD individuals are only included if they are aged 24+ at the time of observation in the electoral register, and lived at a separate address from their parents. Only people born 1999 and earlier were included in the company director measure.

From the land registry we observe house sale prices 1996-2016. We can thus calculate for each post code, which typically covers 30 houses, an average house value.[8] We also know for their local area, an area covering typically 1,000 houses, the index of multiple deprivation, a measure of the average social status of the local neighborhood.[9] Table 2 shows the data available for these two measures by birth order and sibship size, for birth orders and sibships 1-6+. Birth order and family sizes greater than 6 are set to 6.

For earlier years, 1680-1929 we have information on the occupational status of men around age 40, the attainment of higher education (by men), the literacy of both men and women at marriage 1754-1889, the wealth of both men and women at death, lifespan of both men and women, probability of men attending Oxford or Cambridge, and the probability of being in school or at work aged 10-18 when observed in a census or population register 1851-1921 and 1939.

[7] This is because the genealogy was constructed following all holders of relatively rare surnames, so make identification easier. Since the great majority of men had only one spouse, this provides an unambiguous measure of sibship size in most cases. We did not exclude families with twin births since these are a small share of all families.
[8] We take value by post code, rather than individual house value, to ensure that we get some house sales in the interval 1996-2016 to provide an estimated house value.
[9] https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

Table 1: Data Available in the Families of England Genealogy with Birth Order and Family Size

Outcome	Birth Years	Gender	Number	Average Birth Year
House Value 1999-2024	1910-1999	Both	20,082	1960
Index of Multiple Deprivation	1910-1999	Both	20,148	1960
Company Director	1910-1999	Both	28,144	1960
Oxbridge Attendance	1900-1995	Both	52,815	1938
Occupational Status	1680-1929	Male	37,064	1865
Higher Education	1680-1929	Male	36,761	1865
Oxbridge Attendance	1680-1929	Male	38,844	1865
Literacy at Marriage	1720-1873	Both	7,093	1828
At School, Work 10-18	1833-1929	Both	27,535	1874
Wealth at Death (21+)	1800-1929	Both	41,961	1874
Longevity (aged 21+)	1780-1919	Both	54,858	1864

Table 2: House Value and IMD by birth order and family size, 1910-1999

Size	1	2	3	4	5	6+
1	2,023					
2	3,169	3,145				
3	1,634	1,614	1,666			
4	675	690	734	777		
5	278	283	314	338	360	
6+	242	285	270	314	334	1,056
All	8,021	6,017	2,984	1,429	694	1,056

Notes: Birth order and family sizes 7 and above included in the 6+ category. Individuals were included only if aged 24+ when observed in the electoral register, and not living with their parents.

Table 1 shows the number of observations by type and by birth interval. The genealogy consists of 3 subgroups based on surname average wealth in the mid-nineteenth century: surnames of average wealth, those of moderately high wealth, and those of high wealth. But the process of regression to the mean means that by 2000 the average status of all three groups was close to the social average.

Contemporary Data

For the contemporary data we simplify estimation (1), the cross-section estimates to

$$y_{ijk} = \alpha DFEM_{ij} + \beta_0 FSIZE_{ij} + \beta_1 BORDER_{ij} + \beta_2 PARAGE_{ij} + \sum_{ijk} \delta_k DBYR_k + e_{ijk} \quad (1a)$$

Similarly we simplify (2) to

$$y_{ijk} = \alpha DFEM_{ij} + \beta_1 BORDER_{ij} + \beta_2 PARAGE_{ij} + \sum_{ijk} \delta_k DBYR_k + e_{ijk} \quad (2a)$$

where *BORDER* = birth order, *FSIZE* = family size, PARAGE = average parent age at birth, *DFEM* = 1 if female, and DBYR is an indicator for year of birth. *i* indexes fathers, *j* indexes children, and *k* indexes birth year.

We estimate, in particular, parent age effects not through a set of indicators but in this linear form because it allows for more transparency on how these parent age effects tend to interact with birth order effects in a way that offsets birth order effects.

Table 3 shows the results of that cross-section estimation for the logarithm of house value for people observed 1999-2024 using (1a) in columns (1)-(3). We use the log of house value here because the measure itself is highly rightward skewed, which taking the log corrects. It is clear the children of larger families lived in houses of lower value.

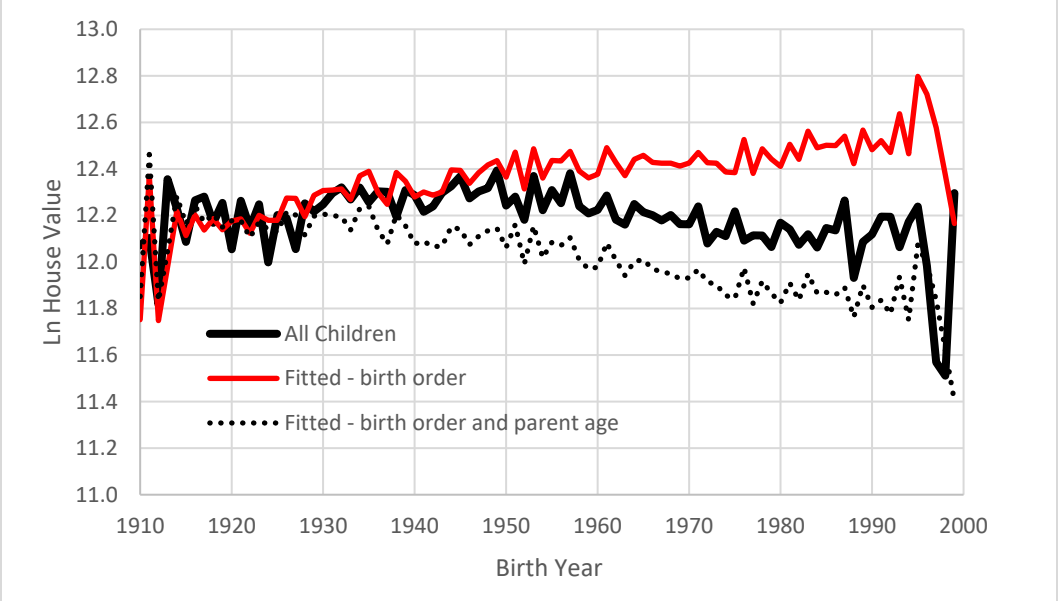
As can be seen in column (3) the pooled estimate (1a) does contain a significant negative birth order effect of 5% on house value for each step increase in birth order. However, interestingly this is combined with an equal and largely offsetting positive parent age effect. Since the average parent age gap between births was 2.93 years for this group the actual net effect of an increase in 1 in birth order was no change in house value This explains why in column (1) and (2), when birth order is included without controls for parent average age, the effect is estimated as zero.

Table 3: Log House Value and Birth Order

	(1)	(2)	(3)	(4)	(5)	(6)
Family Size	-0.037**	-0.044**	-0.021**	-	-	-
	(0.004)	(0.004)	(0.004)			
Birth Order	0.000	0.001	-0.054**	-0.004	-0.018*	-0.021**
	(0.004)	(0.004)	(0.005)	(0.004)	(0.008)	(0.008)
Parent Age	-	-	0.019**	-	-	0.011
			(0.001)			(0.008)
Birth Date	No	Yes	Yes	No	Yes	Yes
Fixed Effects	No	No	No	Yes	Yes	Yes
N	19,066	19,066	18,771	19,066	19,066	18,771

Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

Figure 1: Birth Year Effects underlying Birth Order Effects, Log House Value



Notes: The black line shows average log house value (lhv) by birth year for all children. The red line shows the estimated lhv by birth year where just birth order is included as a control in equation (2a). The dashed line shows estimated lhv where birth order and parent age are included.

The fixed family effects estimate (2a) shown in column (6) again finds negative and statistically significant birth order effects, but again completely counterbalanced by positive parent age effects, so that the net effect of being one higher in birth order is an increase of 1% in house value.

Since birth spacing differs across and within families it is possible that there are significant and important birth order and parent age effects. However, an examination of the fitted birth year effects for table 3 suggests that these results are likely an artifact of the regression method, as opposed to real birth order and parent age effects. Figure 1 shows three sets of birth year effects. The first is just the average across all births of ln house value by birth year (controlling for gender).

The raw data suggests that there was little difference in average house value by birth year 1910-1999 as a function of birth year. The other two curves in figure 1 show the fitted birth order effects from columns (5) and (6) in table 3. Note in both cases how birth year effects are very different from those in the raw data. For column (5) where the net birth order effect is significantly negative the underlying birth year effect shows a strong offsetting positive trend. In column (6) where the net birth order effect is significantly positive the birth order effect in contrast shows a strong negative trend. For these fitted birth year effects to align with the actual average log house value by birth year there would need to be big underlying positive or negative trends in the fixed effects by household. Given the nature of the data, which look at all descendants of each generation, there is no expectation of any such trends.

If we instead remove time trends by first detrending log house value using average log house value by first born children by year, controlling for gender, then we get the estimates shown in table 4.[10] The net effect of birth order is 0 (columns (1) and (3)). Again however, if we add parent age to the regression we again find a significant negative effect from birth order that is almost exactly counterbalanced by a positive parent age effect. Thus the net effect of birth order in column (2) is +0.003, and in column (4) +0.006. The conclusion here is that the fact that these birth order and parent age effects often exactly cancel each other out is strong suggestion that they are an artifact of the regression estimates, and not real world effects.

[10] We use first born children rather than all children in case there are significant adverse birth order effects.

Table 4: Detrended Log House Value and Birth Order Effects

	(1)	(2)	(3)	(4)
Family Size	-0.044**	-0.024**	-	-
	(0.004)	(0.004)		
Birth Order	0.000	-0.050**	0.004	-0.022**
	(0.004)	(0.005)	(0.004)	(0.008)
Parent Age	-	0.018**	-	0.009**
		(0.001)		(0.003)
Fixed Effects	No	No	Yes	Yes
N	19,066	18,771	19,066	18,771

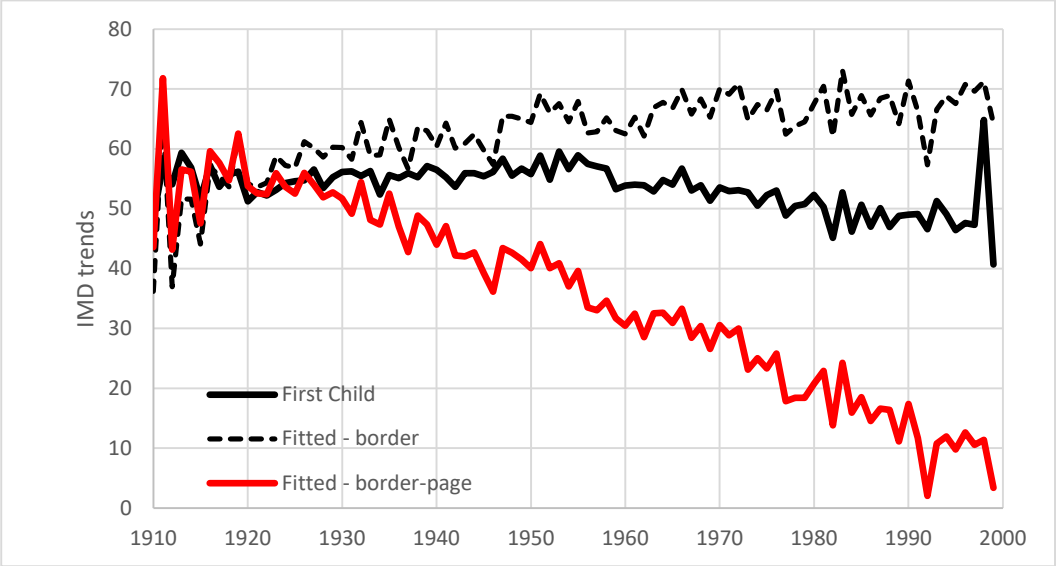
Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

Table 5: Index of Multiple Deprivation and Birth Order

	(1)	(2)	(3)	(4)	(5)	(6)
Family Size	-2.151**	-2.429**	-1.952**	-	-	-
	(0.160)	(0.163)	(0.173)			
Birth Order	0.411*	0.449**	-0.712**	0.015	-0.586	-0.754
	(0.173)	(0.173)	(0.219)	(0.200)	(0.405)	(0.417)
Parent Age			0.413**			0.894*
			(0.046)			(0.378)
Birth Date	No	Yes	Yes	No	Yes	Yes
Fixed Effects	No	No	No	Yes	Yes	Yes
N	19,128	19,128	18,833	19,128	19,128	18,833

Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

Figure 2: Average versus fitted birth year effects, IMD



Notes: The black line shows the average index of multiple deprivation (IMD) by birth year for first children. The dashed line shows the estimated IMD birth year effects where just birth order is included in equation (2a). The red line shows IMD effects where birth order and parent age are included in (2a).

The Index of Multiple Deprivation (IMD) ranks local areas of about 1,000 households on average by multiple measures of the quality of life, such as education, crime, employment, and health. The index for England is given as an ordinal rankin of 32,844 areas in terms of most to least deprived. This we have converted into a 0-100 scale, where higher on this scale is less deprived.[11]

Table 5 shows the same set of estimates for birth order and the index of multiple deprivation as was done in table 3 for log house value. In columns (3) and (6) we observe again negative birth order effects once parental age is included. But in both cases the net effect of birth order would be positive.

However, if we examine the estimated birth year effects for the estimates in columns (5) and (6) we find both to be clearly implausible. For column (6), for example, the average person moves from being born in a district close to average in terms of IMD, to being by the 1990s only around the bottom 10% on this measure. Clearly again these estimates are artifacts.

[11] There are separate rankings for Wales and Scotland. We convert those into an English equivalent ranking by assuming the Scottish and English means are the same, and that the Welsh mean is the same as the North of England mean.

Table 6: Detrended IMD and Birth Order Effects

	(1)	(2)	(3)	(4)
Family Size	-2.403**	-1.985**	-	-
	(0.160)	(0.168)		
Birth Order	0.440*	-0.660**	0.275	-0.701
	(0.173)	(0.216)	(0.201)	(0.418)
Parent Age	-	0.394**	-	0.359**
		(0.045)		(0.130)
Fixed Effects	No	No	Yes	Yes
N	19,128	18,833	19,128	18,833

Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

If as in table 4 we create a detrended IMD variable, which for each year is the IMD value minus the estimated average IMD by year for first born children (controlling for gender), then we get the results reported in table 6. Where just birth order in included, so that we get the net effects of birth order, there is a significant positive effect estimated in cross-section, but no significant effect with the family fixed effects estimation. However, as with log house value, when we include parental age, that parental age effect is significant and positive, but coupled with a negative birth order effect. The net effect of birth order is in both cross section and with fixed effects positive. Though since this variable has a range of 0-100, the net effect of an increase in 1 in birth order of 0.28-0.44 is still modest, and of no or marginal statistical significance.

For the following estimates, given that internally estimated birth year effects are frequently impossible artifacts, we detrend all the outcome measures using the yearly fixed effects observed for first children.

A third modern measure we have of social outcomes is whether or not a person alive until 2000 or later was ever a company director. The UK Companies Register in 2022 contained 4.9 million companies, 96% of which were private limited companies.[12] These companies encompass property management companies, charities, clubs, medical practices, consultancies, and partnerships. In the FOE data being a company director is strongly positively associated with other measures of status such as house value, or the Index of Multiple Deprivation for the local area.

Since the Companies Register lists all company officers, and their date of birth, including for companies that have ceased to trade, we can establish for most people in the FOE genealogy who lived beyond the year 2000 whether they were ever a company director. We get observations on company director status for 26,408 persons with a known birth order and family size for those born 1910-1999. Overall 13.4% of this group were company directors. But the likelihood of being a company director followed an inverse U-shape with year of birth, being 2% for those born in the 1910s, 18% for those born in the 1960s, and 8% for those born in the 1990s.

Table 7 shows the estimates for the effects of birth order on being a company director, detrending the outcomes using the average outcome by year for first-born children (controlling for gender).[13] In this case we do observe a consistent negative birth order effect. There is a decline with each 1 unit increase in birth order of 0.7% in the chance of being a company director. As above, in the cross section estimates the addition of average parent age causes the estimated effect of birth order alone to become much stronger. But the net effect of birth order, factoring in the positive effects of parental age, are again around 0.7%.

[12] https://www.gov.uk/government/statistics/companies-register-activities-statistical-release-2021-to-2022/companies-register-activities-2021-to-2022

[13] Since the dependent variable is 0-1 technically this should not be an OLS regression but a Logit. But OLS will capture well any birth order effects, and is easy to interpret. The logit results are similar qualitatively.

Table 7: Detrended Company Director and Birth Order

	(1)	(2)	(3)	(4)
Family Size	-0.0044**	0.0002	-	-
	(0.0014)	(0.0015)		
Birth Order	-0.0063**	-0.0179**	-0.0072**	-0.0062
	(0.0016)	(0.0021)	(0.0019)	(0.0038)
Parent Age		0.0040**		-0.0005
		(0.0005)		(0.0012)
Fixed Effects	No	No	Yes	Yes
N	26,408	25,677	26,408	25,677

Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

Table 8: Detrended Oxbridge and Birth Order

	(1)	(2)	(3)	(4)
Family Size	-0.0015**	-0.0002	-	-
	(0.0002)	(0.0002)		
Birth Order	-0.0002	-0.0036**	-0.0003	-0.0001
	(0.0003)	(0.0004)	(0.0003)	(0.0006)
Parent Age		0.0013**		0.0001
		(0.0001)		(0.0002)
Fixed Effects	No	No	Yes	Yes
N	49,591	48,615	49,591	48,615

Notes: All specifications include an indicator for female. Standard errors clustered by father. **Significant at 1% level, * significant at 5% level.

A fourth modern measure we have for the effects of birth order is the frequency with which people attended the two elite universities of Oxford and Cambridge. This we measure for those born 1900-1995 in England or Wales. We observe a total of 49,591 such persons with birth order and family size. In this genealogy 1.13% of persons born in England in these years attended one of these universities.

Table 8 shows the between and within family effects of birth order on this outcome across all family sizes, again with detrended data.[14] We include here only persons who lived to at least age 21. There is no sign of any reduction in Oxbridge attendance from birth order, when we consider the net effect of birth order.

Figure 3 summarizes the net effect of birth order on five social outcomes – house value, log house value, the index of multiple deprivation, company directorships, and Oxbridge attendance – where the estimate is made with family fixed effects, detrended outputs, and just gender and birth order as independent variables.

Only one of the birth order effects is significantly negative statistically. But the more important point is the tiny size of these birth order effects relative to the variance of the outcome in the population. The largest point estimates, for being a company director, are that a one-step increase in birth order will reduce the outcome by 0.02 of a standard deviation. Going from birth order 1 to 6 reduces these outcomes by at most 0.1 of a standard deviation.

Other Estimates of Contemporary Birth Order Effects

Figure 3 also shows the effect of birth order on years of education estimated for modern Norway by Black et al. 2005. Here the estimated effects are much greater. On average 1 step up in birth order reduces years of education by 0.1 of a standard deviation. However, the Norwegian estimates where the cross-section estimator (1) is used show exactly the feature above that positive mother age effects cancel negative birth order effects. This is shown in figure 4, which shows the estimated birth order effect as well as the estimated mother age effect for each birth order relative to the first child.[15] As can be seen the net effect of birth order then turns out to average close to 0 across all birth orders.

[14] Again this should technically be a Logit regression.

[15] The mother age effects are not reported in the paper, but were generously communicated by the authors.

Figure 3: Summary of Modern Birth Order Effects, England and Wales

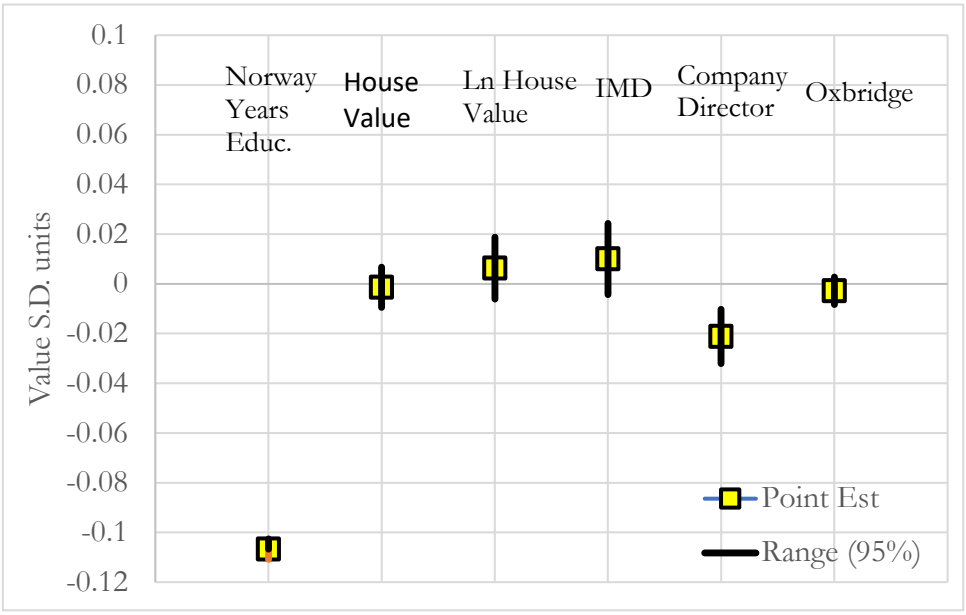
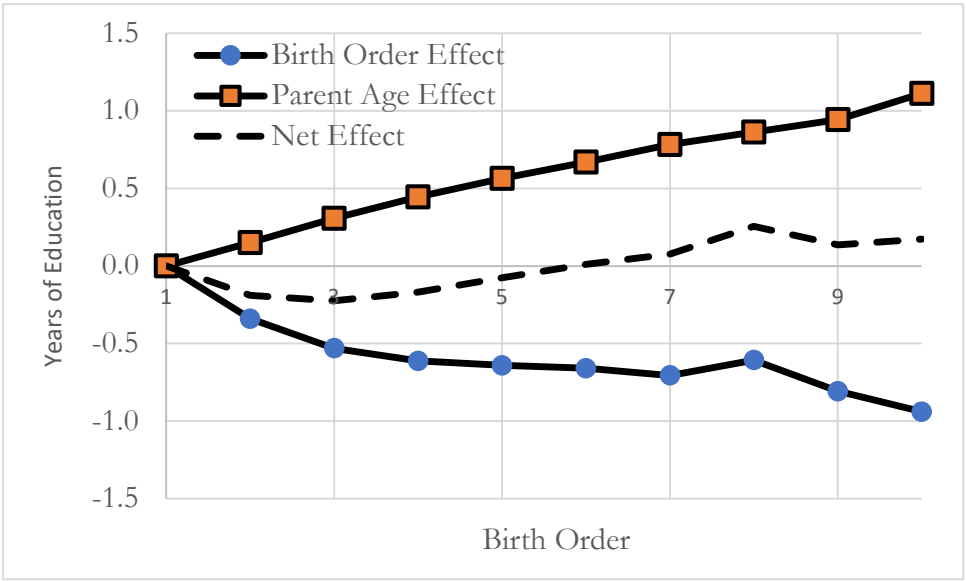
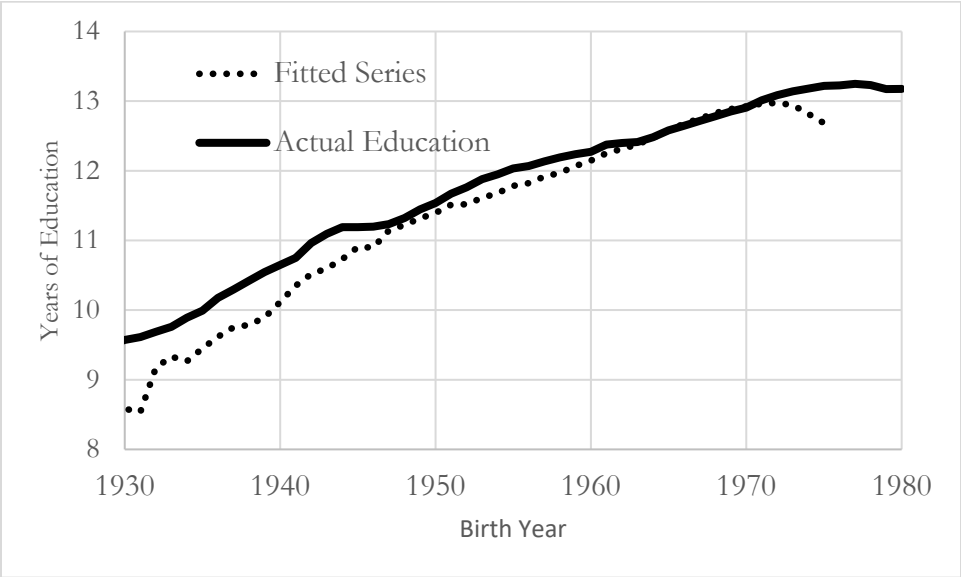


Figure 4: Birth Order and Mother Age Effects on Years of Education in Norway



Notes: Birth order effects from Black et al., 2005, table --. Mother age effects personal communication from authors.

Figure 5: Years of Education by birth year, Norway



In the within family estimator (2) the Black et al. 2005 paper does not, for reasons which are unclear now to the authors, include parent age effects.[16] But the estimated birth year fixed effects on years of education are again different from average years of education by birth year in Norway reported in other sources. This is shown in figure 5. The estimated gain in years of education is greater in the Black et al. estimates than for the population as a whole. This means that to fit the population data there have to be some negative birth order effects. Also there is sign in the years 1970-75 of truncation in reported years of education for those born in the last years of the sample period 1928-1975. These will by necessity be children above 1 in birth order. This again will generate some of the negative birth order effects.

Another issue with the Blanc et al. results is that in the cross-section estimate, equation (1), the net effect of birth order is close to zero (figure 4). This implies that in the time series estimates, equation (2), with mother age omitted, we would expect to observe just this net effect of close to zero. But instead we get a birth order effect that is substantial and negative.

[16] Personal communication.

Table 9: UK Biobank Birth Order Effects

Outcome	University (0-1)	Income (£ 000)	IQ (0-13)	Height (cm)	BMI	Health (0-4)
Birth Order	-0.079**	-1.090**	-0.273**	-0.701**	0.191**	-0.043**
	(0.007)	(.0426)	(0.030)	(0.136)	(0.066)	(0.010)
Parent Age	0.016**	0.262**	0.059**	0.151**	-0.099**	0.011**
	(0.001)	(0.072)	(0.005)	(0.024)	(0.012)	(0.002)
Birth Date	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,220	3,412	10,220	10,220	10,220	10,220

Notes: ** indicates significant at the 1% level. All estimations include controls for birth date and family size, as well as a polygenic educational attainment score.

Source: Abdellaoui et al. 2022, table 1.

Abdellaoui et al., 2022, use the UK Biobank data to investigate the effects of birth order on marital assortment for individuals born 1935-1970. As table 9 shows this source has a rich set of social and health outcomes for individuals. This data records for participants their family size and birth order, but does not systematically have within-family data. Thus it is only possible to implement the between family estimator (1a). When they effectively estimate expression (1a) Abdellaoui et al. find very strong negative birth order effects on variety of adult outcomes: university attendance, income, IQ, height, BMI, subjective health (table 9). For university attendance, for example, a one step increase in birth order reduces the chance of attendance by 8%. For IQ and height a one-step increase in birth order reduces each by more than 0.1 standard deviations in the outcome.

However in each case parentage age is also highly significant with an opposite effect, and generally with a magnitude of 20-25% of the birth order effect, repeating the patterns we see above in England and Norway. Assuming the age gap between births averages 3 years as in the FOE English data, the net birth order effect would be no more than a quarter of the reported effect. But we do not know how the birth year

controls are operating for each of these estimates. As we saw above that these controls can deviate substantially from population trends in the outcome by birth year.[17]

[17] Abdellaoui et al., 2022, wish to demonstrate that birth order also affects the genetic quality of the marital partner. But again this negative birth order effect in terms of marital match only appears when birth order is combined with parent age (see Abdellaoui et al., 2022, table 2). If we just regress the genetic quality of the match against birth order there is no significant association.

1680-1929, First Born Sons

Were birth order effects substantially greater in the past in England than the present? We saw above that in the pre-industrial era that among the gentry eldest sons got more educational opportunities than their younger confreres. The FOE database also has plenty of data on social outcomes, birth order and family size for families in this interval.

The database is based on three sets of lineages, created by following everyone within a set of rare surnames. The first is a set of average status lineages, representative of the population as a whole. The second is a set if rare surname lineages where the holders dying in the years 1858-87 had moderate wealth on average. The third is a set if rare surname lineages where the holders dying in the years 1858-87 had high wealth. We can thus observe how strong birth order effects were in the population as a whole, as well as in moderate and highly wealthy families, for births in the period 1680-1829.

Table 10 summarizes for all three groups their characteristics for births in the 1680-1929 interval. Wealth is measured relative to the average for deaths in the decade of death. Occupational status for males is measured using an index derived from statements of occupations at 1.5 million marriages 1837-1939 for grooms, fathers and fathers-in-law. The set of reported occupations was narrowed to 442 basic occupations. The average social status of these 442 occupations was derived to maximize the correlation of occupational status between fathers and grooms, and father-in-laws and grooms. The occupational scale runs from 0 to 100. It is measured as close to age 40 as the data allows.

As noted above, in earlier years in England there was a preference in terms of education for the first-born son, who would also be expected to inherit more than a proportionate share of family assets. So the first thing we can check is whether indeed first born sons ended up with greater wealth, occupational status, and education. Table 11 shows the results of this investigation for the average lineages and for the two wealthy lineages. In each case we estimate using family fixed effects and controls for year of birth, what was the effect of being the first-born son.

Table 10: Characteristics of Average and Elite Lineages, births 1680-1929

Outcome	Genders	Average Status Lineages	Moderate Wealth Lineages	High Wealth Lineages
Wealth at Death	Both	0.8	7.6	62.7
Occupational Status (0-100)	Males	36	46	63
Attended Oxbridge	Males	0.004	0.059	0.223
Higher education	Males	0.017	0.126	0.352
Literacy, births 1722-1869	Both	0.720	-	-
At Work, Age 14, (1833-1924)	Both	0.495	0.450	0.227
At School, Age 14 (1833-1924)	Both	0.317	0.418	0.620

Notes: For the first four outcomes we include only persons surviving to at least age 21. Wealth at death is measured relative to the population average for each decade.

Table 11: Effect of being first born son, births 1680-1929

Outcome	Gender	Average Lineages	Moderate Wealth Lineages	High Wealth Lineages
Ln Wealth at Death	Both	0.021	0.144*	0.311**
		(0.033)	(0.061)	(0.097)
Occupational Status	Males	0.239	0.615	1.785**
		(0.234)	(0.370)	(0.610)
Attended Oxbridge	Males	0.002*	0.028**	0.097**
		(0.001)	(0.007)	(0.017)
Higher education	Males	-0.000	0.024**	0.068**
		(0.002)	(0.008)	(0.018)
Literacy, births 1722-1869	Both	0.019	-	-
		(0.011)		
At Work, Ages 10-18	Both	-0.006	-0.002	0.014
		(0.009)	(0.014)	(0.019)
At School, Age 10-18	Both	0.004	-0.009	-0.032
		(0.009)	(0.015)	(0.026)

Notes: **, * Significant at 1%, 5% levels. Estimated with family fixed effects and female and birth decade controls.

As the table shows, for the wealthier lineages male first born often derived significant advantage. For the wealthiest lineage they were 31% richer than later sons, 10% more likely to attend Oxford or Cambridge (on a base attendance rate of 22%), though not more likely to attain other forms of higher education, and they gained 1.8 points in occupational rank on a scale of 0-100, where the average for this elite was 63. They were not however more likely to be in schooling aged 10-18, or less likely to be at work than their brothers.

For the intermediate wealth lineage we see many of the same advantages for the first born son, but with less strength. Thus in this group first born sons were 14% richer at death than their siblings, they were 2.8% more likely to attend Oxford or Cambridge.

However, among the average lineages, the first born son seemed to derive almost no social advantage. Only for attendance at Oxford and Cambridge was their any sign of an advantage, and here the statistical significance of the result was barely 5%. For wealth, higher education in general, occupational status, literacy, and schooling, first born showed no advantage over later sons.

Thus the social practice of favoring first born sons seems to have been confined to a small elite share of society in England and Wales in the eighteenth and nineteenth centuries, a share that was likely less than 2% of all families. For the vast bulk of the population if birth order effects existed it would not be through this social mechanism of privileging the first born in terms of wealth transfers or educational opportunities.

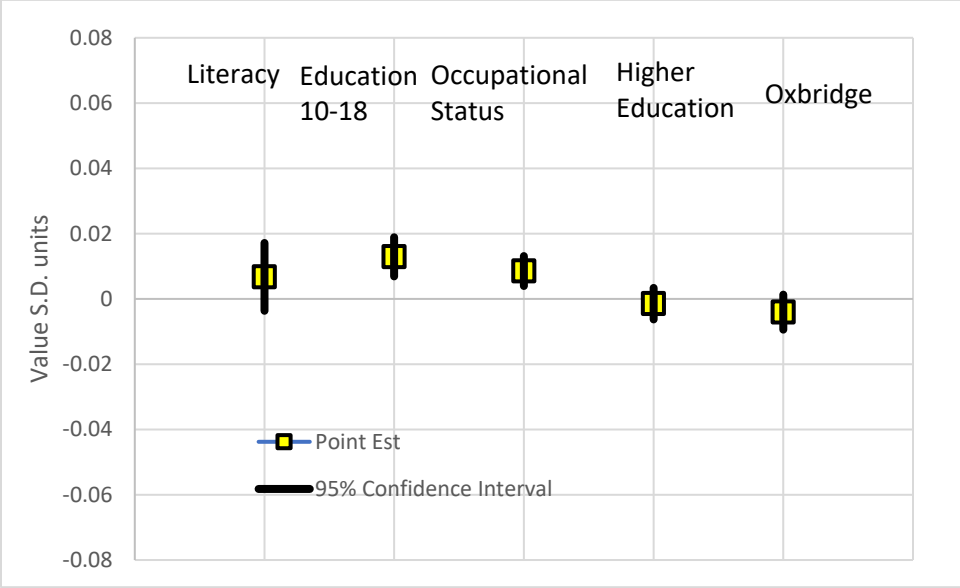
Controlling for the advantages of the first-born son, within the elite lineages there was no sign that second born sons were advantaged compared to third born, and so on, or that oldest daughters were advantaged relative to later born daughters. The birth order advantage was confined to the oldest born son.

1680-1929 – Birth Order Effects, General Lineages

While for the general population born before 1930, first born sons derived no special advantage, there remains the possibility of a more generalized advantage for those low in the birth order, in a world where incomes were much lower than for the last 100 years, and average family sizes much larger. To estimate birth order effects for births in the years 1680-1929, in light of the issues above with regression artifacts created by including controls for birth year and parent age, we detrend the output variable first using the birth year effects observed for first-born children or first-born sons.

Figure 6 summarizes these estimates for literacy at marriage, being in school aged 10-18 when observed in a census or population register 1851-1939, occupational status (men only), higher education (men), and attending Oxbridge (men).

Figure 6: Summary of Birth Order Effects 1680-1929, England and Wales



Note: Standard errors clustered at the level of fathers. Each effect is measured relative to the standard deviation of that outcome in the sample used.

Literacy is literacy observed at marriage from signing the marriage register, for those married 1754-1889.[18] This measure exists for men and women born 1720-1873. "Education 10-18" is whether a child observed in the censuses 1811-1921 or the population register 1939 aged 10-18 is in schooling or an apprenticeship. Occupational status is measured at the age closest to 40, and is measured on a status scale 0-100 created by using father-son and father-in-law-son pairs of occupations to rank status.[19] We have two measures of attainment of higher education for men in these earlier years. The first was matriculation to Oxford or Cambridge. There are near complete records of all men matriculating at Cambridge 1900 and earlier, and Oxford 1886 and earlier. A second more comprehensive measure counts as highly educated men who:

(1) Attended any university
(2) Attended a military college such as Sandhurst
(3) Qualified as a clergyman in the Church of England
(4) Qualified as a barrister, solicitor, medical doctor, Chartered Engineer, or Chartered Accountant

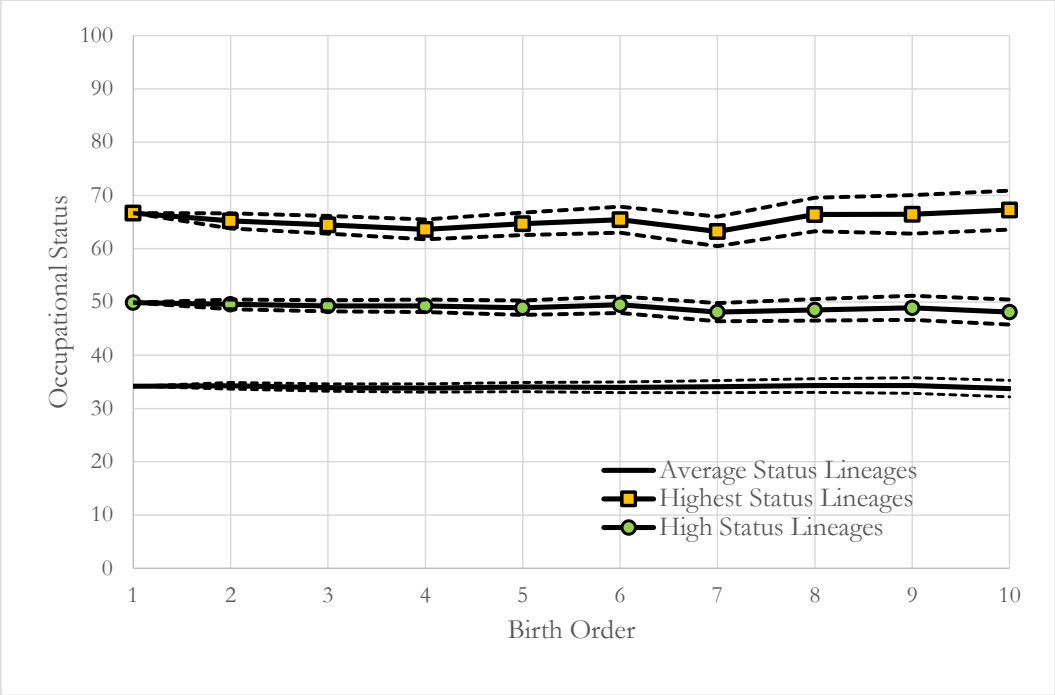
In both cases we utilize this measure only for men who attained age 21 or greater, and were born in England and Wales.

Figure 6 shows the estimated effects of birth order, as well as the 95% confidence interval, measured in standard deviation units. Birth order sometimes has positive and sometimes negative effects on educational and occupational status outcomes. For being in education when observed 10-18, and for occupational status, the effect is positive and significant. However, these effects are very small, less than 0.02 standard deviation units per increase of 1 in birth order in both cases.

Not shown in figure 6 is that the probability of being observed at work for children 10-18 is lower with every increase of 1 in birth order, and this effect is also statistically significant. These effects may be explained by older children being sent to work earlier to help support younger children. For literacy at marriage there is again a positive point estimate, but with smaller numbers of observations for this measure.

[18] Marriage records 1890 and later also contain signatures, but by this date well above 90% of people marrying are literate so the measure is not so informative as earlier about educational outcomes.
[19] Clark, Cummins and Curtis, 2022.

Figure 7: Birth Order and Occupational Status, 1680-1929, England



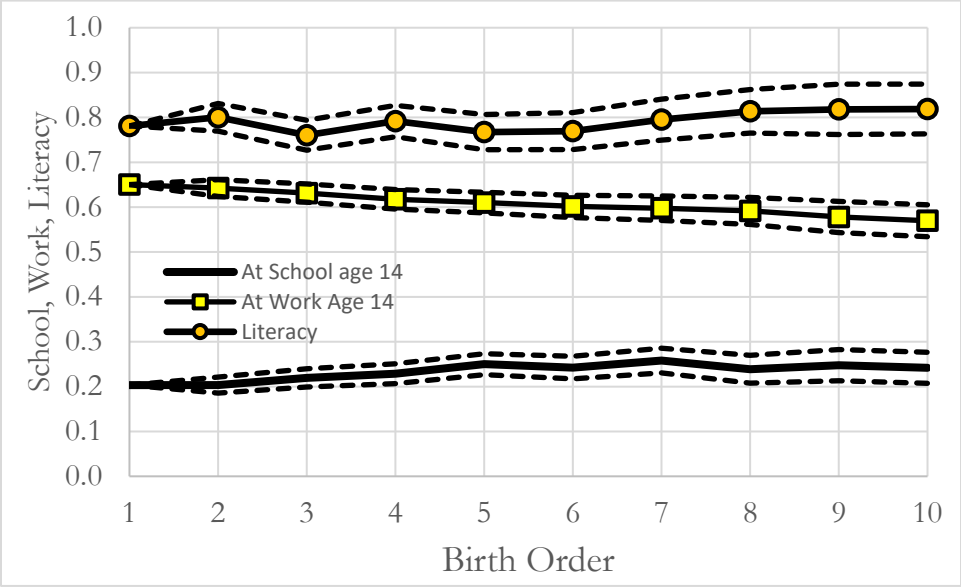
Notes: Estimated with controls for birth years trends, and family fixed effects. Dashed lines indicate 5% confidence interval.

In contrast for both higher education and Oxbridge attendance the effects are negative but not statistically significant. Thus overall for the period of births before 1929, for the families that constituted 98-99% of the population, there is no sign of significant negative birth order effects on educational attainment or occupational status.

The estimates in figures 3 and 6 employ just birth order as a scalar. We can also examine birth order effects where we employ a separate indicator for each birth order. Figure 7 shows these effects for occupational status for the highest status lineages, high status lineages, and average status lineages for births 1680-1929. Because of a first son advantage in occupational status for the highest wealth lineages, there is some negative birth order effect in this group. But for the average status families occupational status is essentially the same for sons of birth order 1 through 10+.

Figure 8 shows outcomes by birth orders 1 to 10+ for the 0-1 variables of literacy, being at work aged 14, and being at school aged 14.

Figure 8: Birth Order and Literacy, Work and Schooling, England



Notes: Dashed lines indicate 95% confidence intervals. These estimates are for average status lineages in the FOE database.

For literacy there is potentially a slight gain for higher birth order children, but no statistically significant gains in literacy with birth order. However, for being at school or being at work at age 14 higher birth order children showed significantly better outcomes in each case. Higher birth order children were more likely to be at school and less likely to be at work.[20] This is consistent with the linear estimate of birth order effects reported in figure 6, where there was a significant correlation between birth order and school attendance.

[20] For some children the census records are blank on occupation, so that the "at work" and "at school" shares add up to less than 1.

Table 12: Adult Longevity and Birth Order, All Lineages, 1780-1919

	(1)	(2)	(3)	(4)
First Son	-0.0003	0.0035	0.0062	0.0041
	(0.0126)	(0.013)	(0.0142)	(0.014)
Family Size	0.0003	0.0042*	-	-
	(0.0018)	(0.002)		
Birth Order	-0.0013	-0.0124**	-0.0020	0.0053
	(0.0022)	(0.003)	(0.0024)	(0.0062)
Parent Ave Age	-	0.0052**	-	-0.0034
		(0.0011)		(0.0027)
Fixed Effects	No	No	Yes	Yes
N	54,178	54,129	54,178	54,129

Notes: Longevity standardized to mean 0 and standard deviation 1 for men and women by birth decade. Standard errors clustered by father.

Lifespan 1780-1919

One further social outcome is the adult lifespan of those reaching age 21. To control for gender and secular movements in lifespan we generate a measure for each birth decade and gender which is years lived minus average years lived for that gender and decade, divided by the standard deviation of years lived in that decade. Thus this data is already controlled for cohort and gender effects. This measure thus has mean 0 and standard deviation 1 for each decade 1780-1919. We estimate birth order effects here for all lineages.

Table 12 shows the results of this estimation. There is no effect of birth order, or indeed of being the eldest son, on lifespan. If we include only birth order as in estimates (1) and (3) we see no effect of birth order on longevity either in the cross-section or the within-family estimate. Adding parent age does produce, as in many cases above, a highly significant negative birth order effect offset by a positive parent age effect in the cross-section regression. But even here the effect size is small. The estimated birth order effect is only 0.01 of a standard deviation per step in birth order. Even with parent age added there is no significant birth order effect in the within-family estimates.

Thus for those born 1780-1919 there is no sign of any birth order effects on health, as represented here by longevity.

Conclusion

For England 1680-2024 we find little sign of significant negative birth order effects. The only exception are elite families, the upper 1-2% of the wealth distribution, where for birth before 1929 the oldest son gained significant advantage over his siblings in outcomes such as higher education, wealth, and occupational status.

The standard ways of estimating birth order effects, where birth year and parent age effects are estimated simultaneously, frequently produces anomalous and implausible birth year effects, or parent age effects which largely cancel out the birth order effects. So our preferred method of estimation is to control for birth year effects first by detrending the output data, and to not include parental age. This allows us to estimate the net effects of birth order on child outcomes in a stable fashion. For modern England, children born 1910-1999, estimated in this fashion there is little sign of significant birth order effects, as illustrated in figure 3. The typical estimated effect is less than 0.01 of a standard deviation of the outcome. For earlier England, and non-elite lineages, again estimated birth order effects are very modest, as illustrated in figure 6. In these years some effects are significantly positive, such as the chance of being in education around age 14, but again very modest in size.

Not only is there little sign of birth order effects in England, but there is also significan possibility that the substantial negative birth order effects estimated for modern Nordic countries, and also recently for the UK, are also artifacts. An examination of some of these estimates shows the artifacts that appear in the English estimates with the standard methods of estimating birth order effects. We see, for example, when we look at years of education as an outcome in Norway that mother age effects almost completely cancel out birth order effects. Also the estimated time trends in education do not match national time trends.

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