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Fertility and Financial Development: Evidence from U.S. Counties in the 19th Century

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Fertility and financial development: evidence from U.S. counties in the 19th century

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Abstract

This paper uses data on fertility and financial development in 19th century U.S. to test the hypothesis that more developed local financial markets reduce the incentives for families to have a large offspring to provide for them at old age, the so-called old-age security hypothesis. We find that the presence of banks is associated to lower children-to-women ratios and crude birth rates even after controlling for a large set of socio-economic factors. To account for possible endogeneity of bank location we instrument for the presence of some banking activity in a given county in 1840 with the existence of at least a bank in that county in 1820. The results of using this identification strategy are in line with the OLS ones, namely that fertility in 1850 is negatively affected by financial development. Next we explore the relationship between banking activity and fertility in the state of Pennsylvania, where, by law, most banks were created before 1820. This allows us to treat banks in 1840 as exogenous and confirm the existence of a strong negative causal effect from financial development to fertility. Finally, we show that our results are robust to measuring banking activity with the number of cities with at least a bank in a given county.

Keywords: fertility; old-age security hypothesis; financial development; 19th century U.S.

JEL Classifications: O10, N31, J10

1 Introduction

In many of today's developing countries and in rich countries around the time of their industrial revolution parents have often used their children as an instrument to secure support when in old age.

*We thank Howard Bodenhorn for very useful comments. All remaining errors are ours.

This phenomenon - known as the old-age security hypothesis - was first proposed by Neher (1971) and Caldwell (1976). Assuming that financial markets and children are substitutes in securing support for old parents, then a direct implication of their analysis is that the fertility behaviour in a given country should be strongly associated with the development of its financial system.

The main purpose of this paper is to test the old-age security hypothesis using county-level data in Northeastern United States for the first half of the 19th century. This is a sensible choice of location and time period to carry out this exercise since the U.S. experienced an astonishing development of the financial, and in particular the banking, system (see Bodenhorn and Cuberes 2010).[1] Another important characteristic of this episode is that the heterogeneous process of granting bank charters (Bodenhorn, 2008) generated wide variations in the degree of financial development across states.[2]

We exploit cross-county variation to test the association between financial development and fertility choice in the first half of the 19th century across U.S. counties, belonging to Northeastern states (New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Delaware and Ohio.) We measure financial development using alternative measures that capture the presence of banks in each county around 1840. Fertility levels are measured using the child-woman ratio and the crude birth rate in 1850.[3] We first assess the relationship by estimating OLS regressions. We then tackle the potential bias of OLS estimates - due to endogeneity issues - employing two different strategies. The first one entails the use of an instrumental variable strategy where we instrument the presence of at least a bank in a given county in 1840 with the presence of at least a bank in 1820. The existence of at least a bank before 1820 is naturally correlated with the presence of a bank before 1840. Our identification assumption is that the crucial factor affecting fertility decisions - measured in 1850 - is the availability of capital markets sometime around this year: past availability should not matter once accounting for "current" availability of capital markets.[4] In our second strategy we consider Pennsylvania as a case study. This state has

[1] See, for instance Sylla (1998) for a description of the "Federalist financial revolution" that fundamentally changed the banking structure in the U.S in the late 18th and early 19th century.

[2] For instance, in 1837 Massachusetts had 116 operating banks, while the figures for New York and Pennsylvania were 49 and 98, respectively.

[3] Other recent studies using similar indicators to measure fertility in a historical context are Becker et al. (2010) and Murtin (forthcoming).

[4] It is important to notice that our measure of financial development, while arguably rough, allows us to implement

the advantage that in most of its counties banks were created before 1820. Since in this case it is then hard to argue that the effect of local banks on fertility reflects reverse causality, we take existing banks in 1840 as exogenous and we look at their association with fertility in 1850 within this state.

Our results strongly support the old-age security hypothesis. The availability of financial markets significantly reduces fertility. We do not argue that the old-age security hypothesis is the main - nor the most important - factor in shaping fertility levels in historical U.S. Our results should rather be interpreted as highlighting the importance of this factor as a reinforcing mechanism to reduce parents' incentives of having a large offspring. Our estimates indicate that the old-age motive is economically important: OLS estimates suggest that the presence of a bank in a given county in 1840 reduces the child-woman ratio by 7%, from 1.79 to 1.67 children per woman. IV estimates suggest that the presence of a bank in a given county in 1840 reduces the child-woman ratio by 9%, from 1.79 to 1.63. This is a considerably larger effect than the one we obtained using OLS.

2 Literature review

There is an abundant literature in demography and economics studying the direction of intergenerational family transfers, their motives, and how they are affected by different institutional and cultural arrangements. This literature argues that intergenerational transfers have a significant impact on family size, in particular desired fertility.

Several authors have explored the old-age security hypothesis and its role in shaping the fertility behaviour from a theoretical perspective. Caldwell (1976, 1982) proposes a theory based on the idea that transfers from children to parents are the main reason behind parents' choice of having a large offspring.[5] Nugent (1985) also emphasizes the importance of this channel (p.76): *"old-age security*

this instrumental variable procedure since the key is that at least a bank operates in a given county. Using an intensive measure of banking - for instance the amount of assets owned by banks - would probably be more informative but would invalidate our exclusion restriction. The reason is that the amount of assets accumulated by a given bank in 1840 may easily be a function of omitted variables that simultaneously determine fertility in 1850. So, unless one could find a valid instrument for banks' assets, establishing a causal link between this variable and fertility would be difficult.

[5] Willis (1980) formalizes Caldwell's argument in a highly stylized model.

is likely to be an important motive for fertility when the relevant parent is both uncertain about his or her ability to be self-supporting in old age and dubious that there are other more reliable or more effective means of such support than his or her own children." Ehrlich and Liu (1991) develop an overlapping-generation model of endogenous growth where different generations are interdependent through financial transfers. Morand (1999) presents a model in which growth and fertility interact with each other as a result of the fact that parents rely on their children to support them in old age. Finally, Boldrin and Jones (2002) modify the setup of Barro and Becker (1989) to allow for altruism running from children to parents.[6]

Financial development can affect fertility behaviour by reducing the importance of the old-age security motive.[7] Guinnane (2011, p. 598) argues that *"children were an important way to ensure against risk and to provide for old age, and that the rise of state social insurance as well as private insurance and savings vehicles led households to substitute out of children"*. The spread of banks would then offer alternative means to provide for old age security. One possible way through which financial development can affect fertility is the possibility of borrowing resources from banks, hence making current consumption less dependent on current income. As children were often sent to work to provide additional resources to the household, the development of a banking system would then reduce parents' optimal number of children as their importance to provide contemporaneous income decreases.

In spite of the solid theoretical foundation of the old-age security motive, the existing empirical relevance is controversial.[8] According to Galor (2012), while the old-age security hypothesis is one of the mechanisms that can explain differences in fertility levels, the existing evidence seems to indicate that its role as trigger of a country's fertility transition is rather small. For instance, there is evidence that 16th century England had institutions that allowed parents to have financial

[6]See also the discussion in Cain (1983).

[7]The literature analyzing fertility behaviour has pointed out several important factors that can explain differences in fertility by studying historical data (Guinnane 2011; Galor 2012). Among these, the most relevant ones are the demand for human capital and the corresponding interplay between quantity and quality of children (Galor and Weil, 2000), income (Becker and Lewis, 1973; Becker, 1981), child and infant mortality rates (Coale 1973; Sah 1991; Ehrlich and Lui 1991; Kalemli-Ozcan 2002; Tamura 2006), and different dimensions of gender gaps (Galor and Weil 1996; Goldin 1990; Lagerlöf, 2003).

[8]Some authors have also criticized the old-age security hypothesis on theoretical grounds. See Nerlove, Razin and Sadka (1986, 1987).

assistance that did not rely on their children (Pelling and Smith, 1991; Hindle, 2004). Moreover, there is some evidence that, before the demographic transition, richer households - who arguably had better access to financial services - tended to have higher fertility casts doubts about the old-age support hypothesis (Clark and Hamilton, 2006).[9] Using data for Bavaria in the period 1880-1910, Brown and Guinnane (2002) argue that the old-age security motive was in fact unimportant. Finally, Kaplan (1994) using data from Peru and Paraguay finds evidence of intergenerational transfers from parents to children rather than the reverse, suggesting that the old-age support hypothesis is not in place in these countries. On the other hand, other studies have found strong support for this hypothesis. Galloway et al. (1994) claims that this hypothesis is validated in Prussia between 1875 and 1910. Steckel (1991) also finds a negative correlation between financial development at the state level and fertility for a sample of rural families from around the U.S. in the 19th century.[10] Evidence in favor of the old-age hypothesis from several currently developing countries is provided by Nugent and Gillapsy (1983). Cain (1981) and Dharmalingam (1994) show this effect in India and Cain (1977, 1981) and Jensen (1990) in Bangladesh and Malaysia, respectively.[11] Finally, Kagitcibasi (1982) and Willis (1980) find support for the old-age security hypothesis in a sample of countries emphasizing the importance of cultural aspects whereas Entwisle and Winegarden (1984) and Nugent and Gillapsy (1983) show that having public policies targeted to provide old-age support has a negative effect on fertility.

3 Theoretical benchmark

In this section we develop a simple theoretical framework that rationalizes the negative relationship between financial development an the number of children a household chooses to have. This is meant to illustrate the main mechanism in place without developing a full-fledged model. Assume a household is formed by two parents and a number of children. Following Ray (1998), let α in (0,1)

[9] The latter argument is however weak if it is indeed the case that most of the wealth of the rich relies on non-wage income since, in that case, there could exist an old-age security motive but fertility may be higher for rich households than for poor ones due to a pure income effect.

[10] Two crucial differences between his study and ours are that we use county-level data on financial development and that we tackle the issue of endogeneity of banking development implementing two different strategies.

[11] Robinson (1986) argues that the old-age security does not really apply to Bangladesh.

be the probability that a child looks after her parents when she grows up. This probability takes into account infant and child mortality, the possibility that the child survives to adulthood but earns an income not high enough to provide for her parents, and the eventuality that her income is high enough but she chooses not to look after them. Parents have another mechanism through which they can receive some income when old, namely the use of financial services provided by a local bank. One natural way to achieve this is to save when young and then use these savings and their financial return when old.[12] Let β in (0,1) be the probability that the location where the parents live has a bank.[13] Finally, let γ in (0,1) be the probability that parents find acceptable as a threshold probability of receiving some kind of economic support from at least a child or a bank. For instance, $\gamma = 0.95$ means that parents find it intolerable to have a 5% chance that they do not receive any support form either a child or a bank when they get old and hence cannot rely on a regular income stream.

Suppose that a household has n children. Then the probability that none of them looks after their parents when they are old is $(1-\alpha)^n$. On the other hand, the probability that there is no local bank in which the household can make its savings grow is $1-\beta$. Therefore, the probability that parents will have some financial resources from at least a child or a bank is:

$$1 - [(1-\alpha)^n(1-\beta)] \tag{1}$$

Parents want to guarantee that this probability is not lower than γ, which leads them to have at least n^* children i.e.:[14]

[12]The importance of local banks in providing financial services to households has been explored, for instance, in Guiso et al. (2004).

[13]We use the term "location" here in a vague way so that it can refer to a town, city, or even a county. The important thing is that the bank is located "nearby" where households live so that it is reasonably easy - in the context of 19th century U.S - for them to visit this bank and use its financial services.

[14]We assume $\gamma > \beta$ to ensure a non-negative optimal number of children. This appears a realistic assumption since it seems reasonable that parents in 19th century U.S. had a markedly high aversion to reach old-age without financial support. For example, Ray (1998) suggests a value of γ equal to 0.95. A plausible estimate of β can be obtained from the percentage of counties without a bank in 1840, which is 46% in our dataset, implying a value of β of around 0.54.

$$n \geq n^{*} \equiv \frac{\ln\left(\frac{1-\gamma}{1-\beta}\right)}{\ln\left(1-\alpha\right)} \tag{2}$$

It is then easy to show that an exogenous increase in the probability that a bank is present near the household location - a proxy for financial development - reduces the number of children that this household chooses to have:

$$\frac{\partial n^{*}}{\partial \beta} = \frac{1}{\left(1-\beta\right)\ln\left(1-\alpha\right)} < 0 \tag{3}$$

4 Data

Our analysis exploits cross-county variation in order to assess the role of financial development on fertility choice. Our largest sample consists of 279 counties belonging to Northeastern states (New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Ohio).

Data on banks creation at the city-level has been collected by Bodenhorn and Cuberes (2010): this has been aggregated so to get county-level measures of financial development. The main measure we use is a dummy variable (labelled *Bank in 1840*) taking a value of one if in the year 1840 there is at least a bank in the county, and zero otherwise. As a robustness check we use a second measure computed as the number of cities in each county with at least one bank by 1840.

In order to assess the association between financial development and fertility, we are interested in measuring the "quantity" of children. Following recent papers analyzing fertility-related issues in historical context using county-level data, we measure fertility with the child-woman ratio computed as the number of children aged 5-14 over the number of women aged 20-39.[15] It is important to note that, by using children aged 5-14, we remove the effect of infant and child mortality, thus

[15] The child-woman ratio is computed for the white population. Recent studies assessing the determinants of fertility levels in historical contexts have adopted this indicator to measure fertility (Becker et al 2010, 2012). We restrict ourselves to white population due to data availability. However, from the U.S. census we know that the percentage of free colored and slaves in the states and time period that we analyze was very small, around 1.9%.

capturing surviving children. As a robustness check we use also the crude birth rate to measure fertility.[16] Both measures of fertility are calculated using the U.S. Population Census of 1850. As Figure 1 shows, there is a strong positive correlation (0.53) between these two alternative measures of fertility.

FIGURE 1 HERE

We control for several factors considered important in determining fertility behaviour. To account for role of the demand for human capital and the interplay between quantity and quality of children, we add as a regressor school attendance in each county. This is measured as the number of individuals (white population) attending school over the population aged 5-19. Since we don't have data on income per capita at the county level, we use three alternative proxies. The first one is public spending in schools per capita from taxation: the rationale for this is that counties with high income should also have larger revenues from taxation and hence more funds for education. [17] Our second measure of income per capita is the county's urbanization rate, defined as the share of population living in cities with at least 5000 inhabitants. Apart from capturing the level of development of a given county, the urban environment might be important because changes in cultural attitudes towards fertility - for example about contraception - tend to spread first in urban areas than in rural ones. Moreover, some authors have shown that fertility has historically been higher in rural areas than in urban ones (Galloway et al., 1998).[18] As recent findings in the literature suggest (e.g. Bodenhorn and Cuberes 2010), urbanization as well depends on banking so by controlling for urbanization we are capturing the effect of banking on fertility independently of its effect on urbanization. Hence the total effect of financial development is likely to be larger than the one captured by our banking measure. Finally, we also account for agricultural productivity - measured as the value of farming implements/machinery per acre of improved land in farms because it is

[16]The crude birth rate is computed using surviving births until June 1, 1950, so it partially accounts for the effect of mortality during childhood, a variable considered as important in explaining fertility choices

[17]This measure also captures the supply of (public) education, which may be relevant for the quantity-quality children trade-off discussed above.

[18]One may argue that income per capita and urbanization are highly correlated and so including both variables as regressors may create problems of collinearity. However, in our case the correlation between our proxy of income per capita and urbanization is rather low, 0.26.

likely to affect income and, among other things, the demand for child labour.[19]

In our regressions we also introduce as regressors several variables that, while they have not been pivotal in the existing theoretical models of fertility, we believe are relevant to predict cross-county variation in 19th century U.S. First we include a measure of parents' education since - especially in the case of mother's education - it has often been regarded as an important factor in explaining fertility behaviour as it affects knowledge of fertility controls, earnings and preferences (see Cochrane 1979). We proxy this with the percentage of literate among men and women (white population) older than 20. In order to address the importance of the economic and social role of women we also use the ratio between literate women and literate men, as a proxy of the gender gap. Furthermore, since marriage is one of the main explanatory factors of fertility behaviour, we use a proxy for married women computed as the number of families over women older than 15. Finally, an important issue we account for is selective migration as one may argue that individuals who prefer finance to children as means of securing financial support at old age or that for some reason have few or no children may relocate closer to banks or to counties that have a local bank. We do this by controlling for migration flows from other states and from abroad. Table 1 displays the source of each variable while Table 2 shows some descriptive statistics.

TABLE 1 HERE

TABLE 2 HERE

5 Empirical strategy

Our empirical strategy consists of estimating several cross-sectional regressions of the following form:

[19]For instance, Rosenzweig and Evenson (1977) show that agricultural productivity is positively related to child labour-force participation in rural India.

$$fert_i = \gamma_1\, findev_i + \gamma_2\, X_i + \psi_i \tag{4}$$

where $fert_i$ is the child-woman ratio (or the log CBR) in county i, $findev_i$ is the measure of financial development in county i, and X_i includes the different county-level control variables discussed in the previous section.

We start estimating OLS regressions to assess the association between our measure of financial development and fertility. However, since bank location is likely to be endogenous, our OLS estimates may indeed be biased if, for some reason, banks tend to locate in counties with higher or lower fertility, or if a common omitted variable, like for instance technological progress affects simultaneously households' fertility decisions and bank location. To account for this possible bias we use two alternative strategies. The first entails the use of an instrumental variable procedure where we instrument the presence of at least a bank by the year 1840 in a given county with the presence of at least a bank by 1820. The correlation between these two dummies is strong (0.64). Our identification assumption is that the instrument is unlikely to have a direct effect on fertility in 1850, thus satisfying the exclusion restriction. The existence of at least a bank before 1820 is well correlated with the presence of bank before 1840 but the crucial factor affecting fertility decision around 1850 is the availability of capital markets in a period around this year: past availability should not matter once accounting for "current" availability of capital markets.

In our second strategy we look at Pennsylvania as a case study. Pennsylvania is a convenient state to test the old-age security hypothesis because in most of its counties banks were created before 1820. This was a direct consequence of a banking act passed in 1814 in which the state was divided into twenty-seven districts, and a total of forty-two banks were chartered. Each district received at least one bank but after 1814 the state was very reluctant to charter new banks (Bodenhorn, 2008).[20] Since in this context it is indeed hard to argue that the effect of local banks on fertility reflects

[20] A few new banks were established after 1820, but this was a quite rare event. Below we eliminate the counties where this was the case.

reverse causality, we take banks existing in 1840 as exogenous and we look at their association with fertility in 1850.

6 Results

Figure 2 shows the unconditional relationship between our first measure of financial development - the presence of at least a bank in 1840 - and fertility across counties, while Figure 3 correlates fertility with the number of cities with at least a bank in 1840. In both cases it is apparent that there is a strong negative correlation between the two variables - as implied by the old-age security hypothesis - and this does not seem to be driven by outliers. We now proceed to study this relationship more systematically. Table 3 reports the OLS estimates of equation (4) using the presence of at least a bank in the county in 1840 as a proxy for the availability of capital markets. The coefficient on local bank development in 1840 is significantly negative in all specifications, suggesting that financial development reduces the incentives of families to have a large offspring. School attendance enters negatively in most cases but it is never statistically significant. Our proxy of income per capita, on the other hand, has a negative impact on fertility in all specifications, supporting Becker's (1981) hypothesis that, with economic development, the associated income effect becomes smaller than the substitution effect, and households optimally choose to have fewer and more educated children. Urbanization is also strongly associated with lower fertility, whereas neither female nor male literacy have a significant impact. The coefficient on the education gap (measured as the ratio of women's over men's literacy) is generally negative, confirming the relevance of women's empowerment in affecting fertility choice. (see Galor and Weil, 1996). Fertility is higher in counties with a larger share of married women, and agricultural productivity reduces fertility. As mentioned above, one potential concern with this regression is the possibility of selective migration: households who prefer finance to children as a technology to implement inter-temporal transfers or those with few or no children at all may relocate closer to banks. In order to address this we construct a proxy for immigration flows to a given state from other U.S. states and for immigration from abroad to this state.[21] In both cases higher immigration flows tend to be associated with lower fertility, possibly indicating an important element of selective migration, suggesting that our estimates of the impact of local financial development on fertility without controlling for migration flows may be upward biased. Importantly though, the coefficient associated with banking survives the inclusion of such migration controls.

Using the specifications with the largest number of controls (7 and 8) our estimates suggest that the presence of a bank in a given county in 1840 reduces the child-woman ratio by 7%, from 1.79 children per woman (the average fertility in 1850) to 1.67. This implies that bank availability is associated with a drop of 7% in child-woman ratios. Moreover, the R^2 associated with our regressions is very high, indicating that our empirical model captures a substantial cross-county variation in fertility.

FIGURE 2 HERE

TABLE 3 HERE

The next step of the analysis addresses the important issue of endogeneity in bank location. We first implement the instrumental variable strategy mentioned in the previous section: specifically, we instrument the presence of at least a bank in 1840 with the existence of at least a bank in 1820. Table 4 displays first and second-stage estimates that confirms the negative association between bank's availability and fertility levels. The instrument is strongly correlated with the endogenous variable. As previously mentioned, our identification assumption is that the instrument is unlikely to have a direct effect on fertility in 1850, thus satisfying the exclusion restriction. The crucial factor affecting fertility decision around 1850 is the availability of capital markets in a period around this year: past availability should not matter once accounting for "current" availability of banking services. Using specification (6) in Table 4 - comparable to column (8) in Table 3 - our IV estimate suggest that the presence of a bank in a given county in 1840 reduces the child-woman ratio by 9%, from 1.79 to 1.63. This represents a larger effect than the one we obtained using OLS estimates.

TABLE 4 HERE

[21] Unfortunately, we could not find data of immigration at the county level.

A second strategy to tackle potential bias of OLS estimates consists in using a case study. Following up on our discussion in Section 5, studying the relationship between financial development and fertility in Pennsylvania is useful because in most of its counties banks were created before 1820, so that it is hard to argue that their effect on fertility reflects reverse causality.[22] Table 5 shows that the coefficient on banks is still negative and statistically significant in this state, which is remarkable given the small number of observations (52 compared to 279 in the regressions that use all the Northeastern states).

TABLE 5 HERE

6.1 Robustness check: number of cities with at least a bank

The availability of capital markets to households living in a given county is ensured by the presence of at least a bank operating in that county. However, since transportation costs might have prevented, or at the very least, limited people's mobility across cities in the 19th century, we use an alternative measure of the availability of capital markets. In particular, we use the number of cities with at least a bank in each county in 1840. As we notice from Table 6, the estimation results confirm our previous findings. Counties characterized by a higher number of cities with at least a bank have lower fertility levels.[23]

TABLE 6 HERE

6.2 Robustness check: alternative measure of fertility

As last robustness check, we consider similar regressions to those previously estimated but using the (log) crude birth rate to measure fertility levels. Table 7 shows the results of this exercise. Since crude birth rates may in part depend on the mortality environment (during childhood and

[22]We exclude the 9 (out of 61) counties that got their first bank between 1820 and 1840.

[23]One may argue that we are capturing a scale effect i.e. more populated counties should have a larger population and hence more cities. However, our control for urbanization should capture this size effect.

also adulthood), we add as a control the (log) crude death rate.[24] Since crude birth rates are defined as births over total population, we replace the family-to-woman ratio with the marriage rate, calculated as the number of marriages until June 1, 1950 over total population. The results in Table 7 show similar results to those obtained using the child-woman ratio as dependent variable. The presence of at least a bank in a county is strongly associated with lower birth rates in that county. Making similar calculations as before, our estimates from column (2) suggest a drop in about 7-8% in crude birth rates, from an average of 0.026 to 0.024 (i.e. from 26 to 24 births per 1000 inhabitants). Interestingly, in this case the effect of schooling on fertility is negative and significant in all specifications, whereas the effect of income per capita and urbanization vanish. Counties with higher death rates seem to have higher fertility, although the estimated coefficient is only significant in the Pennsylvania sample. The marriage rate enters positively and lower levels of the literacy gap are again associated with lower birth rates. Agricultural productivity is not significant in these regressions and neither is migration from other states, although migration from abroad is now positively associated with fertility.

TABLE 7 HERE

7 Conclusions

This paper empirically explores the relevance of the so-called old-age security hypothesis to explain differences in fertility levels. We find evidence that the availability of capital markets is related to lower fertility levels across Northeastern U.S. counties in the early 19th century. This result is consistent with the old-age security hypothesis: as children are one of the instruments that parents can use to secure support when old, the availability of capital markets might decrease the incentives of households to have a large offspring. Overall the evidence strongly suggests that the availability of capital markets was important in shaping parents' fertility choice. We implement two alternative methods to tackle the potential bias of OLS estimates. Also, our results are robust to the

[24]Since surviving births are only measured between January and June, they only account for (initial) infant mortality but not for infant mortality six months after birth or child mortality.

use of different measures of fertility and financial development. This finding has important policy implications for today's developing countries that still have relatively high fertility levels. Our results suggest that policies oriented to provide access to capital markets can reduce parents' incentives to have a large offspring, thus facilitating increases in standard of livings through reductions in fertility and their positive indirect effects.

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Table 1: Variables and data sources

Child-woman ratio	Authors' calculations using population census data
Crude birth rate	Authors' calculations using population census data
Bank in 1840	Bodenhorn and Cuberes (2010)
Bank in 1820	Bodenhorn and Cuberes (2010)
Cities with at least a bank in 1840	Bodenhorn and Cuberes (2010)
Cities with at least a bank in 1840	Bodenhorn and Cuberes (2010)
Share of literate women (older than 20)	Authors' calculations using population census data
Share of literate men (older than 20)	Authors' calculations using population census data
Education gap (older than 20)	Authors' calculations using population census data
School attendance	Authors' calculations using population census data
Proxy income per capita	Authors' calculations using population census data
Share of urban population	Authors' calculations using population census data
Share of married women	Authors' calculations using population census data
Marriage rate	Authors' calculations using population census data
Crude death rate	Authors' calculations using population census data
Agricultural productivity	Authors' calculations using population census data
Migration from other state	Authors' calculations using population census data
Migration from abroad	Authors' calculations using population census data

Table 2: Descriptive statistics

	(1) Mean	(2) Std. dev.	(3) Min	(4) Max
Child-woman ratio	1.79	0.34	0.87	2.57
Crude birth rate	0.03	0.00	0.01	0.04
Bank in 1840	0.54	0.49	0	1
Bank in 1820	0.33	0.47	0	1
Cities with at least a bank in 1840	0.93	1.52	0	12
Cities with at least a bank in 1820	0.43	0.83	0	7
Share of literate women (older than 20)	0.92	0.08	0.59	1
Share of literate men (older than 20)	0.95	0.04	0.67	1
Education gap (women/men)	0.96	0.06	0.69	1.06
School attendance	0.68	0.12	0.28	1.01
Proxy income per capita	0.28	0.23	0	1.71
Share of urban population	0.12	0.22	0	1
Share of married women	0.63	0.06	0.46	1.10
Marriage rate	0.01	0.00	0.00	0.03
Crude death rate	0.01	0.01	0.00	0.06
Agricultural productivity	1.66	1.12	0.35	16.12
Migration from other state	0.16	0.11	0.00	0.50
Migration from abroad	0.09	0.08	0.00	0.47

Data on 279 U.S. counties belonging to New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Delaware and Ohio.

Table 3: Financial development and fertility: OLS

Dependent variable	Child-woman ratio							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank in 1840	-0.210***	-0.191***	-0.150***	-0.141***	-0.151***	-0.121***	-0.120***	-0.116***
	[0.027]	[0.027]	[0.024]	[0.023]	[0.023]	[0.027]	[0.026]	[0.026]
School attendance		0.129	-0.202	0.022	-0.109	-0.044	-0.063	-0.054
		[0.137]	[0.128]	[0.131]	[0.130]	[0.112]	[0.113]	[0.115]
Proxy income per capita		-0.305***	-0.180**	-0.168**	-0.170**	-0.166***	-0.155**	-0.155***
		[0.095]	[0.071]	[0.072]	[0.074]	[0.062]	[0.061]	[0.057]
Urbanization			-0.495***	-0.466***	-0.495***	-0.389***	-0.332***	-0.242***
			[0.081]	[0.078]	[0.081]	[0.068]	[0.069]	[0.064]
Female literacy				-0.405				
				[0.278]				
Male literacy				-0.700				
				[0.534]				
Literacy gap					-0.773***	-0.428**	-0.423**	-0.242
					[0.203]	[0.194]	[0.194]	[0.197]
Share married women						1.859***	1.822***	1.923***
						[0.553]	[0.540]	[0.563]
Agricultural productivity							-0.028***	-0.016**
							[0.009]	[0.008]
Migration from other state								-0.361***
								[0.119]
Migration from abroad								-0.496***
								[0.186]
Constant	1.491***	1.413***	1.754***	2.657***	2.454***	0.910**	0.951**	0.750*
	[0.038]	[0.104]	[0.114]	[0.335]	[0.215]	[0.378]	[0.371]	[0.393]
State dummies	yes	yes	yes	yes	yes	yes	yes	yes
Observations	279	279	279	279	279	279	279	279
R^2	0.664	0.684	0.740	0.763	0.752	0.809	0.814	0.830

***, **,* denote statistical significance at 1% , 5% and 10% levels, respectively. Robust standard errors reported in parentheses. The dependent variable is children aged 5-14 over women 20-39 (white population) measured in 1850.

Table 4: Financial development and fertility: 2SLS

	First stage			Second stage		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable		Bank in 1840			Child-woman ratio	
Bank in 1840				-0.197***	-0.148***	-0.164***
				[0.035]	[0.042]	[0.042]
Bank in 1820	0.641***	0.633***	0.642***			
	[0.045]	[0.047]	[0.047]			
School attendance	0.408*	0.373	0.401	-0.193	-0.059	-0.042
	[0.244]	[0.252]	[0.265]	[0.126]	[0.110]	[0.114]
Proxy income per capita	0.227	0.219	0.216	-0.166**	-0.148**	-0.142***
	[0.148]	[0.150]	[0.147]	[0.067]	[0.058]	[0.052]
Urbanization	0.108	0.060	-0.038	-0.469***	-0.319***	-0.224***
	[0.129]	[0.140]	[0.152]	[0.078]	[0.065]	[0.061]
Literacy gap		0.086	-0.049		-0.432**	-0.256
		[0.305]	[0.325]		[0.187]	[0.188]
Share married women		-0.466	-0.534		1.780***	1.852***
		[0.508]	[0.517]		[0.517]	[0.517]
Agricultural productivity		0.010	-0.002		-0.027***	-0.016**
		[0.020]	[0.018]		[0.009]	[0.008]
Migration from other state			0.272			-0.364***
			[0.365]			[0.118]
Migration from abroad			0.539			-0.476***
			[0.403]			[0.178]
Constant	0.120	0.345	0.453	1.779***	1.001***	0.831**
	[0.230]	[0.504]	[0.527]	[0.113]	[0.369]	[0.377]
State dummies	yes	yes	yes	yes	yes	yes
First-stage F-statistic	200.84	180.74	185.64			
Observations	279	279	279	279	279	279

***, **,* denote statistical significance at 1% , 5% and 10% levels, respectively. Robust standard errors reported in parentheses. The instrument used in all specifications is a dummy taking on value 1 if at least a bank was present in the county in 1820.

Table 5: Financial development and fertility: Pennsylvania case. OLS

Dependent variable	Child-woman ratio		
	(1)	(2)	(3)
Bank in 1840	-0.100***	-0.098***	-0.120***
	[0.028]	[0.027]	[0.033]
School attendance	-0.076	-0.072	-0.095
	[0.220]	[0.219]	[0.259]
Proxy income per capita	-0.357***	-0.357***	-0.383***
	[0.107]	[0.106]	[0.131]
Urbanization	0.105	0.109	0.103
	[0.120]	[0.117]	[0.119]
Female literacy	-0.502**		
	[0.214]		
Male literacy	0.604		
	[0.723]		
Literacy gap		-0.431***	-0.432***
		[0.132]	[0.143]
Share married women	3.072***	3.035***	3.002***
	[0.531]	[0.496]	[0.557]
Agricultural productivity	-0.067**	-0.067**	-0.056
	[0.030]	[0.029]	[0.033]
Migration from other state	-0.308*	-0.305*	-0.349*
	[0.160]	[0.157]	[0.195]
Migration from abroad	-1.098***	-1.122***	-1.148***
	[0.190]	[0.167]	[0.205]
Constant	0.313	0.865**	0.902*
	[0.755]	[0.401]	[0.471]
Observations	61	61	52
R^2	0.805	0.806	0.818

***, **,* denote statistical significance at 1% , 5% and 10% levels, respectively. Robust standard errors reported in parentheses. In column 3 we exclude 9 counties that got their first bank between 1820 and 1840.

Table 6: Financial development and fertility. Robustness check: cities with at least a bank in 1840

Dependent variable	Child-woman ratio			
	(1)	(2)	(3)	(4)
Sample	All	All	Pennsylvania only	
	OLS	IV	OLS	OLS
Cities with at least a bank in 1840	-0.028***	-0.097***	-0.064***	-0.066***
	[0.009]	[0.028]	[0.016]	[0.019]
School attendance	-0.081	-0.078	-0.065	-0.078
	[0.116]	[0.118]	[0.223]	[0.274]
Proxy income per capita	-0.175***	-0.146**	-0.344***	-0.371***
	[0.061]	[0.066]	[0.107]	[0.132]
Urbanization	-0.263***	-0.204**	0.033	0.001
	[0.068]	[0.080]	[0.124]	[0.132]
Literacy gap	-0.230	-0.281	-0.355**	-0.329**
	[0.208]	[0.196]	[0.136]	[0.149]
Share married women	2.025***	1.858***	3.020***	3.061***
	[0.626]	[0.564]	[0.499]	[0.559]
Agricultural productivity	-0.017**	-0.019**	-0.059*	-0.049
	[0.009]	[0.008]	[0.031]	[0.036]
Migration from other state	-0.329***	-0.275**	-0.328**	-0.371*
	[0.122]	[0.133]	[0.155]	[0.192]
Migration from abroad	-0.511***	-0.429**	-1.075***	-1.043***
	[0.191]	[0.187]	[0.163]	[0.219]
Constant	0.659	0.911**	0.771*	0.724
	[0.422]	[0.429]	[0.403]	[0.473]
State dummies	yes	yes	no	no
Observations	279	279	61	52
R^2	0.818		0.802	0.806

***, **,* denote statistical significance at 1% , 5% and 10% levels, respectively. Robust standard errors reported in parentheses. The dependent variable is children aged 5-14 over women 20-39 (white population) measured in 1850. The instrument used in column 2 is a dummy taking on a value of 1 if at least a bank was present in the county in 1820.

Table 7: Financial development and fertility: alternative measure of fertility

Dependent variable	(Log) Crude birth rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	All	All	Pennsylvania only		All
	OLS	OLS	IV	OLS	OLS	IV
Bank in 1840	-0.065***	-0.070***	-0.063***	-0.060*		
	[0.019]	[0.019]	[0.022]	[0.030]		
Cities with at least a bank in 1840					-0.033*	-0.037***
					[0.018]	[0.014]
School attendance	-0.310***	-0.370***	-0.372***	-0.649***	-0.649***	-0.392***
	[0.108]	[0.104]	[0.102]	[0.158]	[0.161]	[0.104]
Proxy income per capita	0.056	0.059	0.057	0.074	0.068	0.057
	[0.046]	[0.047]	[0.045]	[0.158]	[0.156]	[0.051]
Urbanization	-0.013	-0.034	-0.037	-0.071	-0.119	-0.030
	[0.058]	[0.055]	[0.053]	[0.130]	[0.127]	[0.065]
(Log) Crude death rate	0.043	0.032	0.032	0.097**	0.099*	0.029
	[0.029]	[0.029]	[0.028]	[0.047]	[0.050]	[0.029]
Marriage rate	5.549*	6.833**	6.825***	3.177	4.182	7.487***
	[2.844]	[2.738]	[2.637]	[6.554]	[6.564]	[2.694]
Female literacy	-0.628**					
	[0.257]					
Male literacy	0.076					
	[0.416]					
Literacy gap		-0.742***	-0.742***	-0.172	-0.104	-0.745***
		[0.202]	[0.194]	[0.337]	[0.319]	[0.195]
Agricultural productivity	-0.008	-0.011	-0.011	-0.045	-0.043	-0.012
	[0.009]	[0.010]	[0.010]	[0.028]	[0.029]	[0.009]
Migration from other state	0.086	0.082	0.083	0.318*	0.303*	0.113
	[0.118]	[0.117]	[0.113]	[0.174]	[0.173]	[0.114]
Migration from abroad	0.344**	0.432***	0.430***	0.111	0.159	0.443***
	[0.142]	[0.127]	[0.124]	[0.310]	[0.305]	[0.131]
Constant	-2.968***	-2.776***	-2.781***	-2.552***	-2.621***	-2.767***
	[0.277]	[0.244]	[0.232]	[0.454]	[0.448]	[0.235]
State dummies	yes	yes	yes	no	no	yes
Observations	279	279	279	52	52	279
R^2	0.630	0.621		0.390	0.379	

***, **,* denote statistical significance at 1% , 5% and 10% levels, respectively. Robust standard errors reported in parentheses. The instrument used in columns 3 and 6 is a dummy taking on a value of 1 if at least a bank was present in the county in 1820.

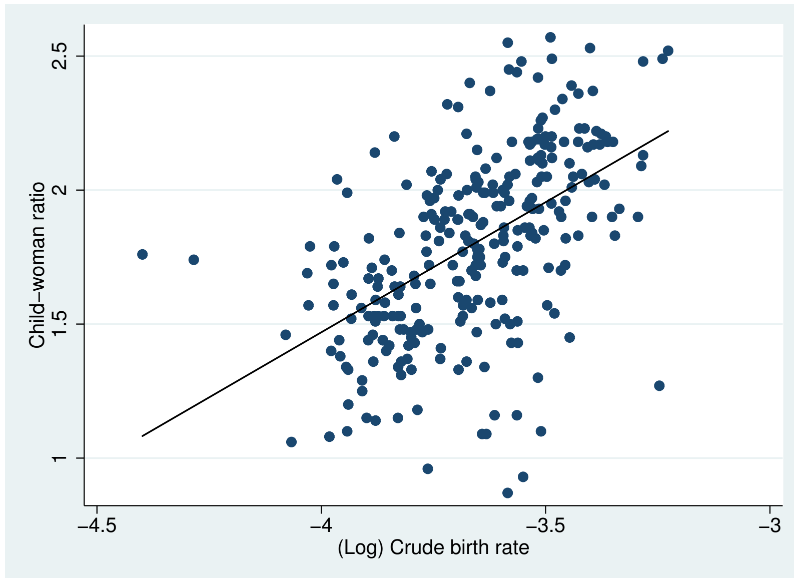

Figure 1: Child-woman ratio and (log) crude birth rate across counties

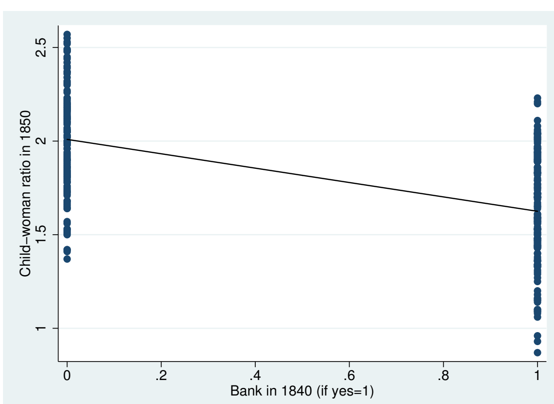

Figure 2: Fertility and financial development: banking dummy in 1840.

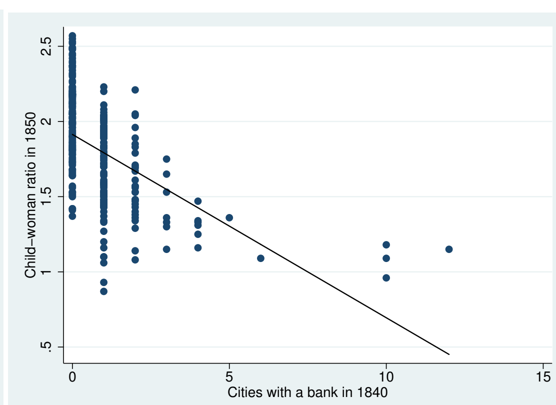

Figure 3: Fertility and financial development: number of cities with banks in 1840.