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ABSTRACT

Fecundity, Fertility and Family Reconstitution Data: The Child Quantity-Quality Trade-Off Revisited*

Growth theorists have recently argued that western nations grew rich by parents substituting child quantity (number of births) for child quality (education). Using family reconstitution data from historical England, we explore the causal link between family size and human capital of offspring measured by their literacy status and professional skills. We use a proxy of marital fecundity to instrument family size, finding that children of couples of low fecundity (and hence small families) were more likely to become literate and employed in a skilled profession than those born to couples of high fecundity (and hence large families). Robust to a variety of specifications, our findings are unusually supportive of the notion of a child quantity-quality trade-off, suggesting this could well have played a key role for the wealth of nations.

JEL Classification: J13, N3 and O10
Keywords: child quantity-quality trade-off, demographic transition, human capital formation, industrial revolution and instrumental variable analysis

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1 Introduction

Recent years have seen a rising interest in how western nations grew rich. Growth theorists speculate that technological progress raised the incentive to invest in the education of offspring, and that this investment was financed by a reduced number of births (Galor, 2011). Despite considerable theoretical attention, there have been very few attempts to test the child quantity-quality trade-off historically.[1] Becker et al. (2010) have used Prussian data and landownership inequality to instrument education, finding a negative effect of education on family size in 1816. Bleakley and Lange (2009) have argued that the eradication of the hookworm disease in South America brought about a change in the price of education, showing that this was associated with declining fertility in 1910. Fernihough (2011) has used Irish data and instrumented family size by multiple births, finding a negative effect of family size on school enrolment in 1911. However, to date, the trade-off has not been investigated for the world's first economy to undergo the transition from economic stagnation to sustained growth: historical England.

In this paper we use 18$^{\text{th}}$–19$^{\text{th}}$-century family reconstitution data from English parish records to study the effect of family size on the human capital of offspring, advancing the research frontier along three dimensions. First, our data cover an exceptionally long period of time, over 130 years, during which England underwent the Industrial Revolution (Clark, 2007; Galor, 2011). Although public education was not yet widespread during this period, we are able to use literacy information (derived from signatures on marriage certificates), as well as professional skills (derived from occupational titles), to measure individual human capital achievements. Second, and unusually for historical records, the family reconstitution data provide statistics at the micro level, enabling us to explore the effect of the number of siblings on the siblings' human capital while controlling for a large variety of family characteristics, including parental human capital, longevity and social class. Third, we introduce a new identification strategy in the context of testing the child quantity-quality trade-off hypothesis, using marital fecundity to instrument family size. In societies where marriage marks the onset of unprotected sex, such as in many present-day Muslim countries as well as historical western societies, marital fecundity is estimated by demographers using the time-interval from a couple's marriage date to their first birth. The great variability in fecundity as well as fertility among our sampled couples makes the family reconstitution data particularly appropriate for testing the child quantity-quality trade-off in historical England.

Our data show that children of parents of low fecundity (and hence few siblings) were significantly more likely to become literate and find employment among the skilled professions than those of parents of high fecundity (and hence many siblings). Specifically,

[1]Recent attempts to measure the trade-off effects using contemporary data include Angrist et al. (2010); Black et al. (2005); Caceres (2006); Li et al. (2008); Rosenzweig and Zhang (2009). Support for the trade-off is normally found among developing countries but far less so among developed countries.

we find that an extra sibling reduced the probability of acquiring a skilled profession by 7.5 percentage points and the probability of being literate by 6.7 percentage points. Since double-digit sibship sizes were not unusual in historical England, the chances of achieving literacy and profession skills were cut dramatically among those born to larger families. To validate our empirical strategy we show that family characteristics, such as parental human capital, longevity and social class, have no significant influence on the marital fecundity of the sampled couples. We also assess the validity of the exclusion restriction by comparing the marital fecundity of the sampled couples to those of Muslim couples in rural Palestine (among whom marriage marks the onset of unprotected sex), finding that the rates of fecundability are virtually identical in the two samples. Our results are robust to excluding extreme outliers; including potentially unobserved births; treating issues of censoring due to migration; and using an alternative specification of marital fecundity. Our findings are unusually supportive of the child quantity-quality trade-of hypothesis and thus to *unified growth theory* in which the trade-off is key in understanding the emergence of the wealth of nations (Galor and Weil, 2000; Galor and Moav, 2002).

2 Data and Data Limitation

The family reconstitution data used for the analysis below come from Anglican parish registers (English church books). The data were transcribed by the *Cambridge Group for the History of Population and Social Structure* and is documented by Wrigley et al. (1997). The family reconstitutions are based on ecclesiastical events recorded in a total of 26 English parishes (Figure 1). The full data set covers more than three centuries of English demographic history, from the first emergence of parish registration, in 1541, until population census became common in 1871. The subsample most relevant for our purpose, however, comes mainly from the 18$^{\text{th}}$ and early 19$^{\text{th}}$ centuries. The sampled parishes were selected by the Cambridge Group due to the high quality of the data and with the intention of making them representative of the entire country. The parishes range from market towns to remote rural villages, including proto-industrial, retail-handicraft, and agricultural communities, and have been organised by Schofield (2005) into four groups: "agriculture", "industry", "retail and handicraft" and "other" (a mix), enabling us to control for their occupational structure in the analysis below.

Each family in the reconstitution data is built around a marriage, including information about the birth, marriage, and death dates of the spouses, as well as the gender and birth and death dates of their offspring. For certain periods (mostly after 1700) the records also contain the literacy status of the spouses (literate/illiterate) as well as the father's occupational title. As indicated below, we explore the information hidden in the occupational titles with regards to the working skills of individuals and their income potential. First, looking at pre-modern wills from London and South-East Anglia,

Figure 1: Locations of the parishes (source: Schofield (2005)).

Clark and Cummins (2010) have classified the recorded occupations according to the information regarding wealth that is given in the wills. From poorest to richest these are: labourers, husbandmen, craftsmen, traders, farmers, merchants, and gentry. By grouping labourers and husbandmen together we are able to separate in our data the poorest from the more affluent segments of English society. Second, using the so-called HISCO/HISCLASS schemes, documented by Leeuwen et al. (2007) and Leeuwen and Maas (2011), we sub-divide the sampled individuals into two groups – skilled and unskilled workers – depending on the educational training needed to conduct the work described by the occupational title.[2] To this end, we employ a standard two-step procedure. First, we assign the occupational title a five-digit code using the HISCO system. Next, we enter the code into the HISCLASS system, which classifies the professional skills of an individual using a two-dimensional scheme quantifying the academic and vocational training needed to conduct the work. For example, according to the HISCO scheme, an

[2]The HISCO system is a historical extension of the ISCO (International Standard Classification of Occupations) for which the ILO (International Labour Organization) is responsible. The HISCLASS system is a historical extension of the DOT (Dictionary of Occupations) system, which gives scores for the skill-content for a wide range of occupations, originally created in the 20th century by the US Employment Service to match job seekers to jobs.

English factory worker would be classified as code number 99930, which according to the HISCLASS scheme designates an "unskilled" profession.[3]

Using the earliest recorded occupations of the sampled individuals (and a binary variable in the case of missing occupations) we map over one hundred distinct occupational titles in the data into skilled and unskilled professions by means of the procedure described above. Some 89% of the occupations are derived from marital records or the earliest ecclesiastical event thereafter (typically the baptism of firstborns). Around 7% of the occupations stem from the time of the burial. The remaining occupations (about 4%) are from an intermediate point in time, i.e. the time of the baptism (or burial) of offspring of parity two or above. The titles "Paupers" and "Gentry" were excluded from the sample.[4]

Table 1 provides an example of a reconstituted family. It includes the statistics transcribed from the church book as well as those inferred either by us or by the Cambridge Group.[5] The records almost always report the baptism and burial dates rather than the birth and death dates. Where available, we always use the latter (i.e. in 87% of the cases). Meanwhile, the time-intervals between the ecclesiastical and the vital events were rather short. For obvious reasons people were buried as soon as possible after death, usually within three days (Schofield, 1970). Furthermore, almost all children were baptized within one month of birth (Midi Berry and Schofield, 1971). To allow for the period of time between birth and baptism, we subtract three weeks from all baptism dates.[6] We refer to the combined birth/baptism and death/burial dates as birth and death dates. Interestingly, although the Prayer Books of the English Church prescribed that baptisms take place on Sundays, not all families would comply with this rule. The baptism fees paid varied according to family income, and often it was the rich who paid the church for a non-Sunday baptism service, a fact that becomes apparent in the analysis later on.

Following the procedure used in demography, we exclude the couples unable to accomplish their desired family size because of divorce or premature death (i.e. death before the wife completes her reproductive period). In other words, we restrict the sampled cou-

[3]The occupational titles of our sample were coded using http://historyofwork.iisg.nl/.

[4]Our findings are robust in their inclusion on the assumption that paupers are unskilled and gentry skilled.

[5]The record shows that in Odiham on 15 Oct. 1761 Edward Neville (baptized 14 May 1733, buried 3 Nov. 1816 at age 83) married Hannah Sury (baptized 21 July 1740, buried 10 Nov. 1816 at age 76). At the time of the marriage, husband Edward was registered in the church book as a labourer, which according to the HISCLASS is an unskilled occupation. He was recorded as being illiterate, as was his wife. Wife Hannah gave birth to a total of nine children (seven boys and two girls), two of which (Thomas and Francis) died before reaching the age of five, leaving a total of seven "surviving" children. Six of the seven survivors married in their parish of birth. James (a labourer) was unskilled, while Edward (a baker), John and Thos (both sawyers) were skilled workers. The record also shows that Edward was literate but that his siblings were all illiterate, except for lastborn Hannah who at some stage during her life moved away to a parish outside the sample (indicated by her missing death date) rendering her marriage and literacy status unknown.

[6]Our results are robust to different specifications.

Table 1: Example family

Parish Level Information		Family Level Information	
Parish	Occupational Type	TTFB*	TTSB**
Odiham	Mixed	0.92	3.45

Individual Level Information

Family Member	Name	Birth Date	Death Date	Age at Death	Occupation	Skilled Profession	Literate	Marriage Age
Mother	Hanna Sury	21 July 1740	10 Nov. 1816	76.3	-	-	No	21.2
Father	Edward Neville	14 May 1773	3 Nov. 1816	83.5	Labourer	No	No	28.4
Daughter	Ann	8 Oct. 1762	-	-	-	-	No	-
Son	John	17 Apr. 1765	13 Oct. 1850	85.5	Sawyer	Yes	No	-
Son	Edward	3 Mar. 1767	8 May 1852	85.2	Baker	Yes	Yes	-
Son	James	3 May 1769	14 Apr.1849	79.9	Labourer	No	No	-
Son	Thomas	6 Mar. 1771	20 Mar. 1771	0.0	-	-	-	-
Son	Daved	28 Mar. 1773	13 May 1858	85.1	-	-	No	-
Son	Thos	23 Apr. 1775	21 Dec. 1855	80.7	Sawyer	Yes	No	-
Son	Francis	8 June 1777	9 May 1780	2.9	-	-	-	-
Daughter	Hannah	5 Dec. 1779	-	-	-	-	-	-

*TTFB is the time from the marriage to the first birth, measured in years.
**TTSB is the time from the marriage to the second birth, measured in years.

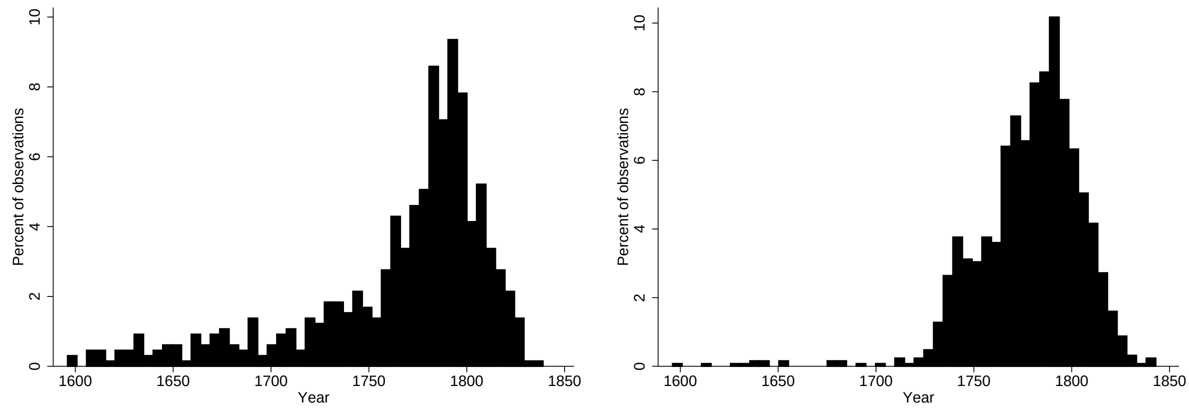
Table 2: Summary statistics

	Mean	SD	Count	P10	P90
Sibship Size	6.96	2.94	1508	3	10
Surviving Siblings (> 5 Years)	4.83	2.51	1508	2	8
Literate	0.56	0.50	1,248	0	1
Skilled	0.68	0.47	652	0	1
TTFB	1.59	1.18	1508	0.81	2.99
Male	0.53	0.50	1508	0	1
Non-Sunday Baptism	0.53	0.50	1476	0	1
Skilled Father	0.69	0.46	918	0	1
Poor Father	0.56	0.50	960	0	1
Skilled Mother	0.63	0.49	35	0	1
Literate Father	0.60	0.49	969	0	1
Literate Mother	0.32	0.47	942	0	1
Longevity of Mother (Years)	71.28	10.36	1508	57.2	84.4
Longevity of Father (Years)	72.38	9.75	1508	59.0	84.1
Age at Marriage of Mother (Years)	25.07	4.67	1508	19.8	31.0
Retail-Handicrafts Location	0.16	0.36	1508	0	1
Industrial Location	0.24	0.43	1508	0	1
Agricultural Location	0.25	0.43	1508	0	1
Other	0.35	0.48	1508	0	1
Centuries since 1500	2.72	0.37	1508	2.34	3.07
TTSB	3.84	1.66	1481	2.37	5.89
Number of Observations	1508				

ples to those with *completed* marriages, meaning that the wife survived in marriage until the age of 50 (Wrigley et al., 1997, p. 359). Since we compute the wife's age using her birth and death dates, and because a missing birth or death date imply migration in or out of the sampled parishes (Souden, 1984), a completed marriage automatically exclude the possibility that the wife had children from an unobserved marriage (i.e. outside the sampled parishes). For similar reasons, we exclude from our sample husbands of missing birth and death dates.

Our data limitations leave us with two main samples. One includes the offspring about which we know their occupation and thus their skill status (652 individuals from 453 families), and the other includes the offspring whose literacy status is available (1,248 individuals from 571 families). The literacy and skill status are jointly known in one-third of all cases (392 individuals from 280 families).[7] The combined sample includes 1,508 individuals from 721 families, and the summary statistics of these individuals are presented in Table 2. Figures 2a and 2b show the distributions of observations across time in the two main samples. Of the sampled individuals, 90% were born between 1690 and 1814, comprising the years of England's Industrial Revolution.

[7]Note that skilled workers were not always literate. A simple linear regression, clustered at the family level, of working skills on literacy using the subset of overlaps ($N = 392$) yields a slope coefficient of 0.382 ($p < 0.000$).



(a) Number of observations with skill status.

(b) Number of observations with literacy status.

Figure 2: Histograms of numbers of observations per sample.

3 Empirical Strategy

Historical families were rather large by today's standard. The fertility rate in the UK is currently two children per woman, while in the 18th century it was close to five (Wrigley et al., 1997). Although child mortality was rather high in the 18th century, three to four children per women nevertheless made it to adulthood (ibid.). The family planning of the 18th century was also rather different from that of contemporary England. First and foremost, births outside marriage were a highly immoral act in the eyes of the English Church and society as a whole, making the postponement of marriage a key form of contraceptive in the past (Cinnirella et al., 2012; Wrigley et al., 1997). Another major difference is that women continued to have children until the menopause set in, which usually happened at around age 40 (ibid.). Figure 3 captures the main implications of these features, showing how the average number of family births decreased with the wife's age at marriage.

There is some evidence showing that birth control was practised within marriage. Using an extended sample of our data, Cinnirella et al. (2012) have found that historical couples responded to lower living standards (measured by real wages and wheat prices) by increasing their birth-spacing intervals, achieved through sexual abstinence, coitus interruptus, and extended breastfeeding (McLaren, 1978; Santow, 1995). Important for the present analysis, Cinnirella et al. (2012) have found that the time-interval from the marriage to the first birth was not influenced either by changes in real wages or food prices. Instead, the sampled couples were found to control the timing of the first birth by adjusting the timing of the marriage. The fact that couples were able to control the size of their family, raises a number of issues regarding endogeneity, which we discuss in detail in the following sections.

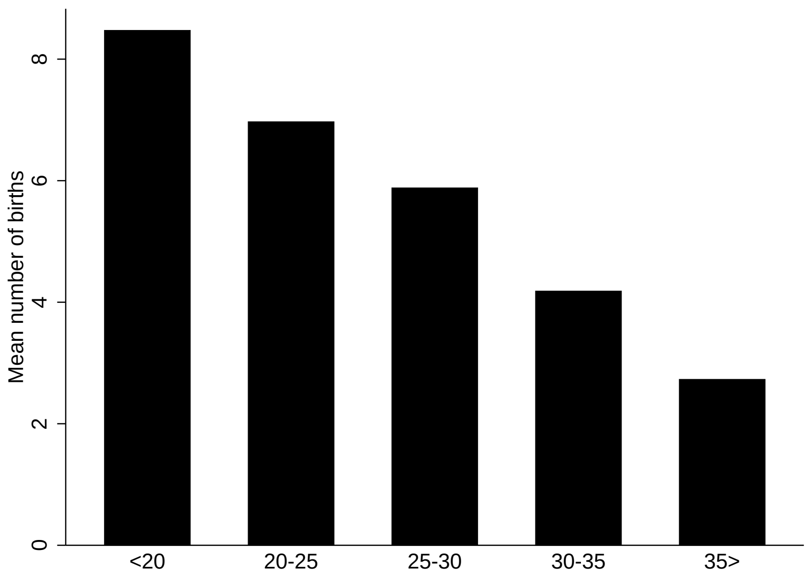


Figure 3: Family size by the wife's age at marriage.

3.1 The Quantity-Quality Trade-Off and Issues of Endogeneity

A test of the child quantity-quality trade-off hypothesis is not straightforward to conduct. Certain factors influencing family size may also affect the human capital formation of the offspring. Income is one example. For instance, evidence suggests that the rich gave birth to more children than the poor (Boberg-Fazlic et al., 2011; Clark and Hamilton, 2006), but also that the rich invested more heavily in the education of their offspring than their less affluent counterparts (Leunig et al., 2011). Factors such as parental human capital and morbidity are also likely to affect both the quantity and quality of offspring. By excluding variables like parental income, education and morbidity, an estimated OLS effect of family size on human capital will tend to be biased upwards. Likewise, some determining factors may be difficult to fully observe or quantify. In such cases, the estimated OLS effect would potentially suffer from omitted variable bias. By inferring information about family income from occupational titles we can capture some of the variation in income among the sampled couples. Similarly, we can capture some of the variation in parental human capital and morbidity by controlling for the education, literacy, and longevity of parents. But to fully treat the issues of endogeneity we have to adopt an instrumental variable approach.

3.2 Fecundity as an Instrument for Fertility

To this end, we use a novel identification strategy in the context of the child-quantity-quality trade-off literature, exploring the waiting times from a couple's marriage to their first birth to instrument the couple's fertility. A couple's fecundity refers to their reproductive potential while their fertility captures the fulfilment of this potential, i.e. their actual number of births (Gini, 1924). More specifically, a couple's effective fecundability measures the probability of conception within one month (or one menstrual cycle) among a non-contraceptive, non-sterile, and sexually active couple, leading to a live birth. Demographers often use the time-interval from the marriage to the first birth to estimate the mean fecundability of a population in societies where marriage marks the onset of unprotected sex.[8] Here, however, we exploit the information at the micro level.

If there was full homogeneity in the fecundability of a given population, then the waiting time from the marriage to the first birth among couples would follow a geometric distribution: some parents would fall pregnant in their first cycle, others only after several cycles. However, since fecundability in reality varies among individuals, the actual distribution will have a fatter tail than that predicted by the geometric distribution, with a higher representation of low-fecundity individuals among those with long waiting times. Our instrumental variable (the waiting time) thus captures not only the random variation in the time-interval from marriage to first birth, but also the variation in the couples' fecundity.

It is clear that information about the fecundity of an individual is partly inferable from that of other family members. Based on this information, a couple *in spe* can to some extent approximate their marital fecundity in advance of the marriage. But the mix of the genetic material of two non-related individuals introduces a random component regarding their potential joint fecundity. Their actual joint fecundity will not be known until after the decision to start a family is made and the firstborn is delivered.

The couples of low fecundity have longer birth-spacing intervals, and reach sterility earlier, than couples of high fecundity. In historical times when birth continued until sterility set in, it is clear that highly fecund couples, realizing they may end up with more children than expected, could attempt to adjust for this by extending their birth-spacing intervals. However, since the spacing of births was relatively short in the first place (i.e. between two to three years, according to Cinnirella et al. (2012), there are limits to how much low-fecundity couples could cut their spacing of subsequent births in order to reach a target. Giving birth to fewer children than expected, a couple of low fecundity could thus afford to allocate more resources to their offspring by comparison to more fecund couples, capturing in this way the main principles behind the use of marital fecundity as an instrument for fertility.

Below we exploit the idea that the time-interval between marriage and the first birth (henceforth the TTFB) may be correlated with family size. We already know, from a duration analysis made on over a quarter million births using an extended sample of our data, that the TTFB is positively correlated with the birth-spacing intervals of subsequent births (Cinnirella et al., 2012). But we can also demonstrate, analytically as

[8] E.g. Bongaarts (1975), Gini (1924), Olsen and Andersen (1999) and Woods (1994).

well as empirically, that the length of the TTFB negatively affects the number of family births among our sampled couples, i.e. among couples of completed marriages. We begin by demonstrating the relationship formally, and then turn to an empirical demonstration.

Let f denote the fertile period of a married couple, i.e. the time-period spanned by the marriage date and the date when sterility sets in. The remaining fertile period after a couple's first birth is $f-t$, where t represents the TTFB. In this period the total number of births is determined by the average frequency of births, which is inversely related to the average birth-spacing interval, denoted $s(t)$. If x denotes the total number of births, then $x = (f-t)/s(t)+1$. We can approximate the average birth-spacing interval as a linear function of t, so that $s(t) = c+\lambda t$ where c and λ are constants, hence obtaining the expression $x = (f-t)/(c+\lambda t)+1$. Linearizing this expression around the average TTFB, denoted by $\bar{t}$, means that $x \approx \gamma_0 - \gamma_1 t$, where $\gamma_0 \equiv (f-\bar{t})/(c+\lambda\bar{t}) + \bar{t}(c+\lambda f)/(c+\lambda\bar{t})^2$ and $\gamma_1 \equiv (c+\lambda f)/(c+\lambda\bar{t})^2$.

A lower bound of the point in time when sterility set in is given by the couple's final delivery. Using this to proxy for the actual time of sterility, we obtain on the basis of our sample an estimate of the mean fertile period (i.e. the average period from marriage to sterility), which is $\bar{f} = 16.16$ years. Similarly, we can estimate the mean TTFB which is $\bar{t} = 1.59$ years (cf. Table 2). A simple regression of the length of birth-spacing intervals on the TTFB, with standard errors clustered at the family level, yields $\bar{c} = 2.48$ ($p < 0.000$) and $\bar{\lambda} = 0.08$ ($p = 0.010$). These numbers imply that $\bar{\gamma}_0 = 6.47$ and $\bar{\gamma}_1 = 0.56$. Hence, an increase in the TTFB by one year on average decreases the number of births in a completed marriage by roughly half a child.[9]

3.3 The Exclusion Restriction

The exclusion restriction applies only if the couple do not control the length of the TTFB. However, historical couples may in fact have had incentives to deliberately postpone their first births. For instance, a poor couple could have made an effort to delay their first pregnancy in an attempt to reduce the number of births in order to be able to afford to educate their offspring. Other social groups, such as literate or skilled couples, could have pursued the same strategy for similar reasons. Meanwhile, we demonstrate that there is no evidence in the data of such behaviour. To this end, we first show that there are no socio-economic variables available in the data that are significantly correlated with the TTFB. Next, we compare the distribution of the TTFBs in our sample with that from a sample of contemporary Muslim couples, who we know do not delay their waiting time, showing that the two distributions are practically identical.

[9]Unsurprisingly, a simple regression of family size on the TTFB among the couples in our sample, with standard errors clustered at the family level, similar estimates of ($\hat{\gamma}_0 = 7.87$ ($p < 0.000$) and ($\hat{\gamma}_1 = 0.57$ ($p < 0.000$).

3.3.1 Socio-Economic Determinants of the TTFB

An assessment of the validity of the exclusion restriction comes from regressing the TTFB on the socio-economic characteristics of the couple, to see if the TTFB is influenced by such traits. While the conditional exclusion restriction cannot be formally tested this way, we can nevertheless assess the possibility of excluding certain determinants by investigating the degree to which our instrument is correlated with our key explanatory variables. In this case we do not require any knowledge about the human capital acquisition of the offspring, meaning that we can perform the analysis on a larger sample than the one used in the main analysis below.

Table 3 shows the results of a set of OLS regressions, conducted at the family level, using the following regression model:

$$\text{TTFB}_i = \alpha' \mathbf{X}_i + \nu_i. \quad (1)$$

The variable i is indexing the families; $\mathbf{X}$ is a vector of family-level control variables; and ν_i is an error term. The regressions include all of the relevant family-level and geographical control variables (as well as subsets) used in the main analysis further below. The results (Table 3) do not suggest that any of the social characteristics exhibit any deliberate delaying behaviour: none of the control variables have any significant impact on the TTFB, including vital socio-economic traits such as parental human capital and longevity, except for the longevity of the mother in Column 3. Note also that the control variables together explain only 1.1 percent of the TTFB (the adjusted R2 never exceed 0.2%).

3.3.2 Comparison of TTFB Distributions

As a further assessment of the exclusion restriction, we now compare the distribution of the TTFBs among our sampled couples to those of a group of newly wed Muslim couples in rural Palestine, documented by Issa et al. (2010). There are two main reasons why the Palestinian data is appropriate for the comparison. Firstly, pre-marital sex is culturally forbidden according to Muslim tradition. Indeed, Issa et al. found no evidence of pre-marital pregnancies, or even co-habitation, among the observed couples (ibid., p. 4). Secondly, it is cultural tradition that the Palestinian couples strive to become pregnant immediately after the marriage certificate is signed and sealed. According to Issa et al. (2010), the sampled couples all reported that their wedding night marked the onset of unprotected sex, after which intercourse occurred frequently up until the time of pregnancy (ibid., p. 2).[10]

[10] According to Issa et al. (2010, p. 2), 16% reported having had sexual intercourse between one and six times per week, while 73% had intercourse more than seven times weekly. The remaining 11% refused to answer.

Table 3: Assesment of the instrument

	(1)	(2)	(3)	(4)	(5)	(6)
Skilled Father	.012					.028
	(.153)					(.155)
Poor Father	-.006					-.013
	(.126)					(.129)
Skilled Mother	-1.183					-1.263
	(.793)					(.775)
Literate Father		-.045				-.026
		(.143)				(.147)
Literate Mother		.044				.077
		(.146)				(.151)
Longevity of Mother (Years)			.006*			.005
			(.003)			(.003)
Longevity of Father (Years)			-.000			.000
			(.004)			(.004)
Age at Marriage of Mother (Years)				.010		.010
				(.006)		(.006)
Retail-Handicrafts Location					-.080	-.093
					(.099)	(.106)
Industrial Location					-.031	-.012
					(.098)	(.101)
Agricultural Location					.103	.115
					(.099)	(.108)
Centuries since 1500	.113*	.155*	.093	.102	.092	.145
	(.067)	(.086)	(.064)	(.064)	(.064)	(.089)
Constant	2.347***	1.333***	1.127***	1.272***	1.549***	1.567*
	(.789)	(.271)	(.346)	(.219)	(.172)	(.869)
R^2	.005	.003	.003	.003	.003	.011
Adjusted R^2	.000	-.000	.001	.002	.001	.001
Number of Observations (families)	1639	1639	1639	1639	1639	1639
Number of Families						

Dummies for missing information are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

If there were a tendency among our sampled couples to delay the first birth after marriage, then we would expect to see a lower proportion of births following the marriages of our English couples compared to the Palestinians. However, this is not the case. In fact, after one year the couples of our sample were slightly *more* likely to have become pregnant compared to their Palestinian counterparts.[11] The chances of conception in the most relevant control group among the Palestinians (women with less than 10 years of schooling) were 12% after one month; 64% after six months; and 76% after 12 months (ibid., Table 1). In our sample the numbers are 17% after one month; 57% after six months; and 77% after 12 months. When presented this way, small monthly differences will cumulate. Hence, we can also calculate the average monthly probability of conception, which for the Palestinian sample was 12% in month 0-1; 11% in months 2-6; and 5% in months 6-12. The numbers of our sample are 17% in month 0-1; 10% in months 2-6; and

[11]Note that the pregnancies in our sample all lead to a live birth; this was not necessarily the case among the Palestinians.

6% in months 6-12. Note that the falling probability of conception supports the notion that the TTFB actually measures fecundity. Overall, the comparison with the Palestinian data supports the findings of Stone (1977) and others, concluding that marriage in pre-modern England marks the onset of unprotected sex.

4 Analysis and Results

Having described above how the TTFB can potentially function as an instrument for fertility, we now turn to the main analysis of the paper, attempting to quantify a child quantity-quality trade-off effect based on the sampled couples. For comprehensiveness, we first investigate the partial correlations in the data between the quantity and quality of children by conducting a standard OLS analysis. Then we turn to the instrumental variable (IV) analysis.

The OLS model is given by the following equation:

$$\text{Outcome}_j = \beta_{11}\text{SurvivingSiblings}_j + \alpha'_{12}\mathbf{Z}_i + \varepsilon_{1j}, \tag{2}$$

where j is indexing the individuals; $\mathbf{Z}$ is a vector of family- and individual-level control variables; and ε_1 is an error term. The two outcome variables – literacy and skill status of the individual offspring – are regressed on the number of family siblings and a set of covariates.

The second step of our analysis is a 2SLS model. We first regress the number of siblings on the TTFB and the control variables, i.e. we estimate the model:

$$\text{SurvivingSiblings}_j = \beta_{21}\text{YearsToFirstBirth}_j + \beta'_{22}\mathbf{Z}_j + \varepsilon_{2j}, \tag{3}$$

where j is indexing the individuals and ε_2 is an error term. Next we regress the two outcome variables (individual literacy and skills) on the predicted number of siblings, as well as the control variables, using the empirical specification given by Equation (2).

4.1 OLS Results

The OLS results are reported in Table 4. The robust standard errors are clustered at the family level. The cases where the TTFBs are less than 40 weeks, stemming either from premature births or firstborns conceived pre-nuptially, are removed from the sample (excluding 22% of all couples).[12]

The covariate "Centuries Since 1500" is the number of centuries from year 1500 to the birth year of the individual. We measure family size by the number of children born

[12]The results are robust to their inclusion.

Table 4: Baseline results

	(1)	(2) Literate	(3)	(4)	(5) Skilled	(6)
Surviving Siblings (> 5 Years)	-.011		-.067***	-.009		-.075***
	(.009)		(.024)	(.008)		(.028)
TTFB		-.436***			-.483***	
		(.054)			(.063)	
Male	.113***	.016	.113***	-.284***	.199	-.273***
	(.027)	(.105)	(.027)	(.071)	(.316)	(.075)
Non-Sunday Baptism	.068**	-.136	.061*	.106***	-.232	.096***
	(.030)	(.133)	(.032)	(.036)	(.177)	(.037)
Skilled Father	.084	-.233	.068	.212***	-.142	.192***
	(.062)	(.300)	(.063)	(.066)	(.290)	(.067)
Poor Father	-.204***	.264	-.191***	-.236***	.587**	-.202***
	(.055)	(.264)	(.058)	(.054)	(.297)	(.058)
Skilled Mother	.379	3.218**	.576**	.727***	4.091**	1.030***
	(.230)	(1.620)	(.260)	(.209)	(1.800)	(.323)
Literate Father	.192***	.687**	.232***	.076	.849***	.128**
	(.048)	(.274)	(.054)	(.058)	(.307)	(.063)
Literate Mother	.216***	-.177	.202***	.027	-.190	.009
	(.047)	(.277)	(.050)	(.061)	(.332)	(.061)
Longevity of Mother (Years)	.003*	.022**	.004**	.003	.024***	.004**
	(.002)	(.009)	(.002)	(.002)	(.009)	(.002)
Longevity of Father (Years)	-.000	-.004	-.000	-.004**	.011	-.004*
	(.002)	(.008)	(.002)	(.002)	(.009)	(.002)
Age at Marriage of Mother (Years)	.000	-.195***	-.010*	-.001	-.236***	-.016**
	(.004)	(.018)	(.006)	(.004)	(.020)	(.008)
Retail-Handicrafts Location	.132**	-.518*	.103	.022	-.358	.006
	(.062)	(.289)	(.066)	(.051)	(.248)	(.053)
Industrial Location	.103**	.201	.115**	.240***	.345	.269***
	(.051)	(.263)	(.054)	(.057)	(.343)	(.063)
Agricultural Location	.112**	.224	.117**	-.098*	.289	-.087
	(.051)	(.263)	(.055)	(.058)	(.295)	(.062)
Centuries since 1500	.128*	.687**	.158**	-.075*	.547**	-.038
	(.067)	(.332)	(.071)	(.044)	(.219)	(.049)
Constant	-.517	9.980***	.027	1.026***	8.623***	1.521***
	(.366)	(1.917)	(.455)	(.307)	(1.776)	(.391)
R^2	.215	.465	.170	.317	.496	.248
F (Kleibergen-Paap)			66.3			59.1
Endogeneity test p-value			.019			.010
Number of Observations	1,248	1,248	1,248	652	652	652
Number of Families	571	571	571	453	453	453

Dummies for missing information and birth order dummies are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

who survive to age five, reflecting the fact that, naturally, children suffering from child mortality do not present a large financial burden on the family budget.[13]

The sign of the conditional correlation between family size and human capital of offspring is negative, as predicted by the child quantity-quality trade-off hypothesis. This is regardless of whether the outcome variable is literacy or skills (Table 4, Columns 1 and 4). However, the partial correlations are insignificant and very close to zero in both cases.[14]

Turning to the covariates, the coefficients all appear to be in line with the a priori. Males are significantly more likely than females to be literate, but significantly less likely to be skilled. At first glance, the latter finding may appear surprising. However, unskilled work was physically very demanding and working women were, therefore, usually engaged in skilled work (notably spinning and weaving). It also follows that children who were not baptized on a Sunday, as was the convention, are significantly more likely to become literate and skilled, capturing the notion that the higher socioeconomic ranks were able to afford a non-Sunday baptism. Having a skilled father significantly increases the likelihood that the offspring is literate and skilled. Having a literate father, or mother, also makes it significantly more likely that the offspring is literate, while there is no significant effect on skills. Having a poor father makes it significantly less likely that the offspring is skilled and literate. Long-lived parents generally have no significant effect on the human capital of their children,[15] although it should be kept in mind that the sampled parents are long-lived by construction (cf. the restriction regarding completed marriages above).

Furthermore, the children of parents located in parishes dominated by industrial activities are significantly more likely to be skilled than those located in parishes of mixed professions (the background variable). The children of parents located in parishes dominated by retail and handicraft are significantly more likely to be literate. Finally, the time trend suggests that children become significantly less skilled over time (at the 10% level). This is consistent with the deskilling hypothesis, holding that the shift from workshop to factor production during the Industrial Revolution was a skill-saving development (Goldin and Katz, 1998; Nuvolari, 2002).

4.2 IV Results

The results of the first-stage regression of the 2SLS analysis, where we regress the family size on the TTFB and covariates, are presented in Table 4, Columns (2) and (5).[16] It follows that a one-year increase in the TTFB reduces the number of surviving offspring by

[13]Our findings are robust to using number of births instead.

[14]Appendix A includes the results of a series of OLS regressions using a variety of subsets of the control variables.

[15]Except for the fact that long-lived fathers have a very small, significantly negative effect on skills.

[16]Using the ivreg2 module, version 03.1.04, for Stata, provided by Baum et al. (2007a).

close to half a child, depending on the sample. Slightly less than half of the variation in the family size is explained by the TTFB and the covariates. The covariates have practically the same partial effects regardless of the sample used (literate or skilled individuals). The fact that low-income fathers have relatively many children is consistent with evidence showing that the poor were eventually outcompeting the rich in terms of births after 1800 (Boberg-Fazlic et al., 2011). In addition, it appears that literate fathers and long-living mothers give birth to relatively many offspring, while older brides have (as expected) relatively few. In both samples there is a gradual increase in family size over time (roughly half a child per century), consistent with the growing size of England's population at the time Wrigley and Schofield (1989).

In the second stage we regress the literacy and skill status of the offspring on the predicted number of surviving children, as well as the covariates. The findings (Table 4, Columns 3 and 6) reveal a sizeable and significant quantity-quality trade-off effect: an extra sibling on average reduces the chances of obtaining literacy by 6.7 percentage points and of obtaining a skilled profession by 7.5 percentage points.[17] Hence, being born to a large family drastically cuts the changes of achieving literacy and skills, even when controlling for the child's parents being educated, long living and economically affluent. Note that the endogeneity test of family size rejects in both regressions ($p = 0.019$ and $p = 0.010$). Also, the Wald F-test statistics ($F = 66.3$ and $F = 59.1$, respectively), based on the Kleibergen-Paap rk statistic Kleibergen and Paap (2006), do not generate suspicion regarding a weak instrument Baum et al. (2007b).

4.3 Robustness

To gauge the robustness of our results we now perform four main robustness checks, dealing with (*i*) some relatively long TTFBs in the data; (*ii*) some potentially missing births due to temporary migration; (*iii*) some potential dynastic variations in fecundity; and (*iv*) an alternative measure of marital fecundity, i.e. the time-interval from the first to the second births.

4.3.1 Winsorizing the TTFBs

Some of the sampled couples have extraordinary long time-intervals from their marriage to the arrival of their first child (up to ten years). Although the waiting time to a conception can generally be rather extensive we wish to ensure that these are not the source of our findings. Hence, we have repeated the analyses above using a Winzorised version of the instrument, where any TTFB exceeding three years (i.e. falls outside of the 90$^{\text{th}}$ percentile) is set to three years. The results of the Winsorized regressions

[17] Appendix B shows the results of a series of estimates, based on 2SLS regressions, using different subsets of the control variables.

Table 5: Robustness of the literacy results

	(1) Winsorized TTFB	(2) Winsorized TTFB	(3) Imputed Siblings	(4) Controlling for own TTFB	(5) IV: TTSB
Surviving Siblings (> 5 Years)	-.100***			-.067***	-.058***
	(.036)			(.025)	(.022)
Surviving and Imputed Siblings		-.195**			
		(.086)			
Surviving and Imputed Siblings (Spacings > 3 Years)			-.069***		
			(.026)		
TTFB < 40 Weeks				.016	
				(.039)	
40 Weeks ≤ TTFB < 1 Year				-.001	
				(.045)	
1 Year ≤ TTFB < 2 Years				-.035	
				(.041)	
2 Years ≤ TTFB < 3 Years				.084	
				(.063)	
TTFB ≥ 3 Years				.064	
				(.064)	
R^2	.097	-.269	.162	.172	.177
F (Kleibergen-Paap)	31.5	8.4	38.4	63.7	59.4
Endogeneity test p-value	.006	.004	.024	.019	.016
Number of Observations	1,248	1,248	1,248	1,248	1224
Number of Families	571	571	571	571	547

Control variables are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

(Table 5, Column 1 and Table 6, Column 1) demonstrate an even larger effect than in the baseline run, verifying that the main findings (Table 4) are not driven by the TTFBs falling outside of the 90th percentile of the distribution. The same conclusion is reached even if we remove the couples of TTFB greater than 3 years from the analysis instead. It is also possible that the long TTFBs could be the result of unobserved firstborns. However, if we impute an extra child wherever the TTFB exceeds three years and use the Winsorized instrument then we still obtain a significant effect (Table 5, Column 2 and Table 6, Column 2).

4.3.2 Potentially Unobserved Births

By confining the sample to couples who have completed their marriage (i.e. the wife survives in marriage until age 50) we automatically exclude the possibility of permanent migration and for that reason are able to steer clear of births occurring in parishes outside of our sample (see the discussion above). Nevertheless, it was not unusual for a married couple to migrate to an unobserved parish temporarily (Souden, 1984). Being away for more than a couple of years, it is not unlikely that the couple would conceive (and thus baptise) a child in their interim location. Such incidences would appear in the data as

Table 6: Robustness of the skill status results

	(1) Winsorized TTFB	(2) Winsorized TTFB	(3) Imputed Siblings	(4) Controlling for own TTFB	(5) IV: TTSB
Surviving Siblings (> 5 Years)	-.110***			-.074***	-.081***
	(.038)			(.028)	(.030)
Surviving and Imputed Siblings		-.186**			
		(.075)			
Surviving and Imputed Siblings (Spacings > 3 Years)			-.083**		
			(.032)		
TTFB < 40 Weeks				.004	
				(.046)	
40 Weeks ≤ TTFB < 1 Year				-.058	
				(.051)	
1 Year ≤ TTFB < 2 Years				.007	
				(.046)	
2 Years ≤ TTFB < 3 Years				-.022	
				(.073)	
TTFB ≥ 3 Years				-.021	
				(.069)	
R^2	.157	-.156	.212	.253	.235
F (Kleibergen-Paap)	31.6	11.2	29.7	60.8	47.1
Endogeneity test p-value	.002	.002	.009	.010	.007
Number of Observations	652	652	652	652	640
Number of Families	453	453	453	453	441

Control variables are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

an extended birth-spacing interval, and the resulting child would remain unobserved. To address this issue we impute an extra sibling for all the birth-spacing intervals exceeding three years, thus increasing the average family size by 1.3 children. The revised trade-off effects are reported in Table 5, Column 3 and Table 6, Column 3. In both regressions, the estimated effects are nearly unchanged and remain significant.

4.3.3 Controlling for the Dynastic Variations in Fecundity

If fecundity is hereditary then this could influence our findings (e.g. if fecundity and quality are correlated). In order to rule out this potential factor of endogeneity, we can control for the fecundity of offspring, accounting for any variations in the dynastic components of fecundity. The TTFB of offspring is known in 71% of the cases. We have addressed the issue by including dummy variables capturing if the children's own TTFB is less than 40 weeks; between 40 weeks and 1 year; between 1 and 2 years; between 2 and 3 years; or 3 years and above. The background variable is therefore unknown TTFB. Table 5, Column 4 and Table 6, Column 4, show that the baseline results (Table 4) are robust to handling the potential dynastic effects appearing through fecundity. The Table also shows that the children's own TTFBs are not significantly correlated with their human capital outcome.

4.3.4 An Alternative Instrument: the TTSB

There is reason to believe that a couple of low fecundability, and hence a long TTFB, will also have a long time-interval between the first and second birth (henceforth: the TTSB). We can therefore test the robustness of our findings by running the analysis with the TTSBs instead of the TTFBs, bearing in mind that it entails a component of endogeneity because the spacing of births are potentially controlled by the couple. Meanwhile, the use of the TTSB yields results that are virtually identical to those of the baseline run, with estimates of 6.3 percentage points (Table 5, Column 5) and 7.4 percentage points (Table 6, Column 5), for literacy and skills respectively, comparable to the 7.0 and 6.7 percentages points of using the TTFB (Table 4, Column 3 and Column 6), suggesting that our findings are not driven by TTFB anomalies.

4.4 Heckit Analysis

Our sampled individuals were selected based on their presence at the time when their literacy or skill status was reported. This fact may potentially introduce a bias, e.g. if family size affects the probability of death or of migration to an unobserved parish before the literacy or skill status is recorded. It is relevant to ask, therefore, if the trade-off we observe applies to the entire population of completed marriages from which our sample is drawn, and not just those for whom we know their literacy or skill status.

To answer this, we perform a three-step Heckit analysis (Wooldridge, 2010, Procedure 19.2). In the first stage we extend the sample to also include observations where literacy and skill status are unknown, thus expanding the sample to 8,647 individuals representing a total of 1,639 families. Next, we estimate the probability of observing human capital with a probit model, using dummies for missing marriage or death dates as instruments in addition to the TTFB (and covariates). We have 6,037 observations with missing marriage dates; 4,405 observations with missing death dates; and 2,976 cases where both dates are missing. Based on the predicted probabilities, we calculate the inverse Mills ratio, proceeding to estimate Equation (2) by 2SLS including the inverse Mills ratio as a control variable. We conduct the procedure for both outcome variables (i.e. literacy and skill status). If the inverse Mills ratio is statistically significant in the first or second stage, then it means our estimations possibly suffer from a sample selection bias.

Table 7 shows that the dummies for missing marriage and death dates are both highly significant, emphasising their accuracy in predicting a missing literacy or skill status. The inverse Mills ratio turns out to be highly insignificant in both stages of both regressions, verifying the absence of a sample selection bias.

Table 7: Heckit analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Surviving Siblings (> 5 Years)			-.066***			-.074***
			(.025)			(.028)
Missing Death Date	-.608***	.068	.021	-.144**	-.042	.046
	(.077)	(.199)	(.045)	(.057)	(.215)	(.047)
Missing Marriage Date	-3.985***	-.619	.141	-1.751***	.571	-.006
	(.148)	(1.738)	(.391)	(.069)	(1.623)	(.413)
TTFB	.018	-.437***		.007	-.483***	
	(.035)	(.053)		(.024)	(.063)	
Inverse Mills Ratio		.166	-.018		-.335	.003
		(.599)	(.135)		(1.225)	(.312)
R^2		.466	.172		.497	.253
F (Kleibergen-Paap)			66.7			58.6
Endogeneity test p-value			.021			.010
Number of Observations	8647	1,248	1,248	8647	652	652
Number of Families	1639	571	571	1639	453	453

Control variables are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Conclusion

We have used marital fecundity, measured by the time-interval from the marriage to the first birth, as an instrument for marital fertility, showing that additional siblings significantly reduced the chances of the offspring becoming literate and skilled in the 18^{th} –19^{th}-century England. Our findings lend strong support, not only to the child quantity-quality trade-off hypothesis, but also to unified growth theory (Galor, 2011) and to theoretical work by (Galor and Moav, 2002) who conjecture that the trade-off was decisive for economic development throughout the entire history of humanity. Our identification strategy, instrumenting fertility through fecundity, can be employed for a wide range of data, in developing countries and historical economies alike, and is a particularly useful tool for estimating the child quantity-quality trade-off effects in the growing number of family reconstructions of historical populations that are currently becoming available.

A Various OLS Specifications

A.1 Literacy

	(1) Literate	(2) Literate	(3) Literate	(4) Literate	(5) Literate	(6) Literate	(7) Literate
Surviving Siblings (> 5 Years)	-.010	-.007	-.014*	-.012	-.008	-.008	-.011
	(.008)	(.008)	(.008)	(.008)	(.010)	(.009)	(.009)
Male	.083***	.094***	.097***	.077***	.077***	.084***	.113***
	(.029)	(.028)	(.027)	(.029)	(.030)	(.029)	(.027)
Non-Sunday Baptism	.131***						.068**
	(.032)						(.030)
Skilled Father		.143**					.084
		(.065)					(.062)
Poor Father		-.344***					-.204***
		(.055)					(.055)
Skilled Mother		.306					.379
		(.220)					(.230)
Literate Father			.272***				.192***
			(.047)				(.048)
Literate Mother			.287***				.216***
			(.047)				(.047)
Longevity of Mother (Years)				.002			.003*
				(.002)			(.002)
Longevity of Father (Years)				-.002			-.000
				(.002)			(.002)
Age at Marriage of Mother (Years)					.004		.000
					(.005)		(.004)
Retail-Handicrafts Location						.283***	.132**
						(.058)	(.062)
Industrial Location						.039	.103**
						(.049)	(.051)
Agricultural Location						.048	.112**
						(.051)	(.051)
Centuries since 1500	.041	.087	.047	-.004	-.006	-.010	.128*
	(.069)	(.060)	(.072)	(.069)	(.070)	(.071)	(.067)
Constant	.377	.220	.183	.546*	.470*	.528**	-.517
	(.249)	(.269)	(.255)	(.309)	(.278)	(.248)	(.366)
R^2	.033	.135	.154	.020	.018	.040	.215
Number of Observations	1,248	1,248	1,248	1,248	1,248	1,248	1,248
Number of Families	571	571	571	571	571	571	571

Dummies for missing information and birth order dummies are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.2 Skills

	(1) Skilled	(2) Skilled	(3) Skilled	(4) Skilled	(5) Skilled	(6) Skilled	(7) Skilled
Surviving Siblings (> 5 Years)	-.011	-.007	-.018*	-.013	-.012	-.015	-.009
	(.011)	(.009)	(.010)	(.010)	(.012)	(.011)	(.008)
Male	-.247***	-.247***	-.262***	-.244***	-.243***	-.276***	-.284***
	(.061)	(.064)	(.067)	(.058)	(.059)	(.064)	(.071)
Non-Sunday Baptism	.170***						.106***
	(.039)						(.036)
Skilled Father		.310***					.212***
		(.069)					(.066)
Poor Father		-.209***					-.236***
		(.055)					(.054)
Skilled Mother		.741***					.727***
		(.205)					(.209)
Literate Father			.276***				.076
			(.060)				(.058)
Literate Mother			.055				.027
			(.069)				(.061)
Longevity of Mother (Years)				.003			.003
				(.002)			(.002)
Longevity of Father (Years)				-.004*			-.004**
				(.002)			(.002)
Age at Marriage of Mother (Years)					.002		-.001
					(.005)		(.004)
Retail-Handicrafts Location						.104**	.022
						(.052)	(.051)
Industrial Location						.328***	.240***
						(.054)	(.057)
Agricultural Location						-.041	-.098*
						(.063)	(.058)
Centuries since 1500	-.146***	-.062*	-.198***	-.181***	-.181***	-.136***	-.075*
	(.039)	(.037)	(.047)	(.039)	(.039)	(.040)	(.044)
Constant	1.382***	.812***	1.461***	1.659***	1.503***	1.427***	1.026***
	(.203)	(.217)	(.239)	(.268)	(.249)	(.206)	(.307)
R^2	.092	.242	.120	.069	.060	.118	.317
Number of Observations	652	652	652	652	652	652	652
Number of Families	453	453	453	453	453	453	453

Dummies for missing information and birth order dummies are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

B Various 2SLS Specifications

B.1 Literacy

	(1) Literate	(2) Literate	(3) Literate	(4) Literate	(5) Literate	(6) Literate	(7) Literate
Surviving Siblings (> 5 Years)	-.072**	-.071**	-.071**	-.072**	-.071**	-.072**	-.067***
	(.031)	(.030)	(.028)	(.033)	(.031)	(.032)	(.024)
Male	.085***	.093***	.099***	.080***	.078**	.087***	.113***
	(.030)	(.029)	(.028)	(.030)	(.031)	(.031)	(.027)
Non-Sunday Baptism	.121***						.061*
	(.035)						(.032)
Skilled Father		.139**					.068
		(.068)					(.063)
Poor Father		-.312***					-.191***
		(.063)					(.058)
Skilled Mother		.564*					.576**
		(.325)					(.260)
Literate Father			.305***				.232***
			(.052)				(.054)
Literate Mother			.262***				.202***
			(.053)				(.050)
Longevity of Mother (Years)				.003			.004**
				(.002)			(.002)
Longevity of Father (Years)				-.002			-.000
				(.002)			(.002)
Age at Marriage of Mother (Years)					-.009		-.010*
					(.008)		(.006)
Retail-Handicrafts Location						.232***	.103
						(.065)	(.066)
Industrial Location						.062	.115**
						(.052)	(.054)
Agricultural Location						.063	.117**
						(.055)	(.055)
Centuries since 1500	.096	.133*	.089	.054	.046	.058	.158**
	(.080)	(.069)	(.080)	(.081)	(.076)	(.085)	(.071)
Constant	.845**	.634*	.624*	.957**	1.218**	.977***	.027
	(.376)	(.366)	(.362)	(.420)	(.489)	(.363)	(.455)
R^2	-.041	.061	.093	-.051	-.047	-.040	.170
F (Kleibergen-Paap)	67.8	60.6	63.0	65.2	72.3	64.1	66.3
Endogeneity test p-value	.033	.022	.035	.049	.035	.029	.019
Number of Observations	1,248	1,248	1,248	1,248	1,248	1,248	1,248
Number of Families	571	571	571	571	571	571	571

Dummies for missing information and birth order dummies are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

B.2 Skills

	(1) Skilled	(2) Skilled	(3) Skilled	(4) Skilled	(5) Skilled	(6) Skilled	(7) Skilled
Surviving Siblings (> 5 Years)	-.073*	-.064*	-.052	-.068	-.059*	-.083**	-.075***
	(.040)	(.034)	(.040)	(.043)	(.035)	(.038)	(.028)
Male	-.239***	-.247***	-.254***	-.237***	-.230***	-.257***	-.273***
	(.064)	(.065)	(.069)	(.061)	(.063)	(.071)	(.075)
Non-Sunday Baptism	.146***						.096***
	(.043)						(.037)
Skilled Father		.299***					.192***
		(.075)					(.067)
Poor Father		-.179***					-.202***
		(.063)					(.058)
Skilled Mother		.995***					1.030***
		(.366)					(.323)
Literate Father			.295***				.128**
			(.065)				(.063)
Literate Mother			.040				.009
			(.072)				(.061)
Longevity of Mother (Years)				.003			.004**
				(.002)			(.002)
Longevity of Father (Years)				-.003			-.004*
				(.002)			(.002)
Age at Marriage of Mother (Years)					-.009		-.016**
					(.009)		(.008)
Retail-Handicrafts Location						.052	.006
						(.061)	(.053)
Industrial Location						.350***	.269***
						(.063)	(.063)
Agricultural Location						-.028	-.087
						(.070)	(.062)
Centuries since 1500	-.098**	-.027	-.173***	-.137***	-.142***	-.098**	-.038
	(.049)	(.043)	(.054)	(.052)	(.048)	(.046)	(.049)
Constant	1.844***	1.206***	1.712***	1.947***	2.032***	1.958***	1.521***
	(.378)	(.347)	(.388)	(.374)	(.478)	(.380)	(.391)
R^2	.004	.172	.093	.001	.021	.014	.248
F (Kleibergen-Paap)	40.0	36.1	38.4	36.4	58.9	45.9	59.1
Endogeneity test p-value	.106	.081	.380	.191	.159	.060	.010
Number of Observations	652	652	652	652	652	652	652
Number of Families	453	453	453	453	453	453	453

Dummies for missing information and birth order dummies are excluded from the Table. Standard errors clustered at the family level are reported in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

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