UNIVERSITÀ di VERONA

Department of ECONOMICS

Working Paper Series
Department of Economics
University of Verona

Intergenerational Coresidence and Fertility during the American Demographic Transition: Theory and Evidence.

Luca Pensieroso, Alessandro Sommacal, Gaia Spolverini

WP Number: 8 October 2025

ISSN: 2036-2919 (paper), 2036-4679 (online)

Intergenerational Coresidence and Fertility during the American Demographic Transition: Theory and Evidence *

Luca Pensieroso† Alessandro Sommacal‡ Gaia Spolverini§

October 28, 2025

Abstract

We study the U.S. fertility transition by family type and document a novel fact: intergenerational coresidence has been systematically associated with lower fertility than nuclear families. This gap has been narrowing over time. This fact cannot be easily explained by existing theories. We propose a new theory in which both fertility and family structure are endogenous. In our theory, a positive fertility differential in favour of the nuclear family emerges when the amount of resources allocated to the young generation under coresidence is lower than the amount they would enjoy in a nuclear family. The allocation of resources depends on the income of the young relative to that of their coresiding parents and on preferences for intergenerational coresidence. We derive the model analytically, and find empirical support for its main mechanism. Simulations from a calibrated dynamic general equilibrium version of the model confirm that the model has the right qualitative behaviour, and is quantitatively meaningful.

Keywords: Family type, Family structure, Quantity-quality trade off, Overlapping generations, Dynamic General Equilibrium, Unified Growth Theory
JEL Classification: J10, O40, O11, E13

1 Introduction

There is broad consensus that family ties differ across societies and over time and play a crucial role in shaping economic outcomes (Alesina and Giuliano (2014); Baudin et al. (2023); Doepke and Tertilt (2016)). In the United States, the last two centuries have been characterised by the weakening of extended family ties and the rise of the nuclear family (Salcedo et al. (2012);

*Paper presented at the AMSE 2022 Summer School on the Economics of Growth in Aix-en-Provence, the LORDE 2023 Workshop in Paris, the 2nd Workshop on Family and Migration in Paris, the ESPE 2023 conference in Belgrade, the ASSET 2023 conference in Lisbon, the NASMES 2024 conference in Nashville, the EEA 2024 conference in Rotterdam. We thank participants to those meetings as well as the participants in seminars at BU, Brown, Clark, Ghent, Namur, Odense (SDU), Osaka (ISER), GEFam, Tufts, UCLouvain (DEMO and IRES), ULB, for interesting remarks. David de la Croix, Marc Fleurbaey, and Fabio Mariani made useful comments on an earlier version. We have benefited from extensive discussions with Oded Galor, Stelios Michalopoulos, Enrico Spolaore, and David Weil. The usual disclaimers apply. Financial support from the Fonds de la Recherche Scientifique - FNRS, Belgium (Grant CDR no J.0144.21 on "Fertility and Intergenerational Coresidence") is gratefully acknowledged.

†IRES/LIDAM, UCLouvain. Email: luca.pensieroso@uclouvain.be
‡Department of Economics, University of Verona. Email: alessandro.sommacal@univr.it
§Universidad Pública de Navarra and Fundación Ramón Areces. Email: gaia.spolverini@unavarra.es

Pensieroso and Sommacal (2014, 2019)). This period coincides with the American fertility transition, which has been studied by the economic literature mostly without any explicit reference to family structure (Galor (2011), Jones and Tertilt (2008)).

In this paper, we look at fertility by family type and highlight a fact that has been overlooked in the economic literature so far: in the 19th and 20th century United States, fertility for women living in households characterized by intergenerational coresidence – i.e., coresidence between parents, 'the old', and their adult children, 'the young' – was systematically lower than that for women living in nuclear families. This cross-family fertility differential has been shrinking over time, along the fertility transition. We show that this fact is i) independent of the measure of fertility, ii) robust to controlling for several demographic and economic confounders, and iii) common to the USA and a set of European countries for which historical census data exist. We then propose a novel theory of intergenerational coresidence and fertility that can explain this fact. We present an analytical model spelling out the theoretical mechanism in detail, discuss to what extent its testable implications hold in the available data, and explore its quantitative relevance in a full-fledged dynamic general equilibrium model.

We start by investigating how different types of family structure correlate with the completed fertility of married women during the 19th and 20th century. Using the American Census microdata (Ruggles et al. (2024b)), we reconstruct married women's family structure and distinguish between nuclear and extended families. We perform a thorough descriptive analysis of these families, detailing their geographic, demographic and socio-economic characteristics. We provide extensive evidence of a puzzling fact about the American fertility decline: women living in extended vertical families, *i.e.*, those characterised by intergenerational coresidence, experienced systematically lower fertility rates than those living in nuclear families. This difference is wider at the beginning of our time window, and shrinks over time. This finding is puzzling, for a copious literature exists in development economics arguing that extended family arrangements typically act as providers of several services, such as insurance and childcare, that typically enhance fertility (see, for instance, Cox and Fafchamps (2007)). To corroborate our findings, we carry out a complete heterogeneity analysis by i) repeatedly splitting the sample along different dimensions of heterogeneity and ii) including them as controls in a regression analysis. We show that the cross-family fertility differential cannot be explained by race, rural status, migration status (first and second-generation migrants), wealth, income, female labour force participation, age at first marriage. In addition, we show that the fertility differential remains sizable even when excluding childless married women (Baudin et al. (2015)), or when carrying out the analysis on surviving children. We discuss several potential explanations for the fertility differential across family types and dismiss them in the light of the available data.

We then propose a new theory, which we call the 'relative income hypothesis'.[1] This theory rests on the idea that intergenerational coresidence depends on preferences for coresidence (cultural factors) and the relative income of the young with respect to the old (economic factors), and both also affect the fertility choice. Given the young's preference for coresidence, the balance between the resources they contribute to the common pot under coresidence and the resources they extract from it determines whether they will have more or fewer children than they would in a nuclear family. Specifically, if they bring more resources to coresidence than they extract from it, they will have fewer children, and *vice versa*. In turn, the fraction of resources extracted by the young depends on their bargaining power, which is a function of their relative income.

We extend this model to a dynamic context, in which technical progress induces a change

[1]It is important to stress that, in this theory, income plays a major role, but the theoretically relevant concept of income is not the husband's income typically used in empirical analyses: what matters is the income of the adult children relative to that of their parents.

in the relative income of the young. We show that a calibrated version of the model can reproduce the time-series behaviour of both the cross-family fertility differential and the intergenerational coresidence rate. In particular, for given cultural factors, changes in relative income can account for 68% of the drop in the fertility differential between the 1833 and the 1953 cohorts and 32% of the drop in the coresidence rate between 1850 and 1970. If we focus only on the period between 1850 and 1930, the model reproduces the data almost perfectly. Assuming that cultural factors can also change over the same time period, such that the model matches the pattern of co-residence, the model can explain up to 91% of the decline in the fertility differential between the 1833 and 1953 cohorts. To disentangle the respective roles of economic and cultural factors – relative income and preferences – we run a third simulation, in which changes in the coresidence pattern are only driven by changes in cultural factors. Interestingly, while the model matches by construction the coresidence rate, it misses the fertility transition, and instead generates an increase in fertility rates. Hence, our computational experiment shows that economic factors are crucial to account for the shrinking fertility differential, the fertility transition and the secular change in family structure.

Finally, as an additional step in assessing the correspondence between our theory and the data, we investigate the empirical relevance of our proposed mechanism. Specifically, the model predicts that the fertility of women living in vertical families should depend on their bargaining position (and that of their husbands) with regard to their parents/in-laws. By interpreting registered household headship as a measure of an individual's bargaining position, we can analyse how fertility in vertical families depends on the bargaining power of the young. Our findings show that, on average, vertical families headed by young individuals have almost one more child per woman than those headed by older individuals, thereby supporting our theoretical result.

This article sits at the crossroads of economic history, family economics and long-term macroeconomics.

Following the seminal work of Becker (1960) and Becker and Lewis (1973), the literature on the economics of the family has been burgeoning (Becker (1991), Browning et al. (2014)). This literature focuses on the importance of taking within-household heterogeneity into account, for this affects the outcome of many economic decisions, and, most importantly, the efficacy of economic policies. However, family economists have primarily framed the household's decision-making process in the context of nuclear families, *i.e.*, families formed by a couple of parents and their non-adult children. While nuclear families have been predominant in Western societies, other types of families (*e.g.* adults living with their parents, adults living with their siblings and/or other relatives. . .) were widespread in the past, and still are in today's developing economies (Baudin et al. (2023), Laslett (1972), Todd (1983)). Furthermore, evidence suggests that, even in Western societies, sudden dramatic events, like pervasive economic crises, might induce a return *in auge* of extended families (Kaplan (2012)). There is wide acceptance in the literature that family types are related to cultural attitudes and institutions (Anderson and Bidner (2023), Bau and Fernández (2023)), and that family ties might affect economic outcomes (Alesina and Giuliano (2014); Bahrami-Rad et al. (2024); Doepke and Tertilt (2016); Duranton et al. (2009); Ghosh et al. (2023)).

In this paper, we contribute to the literature on family economics by focusing on the impact of family types on one specific outcome: fertility. This allows us to uncover a new fact characterising the American Demographic Transition – the cross-family fertility differential – and identify a new mechanism – an income effect operating through the coresidence choice.

Our work also has bearings on the more general quest about the "mystery" of economic growth (Galor (2022)). In particular, it contributes to the literature on unified growth theory (Galor and Weil (1996, 2000), Galor and Moav (2002) and Galor and Michalopoulos (2012)). In this approach, the Demographic Transition – the historical shift from a high-fertility, high-mortality regime to a low-fertility, low-mortality one experienced by most countries between the 18th and the 20th century (Chesnais (1992)) – is considered a key factor for explaining the transition from Malthusian stagnation to modern economic growth.[2] In unified growth theory, as in our work, the demographic transition is rationalised in terms of the quantity-quality trade off applied to fertility decisions. The idea is that returns to education have increased over the past two centuries to the extent that parents have started to prefer having fewer, more educated children – quality, over quantity. However, unlike our work, unified growth theory has traditionally relied on a unitary representation of the household, or theorised households' decision-making in the context of nuclear families. Thus, the existence of a fertility differential across family types that is apparently unrelated to income or education might, *prima facie*, seem beyond the reach of unified growth theory. In this paper, however, we show that this is not the case. Once explicitly framed against family types, as we do in this research, the cross-family fertility differential becomes perfectly understandable and finds its natural place within a unified growth theory model. Our analysis, therefore, suggests that integrating non-nuclear families into unified growth theory would broaden its scope and refine its findings, paving the way for further research on the topic.[3]

The rest of the paper is organised as follows. In Section 2, we present our benchmark fact – the fertility differential across family types and its time series properties – and discuss its determinants and whereabouts. Having dismissed all alternative explanations, in Section 3 we develop a novel analytical model of endogenous fertility and coresidence. We explore the dynamics of the model in Section 4, where we also calibrate the model on the actual data and simulate it. In Section 5, we further explore the empirical implications of the model. Section 6 concludes.

2 Empirical analysis

In this Section, we explore the evolution of fertility by family type in the United States between the 19th and the 20th century.

We use the 1% sample of the U.S. census data from IPUMS (Ruggles et al. (2024b)), consisting of individual data recorded at the household level.[4] We exclude persons living in group quarters. Since our focus is on family relationships and fertility, we also exclude households with multiple families, *i.e.*, situations of coresidence among unrelated individuals.[5]

2.1 Fertility

From the theoretical perspective adopted herein, the relevant measure of fertility, *i.e.*, the one compatible with an economic model of endogenous fertility, is completed fertility. Accordingly, this will be our benchmark measure. However, since completed fertility imposes a lot of structure on the data, especially when it comes to family relationships, in Section 2.5 we will verify that our results are systematically robust to other measures of fertility.

Following Jones and Tertilt (2008), we use the variable Children Ever Born (CEB) to reconstruct a measure of completed fertility at the cohort level. Each cohort covers five (birth) years and, in the rest of the paper, it is labeled with its midpoint: for instance the 1851-1855 cohort is

[2] Several studies have tested the theory, either empirically (Becker et al. (2010), Bleakley and Lange (2009), Ager and Cinnirella (2020), Madsen and Strulik (2023)), or in quantitative models (Doepke (2004), Lagerlöf (2006)). Others have used it to explain cross-sectional fertility differentials (de la Croix and Doepke (2003)).

[3] See also de la Croix and Perrin (2018) on this.

[4] In particular, for 1970 we use the 1% Form 1 sample; for 1980, we use the 1% metro sample. In a robustness exercise available upon request, we have performed the regression analysis of Section 2.4 using the full-count samples, when available. Results hold virtually unchanged.

[5] In other words, we restrict the analysis only to households in which only the householder's family is present.

labeled the 1853 cohort. CEB indicates how many children a woman had throughout her life at the moment of the Census interview. To interpret CEB as a measure of completed fertility, we focus on women aged 40-49. These women were at the end of their fertile life (the median age of menopause oscillates between 48 and 50 in developed countries (Davis et al. (2015)), and yet not too old to induce selection issues due to survival bias. Accordingly, we generally use CEB of women in the age range 40-49 to measure completed fertility of women born 40-49 years before. For instance, to get a measure of completed fertility for the 1853 cohort, we look at the average CEB of women aged 45-49 in the 1900 census.

Although our reference age to measure completed fertility is 40-49, in some instances we are forced to use different age ranges. Indeed, the variable CEB is available only in the decennial censuses between 1900 and 1990, with a gap in 1920 and 1930. To fill this gap, and have data for the 1873-1888 cohorts, we use women aged between 50 and 69 from the 1940 Census. Relaxing the age restriction can also be useful to extend the time series before the 1853 cohort and after the 1948 one. To retrieve information on the 1833-to-1848 cohorts, we use women aged from 50 to 69 in the 1900 Census. By the same token, we use information on women aged between 30 and 39 to reconstruct fertility for the 1953 and the 1958 cohorts. Fertility figures computed using age ranges different from 40-49, however, must be interpreted with some caution: older cohorts might suffer from a survival bias, while younger cohorts might not have completed their fertility yet. To signal the different quality of the fertility data, in the following Figures we highlight in grey the cohorts whose CEB was observed in the 40-49 age range; in other terms, the grey-highlighted areas indicate the cohorts whose data are more reliable.

Finally, we restrict the analysis to those women who are married, and whose husband holds a valid occupation, according to the Census definition. We limit the analysis to marital fertility since the Census reports CEB for unmarried women only after 1960. To grasp the extent of the approximation so introduced, notice that in our data births out of the wedlock are 5% of total birth in 1920, and 10% in 1970 (see Greenwood and Guner (2010)). We consider women whose husband held a valid occupation, because we want to include household income in the analysis.[6]

2.2 Family types and fertility

We reconstruct the woman's family structure from the family relationships registered in the Census.

To classify families along some meaningful dimension, we start with the canonical definition by Le Play, singling out three main types of family: the 'nuclear' , the 'stem' and the 'complex' family (Le Play (1871)).[7] The nuclear family consists of a couple and their children. The stem family adds the presence of the couple's parents to it. Complex families are a somewhat residual category that includes all other possible configurations involving the couple's siblings and/or other relatives.[8] We use the same temporal structure as in the analysis of fertility. So, for instance, for the 1853 birth cohort, we first attach the family structure to each woman aged 45-49 in the 1900 census, and then we average fertility rates by family structure.

[6] We have performed our analysis also on the sample including all married women. Results are unaffected, and are available upon request.

[7] In the original French text, they correspond to *la famille instable*, *la famille-souche* and *la famille patriarcale*.

[8] A more complex family classification has been proposed by Todd (2011), who builds on Le Play's family trilogy, and additionally distinguishes between i) adult children's post-marriage location choices (*i.e.*, patrilocal *vs* matrilocal) and ii) inheritance practices (*i.e.*, partible *vs* non-partible). The interested reader may consult Baudin et al. (2023) for an up-to-date, extensive discussion on the matter, and Gay et al. (forthcoming) for an assessment of the impact of inheritance practices on fertility in France, after the French Revolution. We stick to Le Play's definition for it is simpler, and allows for a more straightforward family-structure classification based only on the presence of family members, which we are able to retrieve more easily from the Census microdata.

Doing so for all the women in the sample, we obtain a time series of CEB by family structure and by cohort, which we report in Figure 1. The graph shows that the three types of families share a similar time-series pattern. We can clearly witness the fertility transition, with completed fertility rates declining over time, from 4-to-6 children per woman among earlier cohorts to roughly 2 among last cohorts, depending on the family structure. We also see the post WWII baby-boom, with fertility rates abruptly increasing to up to 4 children among women born in the late 1920s/early 1930s. While different families share similar time-series properties, there is evidence of cross-family differences in fertility levels: women living in complex families have the highest level of fertility (up to 6 children in earliest cohorts), followed by those living in nuclear families. Somewhat surprisingly, however, stem families have the lowest level of fertility (up to a difference of 2 children for earlier cohorts).

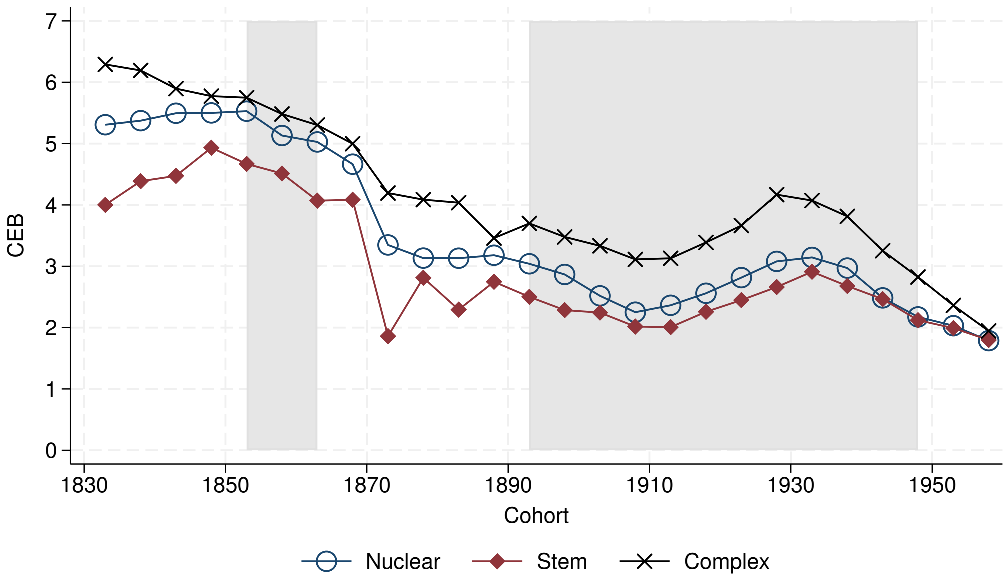


Figure 1: Children ever born by cohort and family type.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Stem, nuclear family plus the couple's parents; iii) Complex, all other family configurations, see Section 2.2. Source: our calculations from IPUMS.

To understand the latter result, we zoom in on complex families, looking for the presence of the woman's parents/in-laws. We call 'patriarchal' those complex families in which there is at least one coresiding parent/in-law of the woman, and 'other' the rest. The results of this decomposition on the CEB figures by cohort and family structure are shown in Figure 2.[9]

As evident from the graph, fertility in patriarchal complex families turns out to be remarkably similar to that in stem families. This suggests a leading role for the presence of women's parents/in-laws, and calls for a re-definition of family types with a focus on intergenerational coresidence. Accordingly, we define family types as follows:

- Nuclear families, those characterised by the presence of parents and their children;
- Extended vertical families, those characterised by intergenerational coresidence between grandparents, parents and their children;

[9] The CEB for the complex patriarchal family in the 1833 cohort clearly reflects the survival bias already mentioned in Section 2.2.

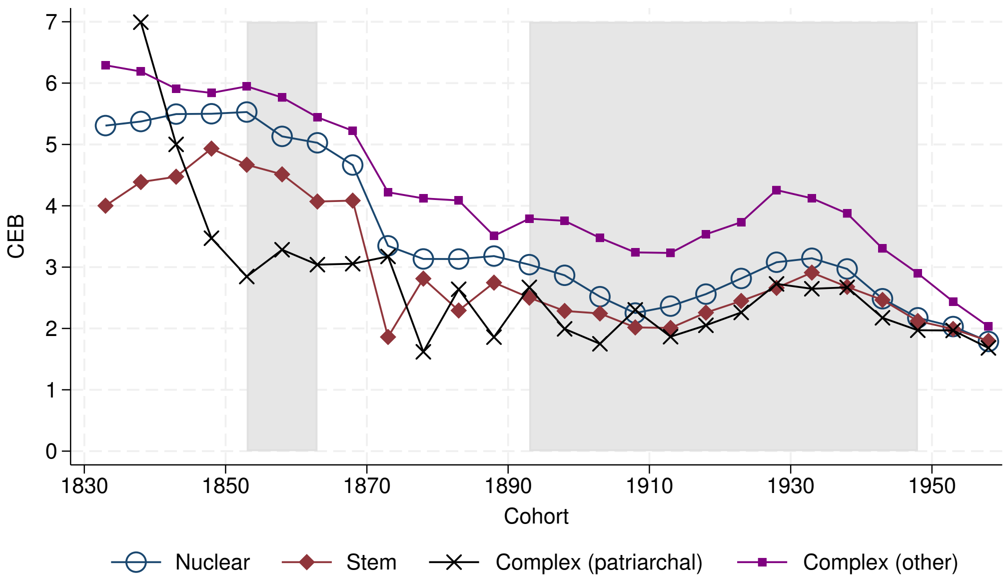


Figure 2: Children ever born by cohort and by family type.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Stem, nuclear family plus the couple's parents; iii) Complex (patriarchal), stem family plus some other coresiding relative; iv) Complex (other), all other family configurations, see Section 2.2. Source: our calculations from IPUMS.

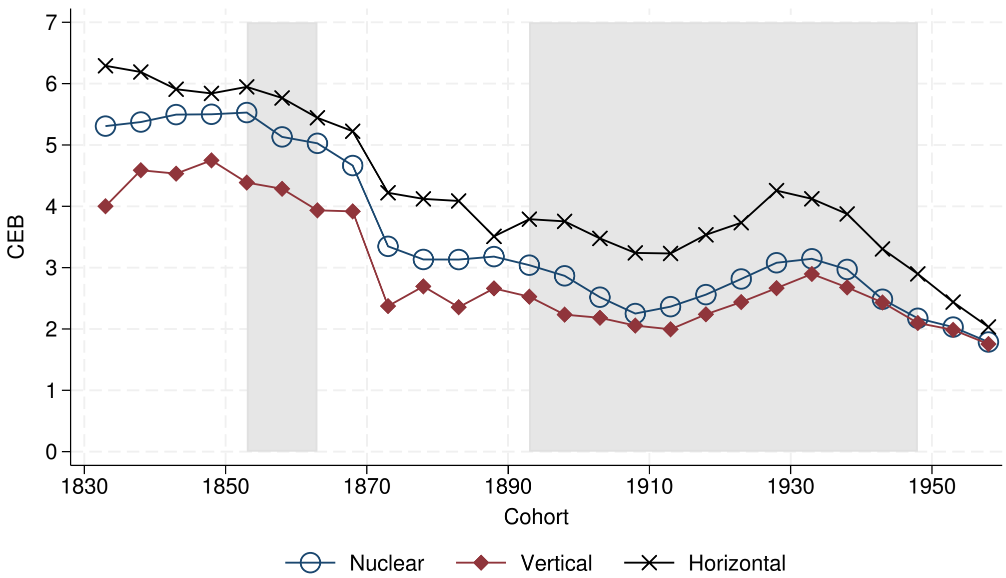


Figure 3: Children ever born by cohort and family type.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence ; iii) Horizontal, all others (complex families without intergenerational coresidence), see Section 2.2. Source: our calculations from IPUMS.

- Extended horizontal families: other forms of complex families not involving intergenerational coresidence, typically parents, their siblings and their children.

Notice that the defining feature of extended vertical families is intergenerational coresidence, *i.e.*, the presence of at least one grandparent in the household. This does not exclude the possibility of the presence of a horizontal component in these vertical families as well.

Figure 3 shows the completed fertility rates by family structure, according to this last classification.

A new fact emerges from this preliminary investigation: intergenerational coresidence is systematically associated with lower fertility than what is observed in the nuclear family (and *a fortiori* in the more prolific horizontal family). Such a difference is sizeable at the beginning of the sample, but tends to shrink over time. Establishing and explaining this fact constitutes the core of this paper.

Our argument will now proceed as follows. In Section 2.3, we are going to delve deeper into intergenerational coresidence. In Section 2.4, we are going to compare vertical families with the other family types along several dimensions of heterogeneity, in search of an explanation for the cross-family fertility differential.

2.3 Zooming in on intergenerational coresidence

We first look at the incidence of vertical families in the data. Since our unit of analysis is a married woman, we start measuring intergenerational coresidence "from the point of view" of the adult children, by looking at the fraction of married women who coreside with at least one parent/in-law. In Figure 4, we plot this variable for the 20-29, 20-39 and the 20-49 age range. The incidence of intergenerational coresidence among married women in the 20-29 age bracket ranges between about 8% in 1850 and 14% in 1940, to sharply decline later on. The measure, however, is sensible to the age range of the woman: considering older women reduces the incidence of intergenerational coresidence, most likely because the coresiding parent/in-law has died in the meantime. This shows a general concern about measures of intergenerational coresidence, namely their being influenced by many demographic factors other than the choice of individuals to form an intergenerational family or not. This issue is discussed at some length in Pensieroso and Sommacal (2019), who choose to measure intergenerational coresidence "from the point of view" of the elderly, by looking at the percentage of the elderly who coreside with at least one young adult son/daughter. The incidence of this measure of intergenerational coresidence is shown in Figure 5. Among the elderly, coresidence was a widespread phenomenon, with an incidence ranging between 70% in 1850 and about 50% in 1930, both for elderly persons proper – persons 65 years old or more– and for persons aged 55 years or more. This shows that intergenerational coresidence – especially when measured "from the point of view" of the elderly – was a non-negligible phenomenon in the period under consideration.[10]

In Appendix A, to which we refer the reader for further details, we discuss some specific characteristics of vertical families, namely the composition by gender and the labour force participation of the grandparents. It turns out that, for the cohorts and the age restrictions we use in our main analysis (see Section 2.1), on average 29% of the women living in vertical families were coresiding with their father/father-in-law. This percentage increases to 55%

[10]Which measure of intergenerational coresidence should be used depends on the aim of the analysis. As explained in Pensieroso and Sommacal (2019), the definition of Figure 5 is less sensitive to several measurement issues related to the important changes in demographic patterns observed in the same period, which may make observing coresidence more or less possible: increasing longevity, declining fertility, increasing education, later age at marriage, later age at first birth *et cetera*. As such, this measure is better apt to catch the choices of the young and the old on their family arrangements - independently of the pattern of other demographic variables. This is the measure we shall use to discipline our model of endogenous coresidence in Section 4. However, when we want to measure completed fertility, the unit of analysis is necessarily a woman in the last part of her reproductive age. Accordingly, in the empirical analysis of this paper we measure intergenerational coresidence by looking at her family relationships at the moment in which these are recorded in the Census.

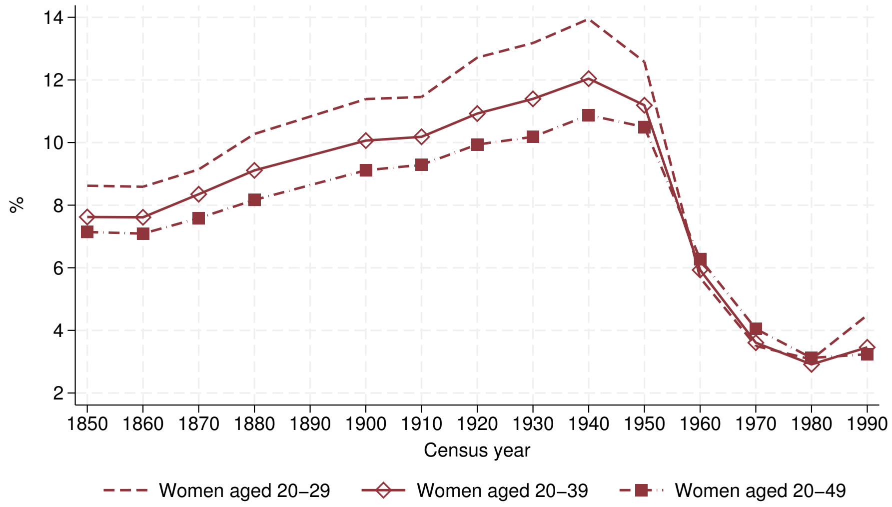


Figure 4: Percentage of women living in vertical families by census year, 1850-1990.
Unit of observation: married woman (various ages) with employed husband. Vertical families: families characterised by intergenerational coresidence. Source: our calculations from IPUMS. Data for 1890 are missing.

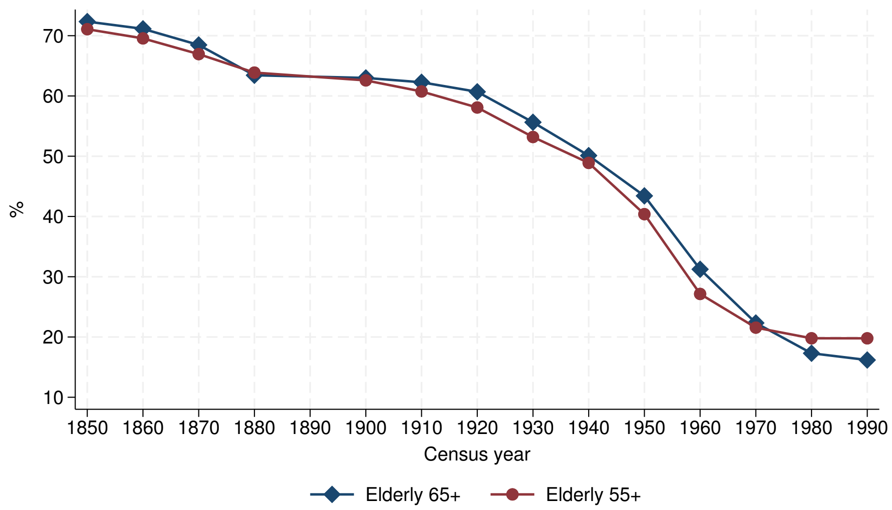


Figure 5: Intergenerational coresidence rate by census year, 1850-1990.
Percentage of the elderly (65+ or 55+) who coreside with at least one young adult son/daughter (18+). Married couples are counted as single observation. Source: our calculations from IPUMS. Data for 1890 are missing.

when considering women aged 20-29, *i.e.*, women in the midst of their reproductive life as opposed to the end of it. This suggests a reasonably even distribution of the coresiding grandparent by gender, especially for younger women. For what concerns the employment status of the coresiding grandparents in vertical families, two patterns emerge from the data. First, the employment rate of grandparents in vertical families was appreciable (about 69% on average). Second, the employment rate was significantly higher (61 percentage points, on average) when the coresiding grandparent was registered in the Census as "head of the family" (which happened on average about 80% of the times). Finally, we zoom in on the employment rate of coresiding grandparents aged 65 or more. The data show that the employment rate of elderly grandparents who were head of the family was appreciable (55% on average, 71% on average for men only). Interestingly, this was higher than among the population of the elderly as a whole (36% on average, 63% on average for men only). Overall the employment analysis here above shows convincingly that coresiding grandparents in vertical families were typically active on the labour market, especially when male and head of the family.

2.4 Family type and fertility: heterogeneity

The starting point to unravel the determinants of fertility differential across family types and its pattern over time must be a thorough characterisation of those family types in socio-economic and demographic terms. Accordingly, we investigate whether family types differ systematically along all the relevant dimensions we can retrieve from our data: race, nativity, characteristics of the dwelling (urban/rural, owned/rented, geographic location), education, income, labour force participation, childlessness, age at marriage. We perform such analysis in details in the Appendix B. Here we report the main findings.

Two key elements emerge:

1. Though vertical and nuclear families were not too different under most socio-economic and demographic factors, still some relevant difference stands out in terms of geographic location, education, degree of dwelling ownership, childlessness, age at first marriage.

2. Horizontal families, on the other hand, were wholly distinct from the other two. They tended to be poorer, more widespread among black persons, with fewer childless and/or educated women.

We are now going to control if the observed heterogeneity may contribute to account for the cross-family fertility differential. We do so in a twofold way. First, by repeatedly splitting the sample along a given dimension of heterogeneity, and checking whether the fertility differential between vertical and horizontal families holds true in the more homogenous two sub-samples. Second, by including all dimensions of heterogeneity, one by one and all together as controls in a regression analysis, where completed fertility is regressed on family types.

Since the benchmark fact turns out to be robust to sub-sampling, in the interest of brevity, we report the graphical analysis carried out by splitting the sample along several dimensions of heterogeneity in Appendix C.

Here, we focus instead on the regression analysis. This allows us to control simultaneously for all dimensions of heterogeneity for which we have data, and hence deliver a more robust correlation.

We estimate the following equation:

$$CEB_i = \beta_0 + \beta_1 V_i + \beta_2 H_i + \mathbf{X_i'b} + \vartheta_c + \gamma_s + \epsilon_i. \tag{1}$$

using Ordinary Least Square (OLS).[11]

The unit of observation is woman i, belonging to cohort c, observed in a Census year and living in state s. Our outcome of interest is completed fertility, measured by the Census entry "Children Ever Born" (CEB), as explained in Section 2.1. Our main explanatory variables are the V dummy, which is equal to 1 if the woman lives in an extended vertical family, and 0 otherwise; and the H dummy, which is equal to 1 if the woman lives in an extended horizontal family, and 0 otherwise.

The vector $\mathbf{X}$ includes all the variables we have analysed in the descriptive sections here above, for all of them are potential confounders that may simultaneously affect fertility and family structure. In particular, we have: a dummy equal to 1 if the woman is white, and 0 otherwise; a dummy equal to 1 if the household's location is urban, 0 otherwise; a dummy equal to 1 if the woman's spouse is a dwelling owner, and 0 if he is a renter; a dummy equal

[11]In Appendix F we perform a robustness analysis using a Poisson regression. Results are qualitatively the same and comparable in magnitude.

to 1 if the spouse's occupational income score (OIS) exceeds the median for that cohort; a dummy equal to 1 if the woman is active in the labor force, and 0 otherwise; age at first marriage; a dummy equal to 1 if the woman is foreign born; a dummy equal to 1 if the woman is a second-generation immigrant (she has at least one foreign parent); education. θ_c and γ_s stand for cohort and state fixed effects, respectively, to control for cohort-specific, state-specific, time-invariant unobservable characteristics. This takes on board sample wide trend evolution of longevity, morbidity and the like, as well as specific geographic patterns at the state level. Our standard errors are robust to heteroskedasticity. In Appendix E, we show that our results are robust to running the same regressions with standard errors adjusted for multiway clustering at the state-cohort level.

In Table 1, we report the results from the regression analysis, first without controls (Column 1), then adding the above-mentioned controls one by one (Columns 2-to-10), and then including all of them in Column (11).[12]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.34***	-0.36***	-0.36***	-0.35***	-0.34***	-0.33***	-0.32***	-0.44***	-0.46***	-0.28***	-0.25***	-0.36***	-0.26***	-0.28***
	(0.017)	(0.017)	(0.019)	(0.017)	(0.017)	(0.017)	(0.028)	(0.022)	(0.022)	(0.017)	(0.034)	(0.019)	(0.034)	(0.020)
Extended horizontal	0.74***	0.67***	0.69***	0.71***	0.70***	0.74***	0.67***	0.72***	0.71***	0.65***	0.48***	0.58***	0.52***	0.55***
	(0.020)	(0.020)	(0.023)	(0.021)	(0.020)	(0.020)	(0.037)	(0.028)	(0.028)	(0.022)	(0.045)	(0.023)	(0.045)	(0.026)
White		-0.49***									-0.28***	-0.49***	-0.37***	-0.36***
		(0.014)									(0.052)	(0.015)	(0.052)	(0.015)
Urban			-0.50***								-0.60***	-0.45***	-0.63***	-0.38***
			(0.009)								(0.023)	(0.009)	(0.023)	(0.010)
Owner				-0.17***							-0.13***	-0.13***	-0.16***	-0.04***
				(0.010)							(0.023)	(0.011)	(0.023)	(0.012)
High income					-0.44***						-0.31***	-0.35***	-0.38***	-0.18***
					(0.007)						(0.020)	(0.008)	(0.019)	(0.008)
Active						-0.47***					-0.58***	-0.50***	-0.61***	-0.44***
						(0.007)					(0.017)	(0.007)	(0.017)	(0.007)
Age at first marriage							-0.12***				-0.12***		-0.12***	
							(0.001)				(0.002)		(0.002)	
Foreign born								0.48***			0.50***		0.63***	
								(0.021)			(0.039)		(0.038)	
Foreign parent									-0.13***		0.08***		0.13***	
									(0.014)		(0.023)		(0.023)	
Educational attainment										-0.16***	-0.09***			-0.13***
										(0.001)	(0.004)			(0.002)
Constant	5.78***	6.20***	5.86***	5.85***	5.96***	5.79***	6.54***	5.97***	6.06***	4.03***	7.42***	6.49***	7.50***	4.47***
	(0.095)	(0.096)	(0.096)	(0.095)	(0.095)	(0.095)	(0.112)	(0.104)	(0.104)	(0.095)	(0.140)	(0.097)	(0.140)	(0.097)
Observations	628,094	628,094	520,477	607,323	628,094	628,094	199,366	298,605	298,605	559,923	113,367	520,477	113,367	452,306
R-squared	0.161	0.165	0.192	0.171	0.169	0.168	0.116	0.150	0.148	0.107	0.174	0.210	0.169	0.131
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1: OLS estimates. Dependent variable: children ever born.

Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman (various ages, see Section 2.1) with an employed husband. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

The coefficient β_1 is the fertility differential between women who live in extended vertical families and those who live in nuclear ones. This coefficient is negative, sizeable, robust to all the potential confounders. In our preferred specification, columns (1) and (11), it amounts to -0.34 and-0.25, respectively, and is significant at the 1% level. This means that according to our regression moving a married woman from a nuclear to a vertical family would imply a decrease of her completed fertility by 0.34 or 0.25 children, respectively. All controls are

[12] The sample size changes according to the availability of the different controls.

significant and have the expected sign. Columns (12)-to-(14) are intended for robustness, showing results for the set of controls for which we have many observations (Column (12)) as opposed to those for which we have fewer observations (Column (14) and, especially, (13)). The stability of the coefficient suggests that the results in Column (11) are not driven by the reduction of the sample. Overall, this analysis reinforces our previous findings pointing to systematic lower fertility rates among women residing in extended vertical families. In Appendix D we perform the analysis of Table 1 using only women with a positive number of children (i.e. we exclude childless women). We show that, even for this sub-sample, women in vertical (horizontal) families have the lowest (highest) fertility.

Our regression analysis also confirms that women living in extended horizontal families had systematically higher fertility than the others, both in absolute and conditional to the many potential confounders considered here. In fact, the coefficient β_2, or the fertility differential between women who live in extended horizontal families and those who live in nuclear ones, is positive, sizeable, and robust to all the controls.

2.5 Family type and fertility: robustness and generality

In this Section, we are going to show that our fact, the cross-family fertility differential, i) is robust to changes in the way one can measure fertility, and ii) is general, in the sense that it is not limited to the United States only, but holds for other countries as well.

2.5.1 Robustness

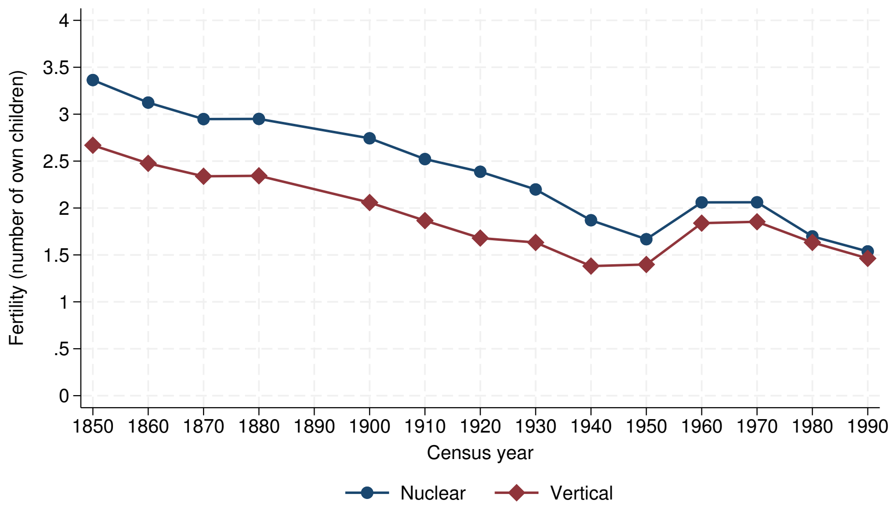


Figure 6: Number of own children in the household by census year and family type.
Number of own children indicates how many coresiding children a woman had at the moment of the Census interview. Unit of observation: married woman aged 20-49 with employed husband. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence, see Section 2.2. Source: our calculations from IPUMS.

In this article, we use completed fertility as benchmark, for this is the relevant concept in economic theory. This, however, imposes a lot of structure on the data. In particular, when we look at completed fertility by family type, we implicitly assume a high degree of stability of family structure along the woman's reproductive life. We measure, indeed, completed fertility and family links when the woman is 40-to-49, which implies that the woman was living in the same family type when she was actually having children, *i.e.*, when she was in her 20-to-40. This, however, might not have always been the case, which may introduce a measurement error in our analysis.[13]

To assuage this concern, we use here a different approach, and measure fertility and coresidence in the same period, without any assumption on the stability of the family structure. For this purpose we don't use completed fertility and coresidence by cohort: we instead relate observed fertility in one census year (namely the number of own children coresiding in that year with a woman aged 20-49) with family arrangements in the very same year.

In Figure 6, we plot this measure of fertility for nuclear and vertical families against the Census year. The pattern is clearly comparable to that in Figure 3. Hence, our benchmark fact – the cross-family fertility differential and its time-series properties – is robust to changes in the measure of fertility. To further strengthen this conclusion, in Table 2, we report results from running the OLS regression (1) with the new measure of fertility as dependent variable, and adding women's age to the controls. Interestingly, our results hold qualitatively, and we get an estimate of the fertility differential between vertical and nuclear families that is quantitatively comparable to that of Table 1. We conclude that, even using a different measure of fertility that imposes no structure on the data, the cross-family fertility differential we find in this paper is robust to heterogeneity.[14]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.35***	-0.35***	-0.38***	-0.39***	-0.35***	-0.32***	-0.29***	-0.38***	-0.39***	-0.24***	-0.26***	-0.39***	-0.28***	-0.29***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.007)	(0.007)	(0.008)	(0.015)	(0.007)	(0.011)	(0.010)
Extended horizontal	0.08***	0.06***	0.06***	0.11***	0.06***	0.09***	0.09***	0.05***	0.05***	0.15***	0.10***	0.06***	0.05***	0.13***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.014)	(0.010)	(0.010)	(0.011)	(0.025)	(0.009)	(0.017)	(0.014)
Age	0.04***	0.04***	0.04***	0.03***	0.04***	0.04***	0.04***	0.04***	0.04***	0.02***	0.02***	0.03***	0.04***	0.01***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
White		-0.24***									-0.33***	-0.31***	-0.26***	-0.39***
		(0.006)									(0.020)	(0.007)	(0.015)	(0.008)
Urban			-0.39***								-0.28***	-0.31***	-0.34***	-0.20***
			(0.004)								(0.010)	(0.004)	(0.007)	(0.005)
Owner				0.17***							0.14***	0.17***	0.09***	0.25***
				(0.004)							(0.009)	(0.004)	(0.007)	(0.005)
High income					-0.28***						-0.08***	-0.22***	-0.18***	-0.06***
					(0.003)						(0.008)	(0.003)	(0.006)	(0.004)
Active						-0.64***					-0.78***	-0.67***	-0.81***	-0.62***
						(0.003)					(0.007)	(0.004)	(0.006)	(0.004)
Age at first marriage							-0.09***				-0.08***		-0.10***	
							(0.001)				(0.001)		(0.001)	
Foreign born								0.35***			0.20***		0.46***	
								(0.006)			(0.020)		(0.013)	
Foreign parent									-0.11***		0.03**		0.07***	
									(0.005)		(0.011)		(0.008)	
Education										-0.33***	-0.19***			-0.26***
										(0.003)	(0.007)			(0.004)
Constant	2.32***	2.51***	2.19***	1.72***	2.37***	2.13***	2.80***	1.83***	1.82***	2.17***	3.63***	2.08***	3.36***	2.54***
	(0.021)	(0.021)	(0.022)	(0.015)	(0.021)	(0.018)	(0.024)	(0.019)	(0.019)	(0.020)	(0.046)	(0.017)	(0.033)	(0.025)
Observations	1,923,955	1,923,955	1,542,493	1,713,982	1,923,955	1,905,568	774,218	1,250,216	1,250,216	1,292,210	306,774	1,404,266	468,927	910,748
R-squared	0.089	0.091	0.102	0.071	0.095	0.108	0.089	0.079	0.076	0.055	0.126	0.108	0.142	0.098
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: OLS estimates. Dependent variable: number of children in the census year
Results from an OLS regression of the number of children in a census year on family structure with year and state fixed effects. Number of own children indicates how many coresiding children a woman had at the moment of the Census interview. Unit of observation: married woman aged 20-49 with employed husband. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1) controls only for age of the woman; Columns (2)-(10), controls added one by one; Column (11), all controls; Column (12)-(14), subset of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

[13] We discuss the issue at some length in Appendix G.

[14] In Appendix H, we run the same analysis using number of children aged 5 or below coresiding with the woman in the census year as measure of fertility. Results do not change appreciably.

2.5.2 Generality

On top of being a sizeable and robust new fact, the fertility differential between vertical and nuclear families is also a general historical fact, not a specific idiosyncrasy of the USA. We substantiate this claim by using IPUMS international (Ruggles et al. (2024a)). For the period we are interested in, we find information on fertility and family arrangements for 6 countries: Denmark, Iceland, Ireland, Norway, Sweden and the UK. Data on children ever born are not available, which makes a cohort based analysis like the one of Section 2.4 not possible. However, there are data on the number of children coresiding with a woman in each census year. For this reason we can perform an analysis similar to that reported in Table 2 of this Section. Due to data limitations, we do not include the covariates we use in the analysis for the USA. Results are reported in Table 3, in which each column corresponds to a single country, while the last column reports the results of a regression run on a sample that pools together the different countries correcting for country fixed effects.[15] Results shows that, with the exception of Iceland, women living in extended vertical families have fewer children than women in nuclear families, suggesting that our main fact is not specific to the USA. Furthermore, the magnitude of the coefficient in the pooled regression (Column 7 in Table 3) is remarkably similar to the one in Column 1, Table 2. Evidence on the association between the extended horizontal families and fertility is mixed: the coefficient is negative and significant for all the countries, but for Sweden (where it is positive) and for Iceland (where it is negative but not significant).

	(1) Denmark	(2) Iceland	(3) Ireland	(4) Norway	(5) Sweden	(6) UK	(7) Pooled
Extended vertical	-0.15***	0.25***	-0.41***	-0.29***	-0.23***	-0.38***	-0.36***
	(0.012)	(0.068)	(0.008)	(0.030)	(0.006)	(0.005)	(0.004)
Extended horizontal	-0.24***	-0.09	-0.23***	-0.59***	0.90***	-0.29***	-0.27***
	(0.015)	(0.080)	(0.011)	(0.041)	(0.015)	(0.004)	(0.004)
Age	0.05***	0.08***	0.12***	0.10***	0.10***	0.10***	0.10***
	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	0.20***	-0.86***	-0.93***	-1.15***	-0.75***	-0.64***	-1.76***
	(0.015)	(0.114)	(0.014)	(0.033)	(0.007)	(0.006)	(0.055)
Observations	312,402	7,495	556,860	459,677	1,688,676	16,311,642	19,336,752
R-squared	0.066	0.110	0.148	0.154	0.140	0.139	0.142
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Dependent variable: number of children in the census year. European countries.
Results from an OLS regression of the number of children in a census year on family structure, with age and year fixed effects. Number of own children indicates how many coresiding children a woman had at the moment of the Census interview. Unit of observation: married woman aged 20-49. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1)-(6), various countries. Column (7), all countries, with country fixed effects. Source: our calculations from IPUMS International. Sample: 1787, 1801, 1845, 1880, 1885 for Denmark; 1703, 1729, 1801, 1901, 1910 for Iceland; 1901, 1911 for Ireland; 1801, 1865, 1875, 1900, 1910 for Norway; 1880, 1890, 1900, 1910 for Sweden; 1851, 1861, 1871, 1881, 1891, 1901, 1911 for the UK.

From the analysis carried out in Section 2.4 and in this Section, we conclude that the empirical evidence suggests that, in the past, extended vertical families were associated with lower fertility than nuclear families. The evidence on fertility in extended horizontal families is on the other hand mixed, depending on the way in which fertility is measured and on the country considered. In the rest of this paper we are going to focus mainly on the fertility

[15]In Appendix I, we run the same analysis the using number of children aged 5 or below coresiding with the woman in the census year as measure of fertility. Results do not change appreciably.

differential between vertical and nuclear families, and refer to the horizontal family only occasionally. It goes without saying that the latter would deserve a proper analysis of its own that we leave to future research.

2.6 Possible explanations

Building on economic intuition and the literature, we now explore several possible mechanisms that might explain the cross-family fertility differential, and we discuss their relevance in the light of the data. The analysis focuses on the United States.

2.6.1 The old maid hypothesis

According to a first possible explanation, the cross-family fertility differential is due to the presence of households where one child, most likely a daughter, remained unmarried and without children to take care of the elderly parent (Wolf and Soldo (1988)). While this was a documented practice in the past, it cannot explain our findings, since our unit of observation consists of married women.

2.6.2 The congestion hypothesis

Alternatively, one may think that vertical families were more affected by congestion problems than nuclear families, with lack of privacy and room at home acting as limits to fertility. This mechanism is suggested, for instance, by Hacker and Roberts (2019). However, this does not align well with data on dwelling ownership, which we consider a measure of wealth (see Table B.1 in the Appendix). Vertical families were as wealthy as, or possibly wealthier than, nuclear families, especially in the early cohorts. Furthermore, if congestion were indeed a limit to fertility, one would expect to see this mechanism at work also in horizontal families, which were, on average, significantly poorer. However, this seems not to be the case: in the United States, horizontal families have the highest fertility rates. Therefore, we can conclude that the congestion hypothesis does not seem to be convincing in light of the available data.

2.6.3 The child labour hypothesis

According to the well-known Caldwell hypothesis (Caldwell (1976, 1978)), in the past children were an asset to parents, not only when the latter were in their old age, but also during their prime, as child work was an important source of family income. Accordingly, one might think that nuclear families had more children to compensate for the absence of working elders. In this explanation, the fertility differential in favour of nuclear families emerges because nuclear families would substitute working children for working elders. This argument, however, also implies that a similar fertility differential should be observed between nuclear and horizontal families, since the latter also include working adults other than the parents (siblings and other relatives). Therefore, one would expect nuclear families to have more children than horizontal families, which does not find support in the data for the United States.

2.6.4 The grandmother hypothesis

A hotly debated issue in anthropology and biology, the "grandmother hypothesis" conjectures that in humans, females survive long after the end of their reproductive life because this enhances the survival probability of their grandchildren (see Kim et al. (2014), Watkins (2021) and the references therein). In our context, this might be an explanation of the cross-family-type fertility differential. If the presence of grandmothers increases the survival probability of children in vertical families compared to nuclear families, it follows that we should observe fewer children ever born (and more surviving children) in vertical families than in nuclear families. To verify whether this is the case, we use the limited information available in the Census on the number of surviving children. Following Jones and Tertilt (2008), we use the variable Surviving Children Ever Born, reconstructed from information on surviving children asked to married women in the Census years 1900 and 1910. Figure 7 shows the surviving

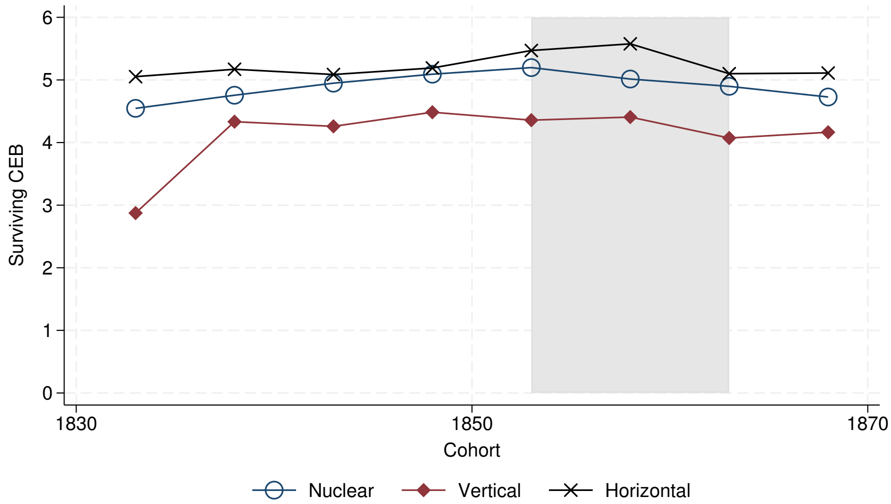


Figure 7: Surviving children ever born by cohort and family type.
Surviving children ever born (CEB) indicates how many surviving children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence (it includes stem and complex patriarchal); iii) Horizontal, complex families without intergenerational coresidence (*i.e.*, complex other), see Section 2.2. Source: our calculations from IPUMS. Data available only for the 1900 and 1910 Censuses.

CEB for each available cohort of women, by family type. Although the sample is limited, we observe that, contrary to what the grandmother hypothesis would suggest, nuclear families had more surviving children than vertical families.

2.6.5 The female emancipation hypothesis

While the effects of fertility on female labour-force participation were possibly negligible before WWII (Aaronson et al. (2020)), there is evidence that higher female employment reduces fertility, even in the short run (Coskun and Dalgic (2024)). Furthermore, Borderías and Ferrer-Alòs (2017) finds that that in early 20th century Catalonia, stem families increased the female labour-force participation, accelerating the diffusion of the factory production system. Accordingly, one might formulate a 'female emancipation hypothesis' to explain the fertility differential by family type. Under this hypothesis, the presence of grandmothers in vertical families would free women from some domestic chores and provide childcare. This would increase female labor-force participation, and hence their employment, which would in turn reduce their completed fertility. Two arguments run against this hypothesis. First, there is another possibility: women in vertical families may have had to care for the coresiding elderly, thereby reducing their labour supply (see, for instance, Ettner (1995)). Second, we control for the woman's female labour force status in our regressions: while this reduces fertility, it does not affect the fertility differential by family type. Moreover, as shown in Figure 8, there was little difference in female labour force participation by family type. Finally, and more crucially, even among women who did not participate in the labour market, those living

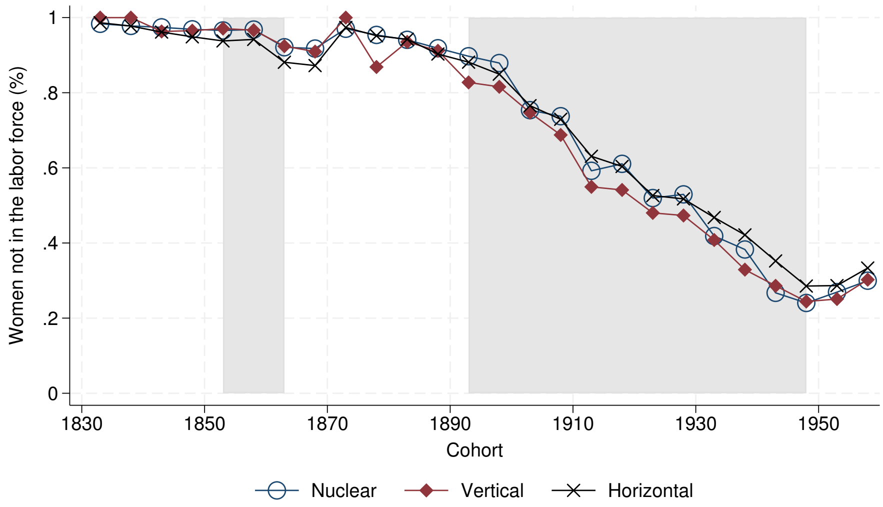


Figure 8: Female labour force non-participation by cohort and family type.
Percentage of women not participating in the labour force. Unit of observation: married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence; iii) Horizontal, complex families without intergenerational coresidence, see Section 2.2. Source: our calculations from IPUMS.

in vertical families had significantly fewer children than those living in nuclear families, as shown in Figure 9.

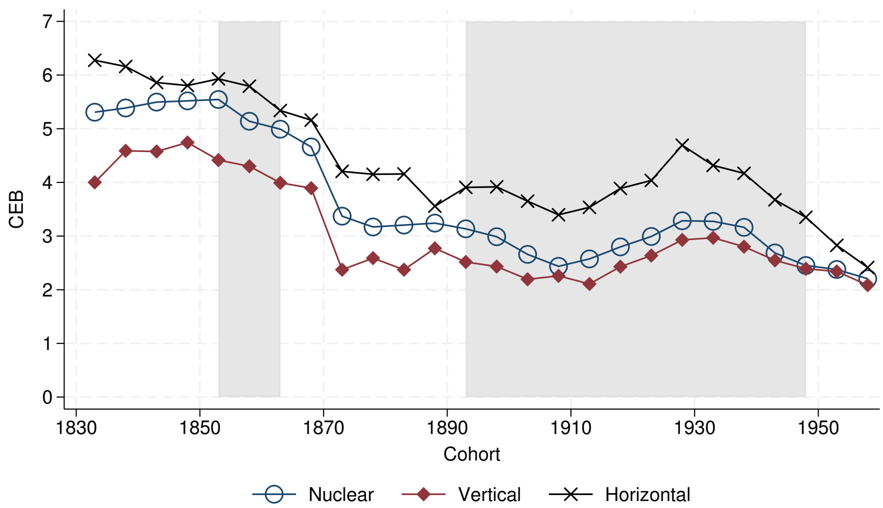


Figure 9: Children ever born by cohort and family type for women who are not in the labour force.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman who is not in the labour force (with employed husband). Grey areas: women aged 40-49. White areas: women of various age, see Section 2.1. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence; iii) Horizontal, complex families without intergenerational coresidence, see Section 2.2. Source: our calculations from IPUMS.

2.6.6 The inverted Caldwell hypothesis

An intriguing possibility that we advance in this paper to explain the cross-family fertility differential is what we call the "inverted Caldwell hypothesis". According to this hypothesis, over the time span that we consider, changes in medicine and public health, as well as the advent of the welfare state, changed the status of coresiding elderly from being a liability to their adult children, to being an asset. The idea is that for earlier cohorts, women living in extended vertical families had to take care of old, possibly sick parents/in-laws. This took time and resources away from child rearing. For more recent cohorts, however, grandparents were in relatively good health and enjoyed pension benefits. Hence, they may have added time and resources to child rearing, leaving more time for the parents to work and possibly have more children.

In the light of our discussion on vertical families in Section 2.3, however, the inverted Caldwell hypothesis seems unlikely. Since grandparents were often head of the family and actively employed, it is unlikely that they constituted a burden for their adult children. [16]

3 Model

In this Section, we propose a novel model in which both the coresidence and the fertility choices are endogenous. The aim is to discipline our thoughts on the various facts we have highlighted in the empirical analysis. In particular there are two facts we would like the model to rationalise.

I. There exists a cross family fertility differential: nuclear families have systematically more children than extended vertical families (see Figure 3).

II. This cross family fertility differential shrinks over time (see Figure 3).

On top of that, as a discipline device, we would like the model to replicate the time-series properties of fertility and coresidence in the United States:

III. There is a fertility transition: the fertility of all types of family decreases over time (see Figure 3).

IV. Family structure changes: the intergenerational coresidence rate decreases over time (see Figure 5).

Our model builds on Kotlikoff and Morris (1990) and Pensieroso and Sommacal (2014), enriched with an endogenous fertility choice featuring a quantity-quality trade off à la Becker and Barro (1988). In this model, income plays a major role, although, as it will be clear momentarily, the theoretically relevant concept of income turns out to be different from the husband's income we have used in our empirical analysis.

3.1 The logic of the model

Before delving into the technicalities of the model, let us briefly recall its building blocks and main mechanisms.

The coresidence choice is modelled as the efficient outcome of a cooperative game: agents (young-adult children, and old parents) coreside if doing so is Pareto improving with respect

[16] Independently of this empirical argument, it is possible to show that, in our model of endogenous coresidence, the inverted Caldwell hypothesis can be understood as a particular case of the more general theory that we develop in the rest of this paper. See Appendix L.

to the outside option "living alone". This depends on i) preferences; and ii) the amount of resources enjoyed when alone compared with those enjoyed under coresidence. The latter is influenced by the bargaining power that each member holds within the extended family, which in turn is a function of agents' relative income. Thus, the coresidence choice eventually depends on relative income (economic factors) and preferences (cultural factors).[17] If the young like coresidence, they will be ready to accept a relatively low share of resources within the extended family. On the contrary, if the young do not like coresidence, they will need a high share of resource to be bribed into coresidence by the old. As shown by Pensieroso and Sommacal (2014), *ceteris paribus* the higher the relative income of the young, the higher its bargaining power and the less likely coresidence, provided the young don't like coresidence "too much", so to speak.

The fertility choice depends on income in a non-trivial way. In nuclear families, what matters is parents' income. Since children are supposed to be a normal good, the demand for children is likely to be increasing in parents' income. This is an income effect. On the other hand, raising children takes time off the labour supply of parents. Hence, labour income is also the opportunity cost of children. This induces a substitution effect: raising labour income should decrease the demand for children. The dominance of one effect on the other depends on how parents' preferences are modelled. Under the assumption that parents care not only for the number of children they have, but also for the human capital they can grant them via education, and using standard preferences, the substitution effect dominates when the expenditure on education is positive.[18] In extended vertical families, all this keeps on holding with one additional complication: grandparents' income matters as well, which brings in an additional income effect.

Bringing the two building blocks together, if the young like coresidence, for a given relative income they will have a lower bargaining power. So, they might extract fewer resources from coresidence than they would have by living alone. Because of an income effect, then, the young living in extended vertical families might end up having fewer children. Hence, the fertility differential between nuclear and extended vertical family turns out to be a by-product of the coresidence choice. If the relative income of the young increases, for given cultural factors, intergenerational coresidence becomes less likely, because the outside option of living alone becomes more and more compelling. At the same time, the fertility differential shrinks, because the bargaining power of the young increases, leading the remaining young under coresidence in a better position to extract resources from the old.

3.2 Preferences and constraints

The economy is populated by three overlapping generations of individuals: the young, denoted by a superscript y; the old, denoted by a superscript o; and the children, who do not make any decisions, but only accumulate human capital as chosen by the young. There are two possible living arrangements, coresidence – the extended vertical family, denoted by a subscript c – or living alone – the nuclear family, denoted by a subscript a.

Both types of agents work, may like or dislike coresidence – a stand-in for cultural factors – and have preferences defined over private consumption, c, and housing services, x. The latter are private goods in the nuclear family, but are shared under coresidence.

Preferences are age-dependent. We assume that the young care also for the number of children they have, n, and their future human capital, h. For the sake of simplicity, we assume that the old only care for their consumption.

[17]This approach being quite general, it could be adapted to both the extended horizontal and vertical families. Here, we focus on the latter only, for the fertility differential between nuclear and extended vertical family is the core of our research question.

[18]See de la Croix (2013) for a general treatment of models of endogenous fertility and a literature review.

Accordingly, for any coresidence status $i = a, c$, the utility function of a young agent at time t reads:

$$U_i^y = (1 - \gamma - \zeta)\ln c_t^y + \zeta \ln x_t^y + \gamma \ln(n_t h_{t+1}) + \delta_i \ln \kappa^y, \tag{2}$$

with $\zeta \in (0, 1)$ and $\gamma \in (0, 1)$ standing for the relative weight in the utility function of the housing services, and the number of children and their human capital, respectively; κ^y representing the young's (positive or negative) taste for coresidence; and δ_i being a dummy variable that depends on the living arrangement, such that $\delta_i = 0$ for $i = a$ and $\delta_i = 1$ for $i = c$. By the same token, the utility function of an old agent at time t reads:

$$U_i^o = (1 - \zeta)\ln c_t^o + \zeta \ln x_t^o + \delta_i \ln \kappa^o. \tag{3}$$

For analytical purposes, we set $\kappa^o = 1$.[19] Also, we do not consider heterogeneity along the gender dimension. Accordingly, our agents must be understood as a couple.[20]

Notice that in this model, we have assumed that fertility decisions and investments in children's human capital are driven by altruism, and not by strategic motivations.[21] Thus we exclude the possibility that parents might decide over fertility and children's human capital in order to affect family arrangement in the next period.[22] This assumption is made for the sake of analytical convenience. Had we assumed otherwise, the choices of young agents at time t would depend on the optimal choices of all future generations, including their coresidence decisions.

Young parents pay a time cost $\phi \in (0, 1)$ for raising each child, and a good cost e for educating them. Education builds up the child's human capital according to the following production function:[23]

$$h_{t+1}^y = (1 + e_t)^\beta, \tag{4}$$

with $0 < \beta < 1$.

[19]It is possible to show that, if $\kappa^o = \kappa^y$, results hold substantially unchanged (available upon request).

[20]This assumption might be questionable when it comes to the analysis of the fertility choice by the young, since, especially in the past, mothers would bear most of the brunt of child raising, without participating much in the labour market. See Galor and Weil (1996) for a model explicitly taking this dimension on board. In our model, instead, the young couple works, and the opportunity cost of children hits the couple. This is an acceptable approximation from a historical perspective under the presumption that children implied some time cost also for the bread-winning husbands. By the same token, the model does not allow to discriminate extended families where the old are both alive, from those where only one is; nor who is the widow, the husband or the wife. Finally, the model is silent about the distinction between natural parents and in laws. As a consequence, the model does not speak to the demographic literature suggesting that the gender dimension of old parents and their being natural parents or in-laws may contribute to explain the fertility differential between family types (see Hacker and Roberts (2019)). The mechanism we stress – relative income – is, however, quite general, and may be seen as complementary to that analysis. Furthermore, although we do not want to push this argument too far, the specificities underlined by the demographic literature (gender of the widow, in-laws) may find a suitable, if incomplete representation through the κ^i variables in our model.

[21]Strategic motivations are ignored by virtually the whole literature studying the quantity-quality trade-off applied to fertility decisions. Only a handful of papers explicitly deal with the issue: Boldrin and Jones (2002) looks at the so-called old-age security hypothesis as an explanation of fertility; Bezin et al. (2024) studies strategic fertility choices when having a larger share of the population helps to increase the power of a religious or ethnic group.

[22]Fertility might influence family arrangements in the next period through two channels: first intergenerational coresidence is obviously possible only when there is at least one child; second, the number of children might affect the probability of having a child with a high taste for coresidence (see Appendix K for a more detailed discussion of this mechanism and of its quantitative relevance). Investment in children's human capital might affect the likelihood of coresidence in the next period because it influences relative human capital and the bargaining power.

[23]Equation (4) is a simplified version of the typical human capital accumulation in the literature (see for instance de la Croix and Doepke (2003)). We use it here for the sake of analytical clarity, but our argument holds good for more general forms, as the one use in Appendix M.

The budget constraint of each agent differs along the age and family dimension. Calling w the wage per efficiency unit and p^x the price of housing services, the budget constraints of the young and the old living alone read:

$$w_t(1-\phi n_t)h_t^y = c_t^y + e_t n_t + p_t^x x_t^y, \tag{5}$$

and

$$w_t h_t^o = c_t^o + p_t^x x_t^o, \tag{6}$$

respectively.

Maximising (2) and (3) subject to (5) and (6), respectively, gives the optimal choices when living alone:

$$c_{t,a}^{y,*} = (1-\gamma-\zeta)h_t^y w_t; \qquad c_{t,a}^{o,*} = (1-\zeta)h_t^o w_t; \tag{7}$$

$$x_{t,a}^{y,*} = \zeta\frac{h_t^y w_t}{p_t^x}; \qquad x_{t,a}^{o,*} = \zeta\frac{h_t^o w_t}{p_t^x}; \tag{8}$$

$$n_{a,t}^* = \begin{cases} \frac{\gamma}{\phi} & \text{if } w_t h_t^y \leq \frac{1}{\beta\phi} \\ \frac{\gamma(1-\beta)h_t^y w_t}{\phi h_t^y w_t - 1} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}; \qquad e_{t,a}^* = \begin{cases} 0 & \text{if } w_t h_t^y \leq \frac{1}{\beta\phi} \\ \frac{\beta h_t^y w_t \phi - 1}{1-\beta} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}. \tag{9}$$

We impose $\gamma + \zeta < 1$, so that $c_{t,a}^{y,*} > 0$. Notice that $e_{t,a}^* > 0$ if $w_t h_t^y > \frac{1}{\beta\phi}$. Hence, this model admits two education regimes, depending on the wage rate. The first, which we shall label the 'Post-Malthusian' regime, is characterised by low income, zero education and high fertility. In the second, or 'Modern' regime, income is higher, education is positive and fertility lower.

We now turn to the optimal solution under coresidence.

We assume that coresidence only happens between one young and one old agent. In other terms our focus in the model is on stem families and not on households with intergenerational coresidence and siblings (i.e., complex patriarchal families, as defined in Section 2). While this may seem restrictive from a theoretical perspective, the empirical evidence suggests this was actually the case for the United States in the period under consideration. In our sample, extended vertical families were mostly stem families, with complex patriarchal families representing only a negligible portion of them.

Sticking to a widespread literature on collective models (Chiappori (1992)), we shall assume that agents under coresidence pool resources together and maximise a family-wide utility function that is a weighted average of the utility of the young and the utility of the old. The parameter θ represents the weight of the young in the maximisation problem, which holds a natural interpretation as the young's bargaining power, as noticed by Pensieroso and Sommacal (2019). The problem of the extended vertical family then reads:

$$\max \theta U_c^y + (1-\theta)U_c^o \tag{10}$$

$$\text{sub}$$

$$w_t\{h_t^o + h_t^y(1-\phi n_t)\} = c_t^o + c_t^y + e_t n_t + p_t^x x_t. \tag{11}$$

In this formulation, the young and the old plays a cooperative game over the allocation of resources within the family. The only restriction this imposes on the outcome of the game is that it should be efficient, that is, no other allocation could represent a Pareto improvement over it (see Browning et al. (2014) for an extended treatment of this class of models). Notice that housing services are assumed to be a public good under coresidence, i.e. $x_t = x_t^y = x_t^o$.

Solving the maximisation problem, optimal choices under coresidence are:

$$c_{t,c}^{y,*} = \theta(1-\gamma-\zeta)w_t(h_t^o + h_t^y); \qquad c_{t,c}^{o,*} = (1-\theta)(1-\zeta)w_t(h_t^o + h_t^y); \tag{12}$$

$$x_{t,c}^{*} = \frac{\zeta w_t(h_t^o + h_t^y)}{p_t^x}; \tag{13}$$

$$n_{c,t}^{*} = \begin{cases} \frac{\gamma\theta(h_t^o+h_t^y)}{h_t^y\phi} & \text{if } w_t h_t^y \leq \frac{1}{\beta\phi} \\ \frac{(1-\beta)\gamma\theta w_t(h_t^o+h_t^y)}{h_t^y w_t\phi-1} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}; \qquad e_{t,c}^{*} = \begin{cases} 0 & \text{if } w_t h_t^y \leq \frac{1}{\beta\phi} \\ \frac{\beta h_t^y w_t\phi-1}{1-\beta} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}. \tag{14}$$

3.3 The coresidence choice in the Modern regime

In our model, the family structure is endogenous. The young and the old compare the utility they can get under coresidence with what they can get by living alone. Only if the former exceeds the latter, coresidence will be chosen. In terms of the model, this means comparing across living arrangements the indirect utility functions V_i^j, with $j = y, o$ and $i = a, c$:

$$V_a^y = U_a^y(c_{t,a}^{y,*}, x_{t,a}^{y,*}, n_{t,a}^*, e_{t,a}^*), \tag{15}$$

$$V_c^y = U_c^y(c_{t,c}^{y,*}, x_{t,c}^{y,*}, n_{t,c}^*, e_{t,c}^*), \tag{16}$$

$$V_a^o = U_a^o(c_{t,a}^{o,*}, x_{t,a}^{o,*}), \tag{17}$$

$$V_c^o = U_c^o(c_{t,c}^{o,*}, x_{t,c}^{o,*}). \tag{18}$$

This allows us to define the threshold levels of the bargaining power of the young such that coresidence is Pareto improving. In particular, we define θ_{min} as the value of θ such that $V_a^y = V_c^y$,

$$\theta_{min} = \left[\frac{1}{\kappa^y}\left(\frac{\iota_t}{1+\iota_t}\right)\right]^{\frac{1}{1-\zeta}}. \tag{19}$$

where $\iota \equiv \frac{h_t^y}{h_t^o}$ is the relative income of the young with respect to the old. In other words, θ_{min} is the minimum value of the bargaining power of the young such that the young is indifferent between living alone (nuclear family) or with the old (intergenerational coresidence – extended vertical family). Since $\frac{\partial V_c^y}{\partial \theta} > 0$, then $\forall \theta > \theta_{min}$, the young prefers coresidence. By the same token, we define θ_{max} as the value of θ such that $V_a^o = V_c^o$:

$$\theta_{max} = 1 - \left[\left(\frac{1}{1+\iota_t}\right)\right]^{\frac{1}{1-\zeta}}. \tag{20}$$

In other words, θ_{max} is the value of the bargaining power of the young such that the old is indifferent between living alone or with the young. Since $\frac{\partial V_c^o}{\partial \theta} < 0$, then $\forall \theta < \theta_{max}$, the old prefers coresidence.

We can can then parametrize the possibility of coresidence to the difference $\Delta_\theta \equiv \theta_{max} - \theta_{min}$:

- if $\Delta_\theta > 0 \ \exists\ \theta$ such that coresidence is attractive for both the young and the old.
- if $\Delta_\theta = 0$, both the young and the old are indifferent between coresidence and living alone.
- if $\Delta_\theta < 0 \ \partial\ \theta$ such that coresidence is attractive for both the young and the old.

As in Pensieroso and Sommacal (2019), we assume that, whenever $\Delta_\theta > 0$, coresidence is actually chosen, for agents do not leave the possibility of a Pareto improvement unexploited. Under this assumption, and using Equations (19) and (20), it is possible to characterise what we define the "coresidence frontier", Φ_c, or the geometric locus of the combinations of κ^y and ι such that $\Delta_\theta = 0$.

Proposition 1 *Given the coresidence frontier*

$$\Phi_{c,t} \equiv \frac{\iota_t \left(\frac{1}{1+\iota_t}\right)^{\frac{1}{1-\zeta}} \left((1+\iota_t)^{\frac{1}{1-\zeta}} - 1\right)^{\zeta}}{1 - \left(\frac{1}{1+\iota_t}\right)^{\frac{1}{1-\zeta}}}, \tag{21}$$

coresidence is Pareto efficient (i.e., $\Delta_\theta > 0$*) if and only if the taste for coresidence* κ^y *is such that* $\kappa^y > \Phi_{c,t}$.

Proof
Solving $\Delta_\theta = 0$ for κ^y gives $\kappa^y = \Phi_c$. The Proposition then follows from the fact that Δ_θ is increasing in κ^y. ■

Proposition 1 lends itself to a graphical representation in the (κ^y, ι) space, Figure 10, which offers an intuitive representation of the working of the model as to the determinants of coresidence.

In this model, coresidence depends on cultural factors and the relative income of the young. For a given ι, higher values of κ^y implies 'more' coresidence. For a given κ^y, instead, higher values of ι implies 'less' coresidence. It is possible to prove that if $\kappa^y < \iota^\zeta$, then Δ_θ always decreases with ι, making coresidence less attractive as the relative income increases. Finally, the figure was drawn for a given ζ. An increase in ζ within the range of admissible values will push the coresidence frontier downwards: as the public good becomes more relevant in the utility of both agents, *ceteris paribus* the region for which coresidence is Pareto improving becomes larger.

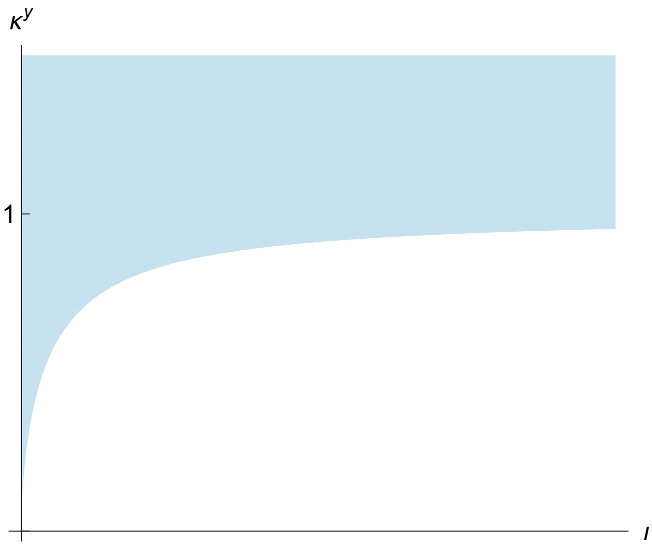


Figure 10: The coresidence frontier $\Phi_{c,t}$ in the (ι, κ^y) space. In the shaded area, $\Delta_\theta > 0$: coresidence is Pareto efficient.

3.4 The coresidence choice in the Post-Malthusian regime

So far, we have studied family formation under the assumption that optimal education is at the interior solution. If the young's income is too low, however, optimal education might fall to the zero corner solution, what we have called the Post-Malthusian regime. As shown in Equations (9) and (14), this affects the fertility choice, while leaving the optimal solutions for the other variables unaltered. The question arises, then, whether the education regime also affects the coresidence choice. Quite interestingly, it turns out of computations that this is not the case. In this model, Equations (19) and (20) characterise the region for which coresidence is Pareto efficient both when education is positive and when it is zero, meaning that the coresidence choice is unaffected by the education regime.[24]

3.5 Fertility, income and coresidence

While the education regime does not affect the coresidence choice, it does affect the fertility one, and it does so in a way that depends on the family structure, as shown by Equations (9) and (14).

We shall now compare the qualitative predictions of the model with the empirical facts on fertility and family structure highlighted in Section 2.

Fact I

We start by Fact I: in the data, fertility differs by family type. In particular, intergenerational coresidence (extended vertical families) is systematically associated with lower fertility than nuclear families. In the model, we now compare two young agents who are otherwise identical but have different preferences regarding coresidence. One has $\kappa^y > \Phi_{c,t}$ and thus coresides with an old agent; the other has $\kappa^y < \Phi_{c,t}$ and accordingly lives alone. Consistent with the empirical evidence, equations (9) and (14) show that in the model fertility differs by family type. In particular, rearranging terms we shall have that, for both education regimes,

$$n_{c,t} = \theta \frac{(h_t^o + h_t^y)}{h_t^y} n_{a,t}. \tag{22}$$

and accordingly:

$$\Delta_{n,t} \equiv n_{a,t} - n_{c,t} > 0 \iff \theta \frac{(h_t^o + h_t^y)}{h_t^y} < 1. \tag{23}$$

where $\Delta_{n,t}$ is the fertility differential between nuclear and extended vertical households.

To understand the sign of the fertility differential, then, we need to know the value of θ, or the allocation of resources within the family. Since our theory is silent with respect to the determinants of the actual bargaining power of the young, we shall take an agnostic stance by assuming

$$\theta = \lambda \theta_{min} + (1 - \lambda)\theta_{max}. \tag{24}$$

This simply means that whenever coresidence is Pareto efficient ($\Delta_\theta > 0$), it will be chosen, and the actual θ will fall within the interval $[\theta_{min}, \theta_{max}]$ according to a parameter $\lambda \in [0, 1]$. The higher λ, the nearer θ to θ_{min}.

The following Proposition characterizes the cross-family fertility differential as a function of λ, κ^y, ζ and the relative income of the young ι_t.

Proposition 2 *Given*

$$\hat{\lambda} = 1 - \frac{\iota_t}{\left[1 - \left(\frac{1}{1+\iota_t}\right)^{\frac{1}{1-\zeta}}\right](1 + \iota_t)}, \tag{25}$$

- *if $\lambda < \hat{\lambda}$, fertility in nuclear families is always lower than in vertical ones (i.e., $\Delta_{n,t} < 0$);*

[24] To prove the statement, it suffices to compare the indirect utility functions when living alone or in coresidence, under the post-Malthusian regime. Solving for θ_{min} and θ_{max} one retrieves Equations (19) and (20).

- *if $\lambda > \hat{\lambda}$, one can define a "fertility differential frontier"*

$$\Phi_n \equiv \frac{\iota_t \lambda^{1-\zeta}\left[(1-\lambda)\left(\frac{1}{1+\iota_t}\right)^{\frac{1}{1-\zeta}} + \frac{\iota_t}{1+\iota_t} - (1-\lambda)\right]^{\zeta}}{(1-\lambda)\left(\frac{1}{1+\iota_t}\right)^{\frac{\zeta}{1-\zeta}} + \lambda(1+\iota_t) - 1}, \tag{26}$$

such that fertility in nuclear families is greater than in vertical ones (i.e., $\Delta_{n,t} > 0$) if and only if the taste for coresidence κ^y is such that $\kappa^y > \Phi_n$.

Proof

Using equations (19), (20) and (24), one gets that, if $\lambda < \hat{\lambda}$, $\theta \frac{(h_t^o + h_t^y)}{h_t^y} > 1$ and hence $\Delta_{n,t} < 0$. For $\lambda > \hat{\lambda}$, it is possible to solve $\Delta_{n,t} = 0$ with respect to κ_y, which delivers Φ_n in equation (26). Since $\Delta_{n,t}$ is increasing in κ^y, it then follows that $\Delta_{n,t} > 0 \iff \kappa^y > \Phi_n$. ■

The intuition behind Proposition 2 can be grasped looking at equation (23): if the young reap fewer resources from coresidence than they would have reaped by living alone, that is if $\theta(h_t^o + h_t^y) < h_t^y$, then they will have fewer children under coresidence. In other words, there is an income effect at work here. For $\lambda < \hat{\lambda}$, the bargaining power of the young, θ, leans towards θ_{max}, and is sufficiently high for the young to grasp more resources than they would have by living alone. Hence, the fertility differential between nuclear and extended vertical households is always negative. For $\lambda > \hat{\lambda}$, instead, the bargaining power of the young, θ, is lower and leans towards θ_{min}. However, this is not enough to reverse the fertility differential per se, for θ_{min} may be high or low, depending in particular upon the young's taste for coresidence κ^y. In fact, from Equation (19) the higher κ_y, the lower θ_{min}: if the young like coresidence they are willing to accept a lower share of resources in order to coreside. Hence, the fertility differential becomes positive only if κ^y is high enough, that is if $\kappa^y > \Phi_n$.

To visualise the working of the model, in Figure 11 we represent the coresidence and fertility differential frontiers in the same graph, for λ and ζ equal to the values calibrated in Section 4. In the figure, for low levels of relative income, if the young have a high enough taste

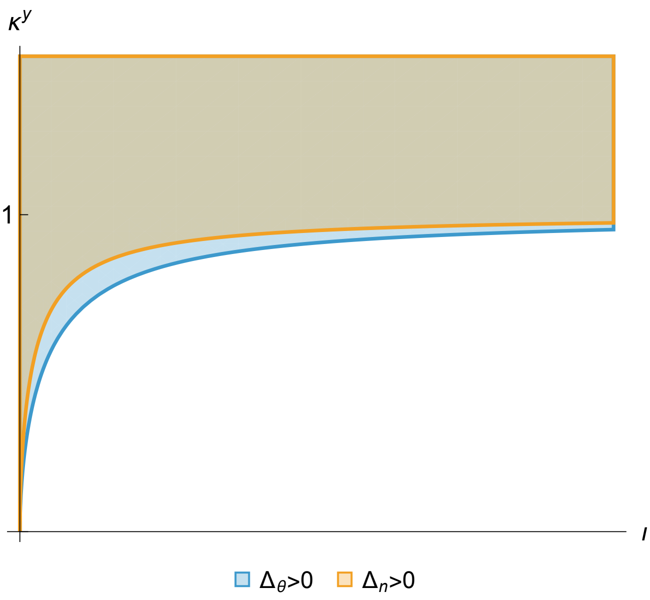


Figure 11: The coresidence frontier $\Phi_{c,t}$ and the fertility differential frontier $\Phi_{n,t}$ in the (ι, κ^y) space.

When the two areas overlap, coresidence is Pareto improving and nuclear families have more children than vertical ones, *i.e.*, $n_a > n_c$.

for coresidence, they will end up in an extended vertical family and have fewer children. As the relative income increases, however, the bargaining position of the young improves, so that, if their taste for coresidence is not too high, they might cross the fertility differential frontier, and have more children that they would have had in the nuclear family. Eventually, for even higher levels of the relative income, the coresidence frontier is crossed, and the extended vertical family dissolves.

Fact II, III, and IV

When it comes to Fact II – in the data, the difference in fertility by family type shrinks over time – the partial equilibrium analysis developed here above needs to be integrated with the production side, and the explicit dynamics underpinning the demographic transition. This will allow the model to speak also to Fact III – the decreasing fertility pattern over time in the United States – and Fact IV – the change of the family structure over time.

To illustrate the compliance of the model with these facts, we shall resort to numerical simulations.

4 A quantitative exercise

In this Section, we propose a dynamic general equilibrium version of the model discussed so far.[25] To this end, we need to specify the source of intragenerational heterogeneity, the production side, and the dynamics of the economy.

At the household level, coresidence has a binary nature: it is either optimal, and hence will be chosen, or it is not. Accordingly, to get an aggregate coresidence rate different from 0 or 100%, we follow Pensieroso and Sommacal (2019) and introduce intragenerational heterogeneity in the taste for coresidence κ^y. In particular we assume that κ^y is distributed across the young following a density function $f_t(\kappa^y)$, which is assumed to be constant over time, i.e. $f_t(\kappa^y) = f(\kappa^y) \quad \forall t$. According to Proposition 1, coresidence is possible only for those young agents with a sufficiently high value of κ^y. We assume that siblings share the same κ^y but, as already explained in Section 3.2, we further assume that, in accordance with the empirical evidence, only one of them actually takes advantage of the possibility of intergenerational coresidence, when it represents a Pareto improvement with respect to living alone. The other siblings form their own nuclear family. [26]

Parameter	Value	Target
g	0.15	Secular growth in the USA
ϕ	0.11	Time cost of children
β	0.6	Elasticity of earnings with respect to education
γ	0.30	Average fertility of nuclear families, 1833
λ	0.99	Average fertility of vertical families, 1833
ζ	0.56	Share of public to private consumption for U.S. households, 1929
μ	0.69	Coresidence rate of the old, 1850
σ	0.26	Coresidence pattern

Table 4: Numerical values of the parameters

[25] In Appendix M we present a version of the model with a different human capital production function and a different mechanism explaining the transition from stagnation to growth. Results are qualitatively and quantitatively comparable to those reported here.

[26] We assume that siblings who are not allowed to exploit the Pareto improvement represented by intergenerational coresidence are not compensated by the sibling who coreside. Note that, since siblings are identical, the selection of the specific sibling who coresides with the parents is immaterial.

Coming to the supply side, we need to specify how the final good and housing services are produced. We assume perfect competition in all markets. The final good is produced using the following production function:

$$Y_t = A_t \left[h_t^y N_t^y \left(1 - \phi \bar{n}_t\right) + h_t^o N_t^o \right]. \tag{27}$$

where A is total factor productivity (TFP) and

$$\bar{n}_t = \frac{\int_{N^y} n_t(j) dj}{N_t^y} \tag{28}$$

is the average fertility at time t, with the number of children generated by a young agent j at time t denoted by $n_t(j)$. The price of the final good is chosen as the *numeraire* and, accordingly, perfect competition implies $w_t = A_t$. The final good can be used for consumption purposes as well as for the production of housing services x, through the linear technology $X = zY^x$, where Y^x are the units of the final good Y used to produce x, and z is a productivity parameter. Thus, perfect competition gives $p_x = 1/z$.

We assume TFP evolves at an exogenous, constant rate g:

$$A_{t+1} = (1 + g) A_t. \tag{29}$$

In the previous sections, we discussed the key role played by the ratio $\iota \equiv h_t^y / h_t^o$. We have assumed that the human capital of the young h_t^y is given by equation (4). To close the model, we also need to specify how h_t^o is determined:

$$h_t^o = \alpha h_{t-1}^y. \tag{30}$$

In other terms, we assume that the old keep the human capital they had when young, but for a depreciation α meant to catch knowledge obsolescence and age-related lost of memory and other brain capacities. We assume fast technical progress makes the old's knowledge more obsolete:

$$\alpha = \frac{1}{1+g}. \tag{31}$$

Assuming no child mortality and no mortality between young and old age, population dynamics reads:

$$N_t^y = \bar{n}_{t-1} N_{t-1}^y; \tag{32}$$

$$N_t^o = N_{t-1}^y; \tag{33}$$

where N_t^i denotes the number of active agents of type i at time t, with $i = y, o$.

The model does not admit a closed form solution. Hence, we resort to numerical simulations. In order to simulate the model, we first need to assign numerical value to its structural parameters.

A model period is set equal to 20 years. We simulate the model for 7 periods (cohorts). The first cohort (period 1) is the 1833 cohort - the first for which we can retrieve data on fertility for both nuclear and vertical household. The last cohort is the 1953 cohort. We fix ϕ following the same procedure used by de la Croix and Doepke (2003). Accordingly, the opportunity cost of a child is set equal to 15% of the parents' time endowment. Such a cost is assumed to be present for the first 15 years of a child's life. Thus, since one period in the model is interpreted as 20 years, $\phi = 0.11$ (=$0.15 * \frac{15}{20}$). Knowing ϕ, we then set γ to match the fertility of the nuclear family for the 1833 cohort, which is equal to 5.31 (see Figure 3).[27] Accordingly

[27]When using fertility data to parametrize the model, we need to take into account that one agent in the model is interpreted as a couple. Accordingly, the number of children generated by the model must be multiplied by two to make it comparable with the data. In other terms: 5.31 children in the data correspond to 2.65 children in the model.

$\gamma = 0.30$ (see equation (9)). The parameter β affects the elasticity of earnings with respect to education, namely it is exactly equal to this elasticity for w that goes to infinity. According to de la Croix and Doepke (2003), the set of admissible values for this elasticity ranges from 0.4 to 0.8. We follow them and choose a value in the mid, i.e. we set $\beta = 0.6$. The parameter λ is chosen to match the average fertility of the vertical family in the first simulation period, i.e. 4 (see Figure 3). Accordingly, we set $\lambda = 0.99$.

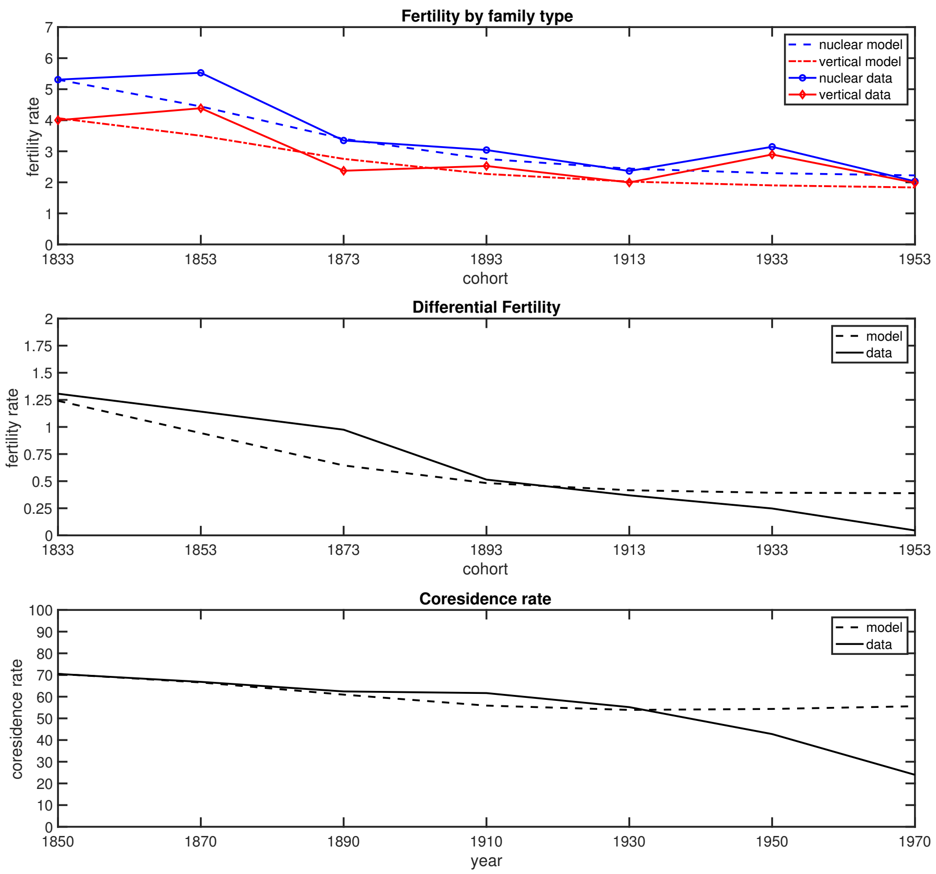


Figure 12: Simulation results. Benchmark: changing economic factors and given cultural factors.

The parameter ζ is calibrated to get an aggregate share of housing services over private consumption equal to *circa* 1.8. This value corresponds to the share of public to private consumption for U.S. households in 1929, as computed by Salcedo et al. (2012).[28] Accordingly, we set $\zeta = 0.56$.

As to the taste for coresidence κ^y, we assume that it is distributed according to a normal distribution (with mean μ and standard deviation σ), which we truncate at 0. The value of parameter μ is calibrated to match the U.S. coresidence rate of the elderly in 1850, which was equal to 70.49% (see Figure 5). This is the first year for which we can compute the coresidence rate and its meant to capture coresidence of women of the 1833 cohort during their fertile period. As to the standard deviation σ we follow the same approach as Pensieroso and Sommacal (2019). A priori, we would like to have a small value of σ, for this would imply that we do not need a high degree of unexplained heterogeneity in unobservables in order to

[28]Given that the first cohort in our simulation is the 1833 cohort, we would need data for the XIX century. Unfortunately, there are no data for this period and therefore we use the first available estimate, which refers to 1929.

account for the data. We run several simulations of the model with different values of σ and choose the one that minimizes the average quadratic distance between the intergenerational coresidence rate in the model and the data. It turns out that the value of σ that gives the best performance of the model in terms of replicating the coresidence pattern is $\sigma = 0.26$. This is a relatively low value compared to the standard normal distribution, suggesting that for our mechanism to work we effectively only need a small degree of unexplained heterogeneity. For this value of σ, μ turns out to be equal to 0.69.

We assume that in period 1 the model economy is on a balanced growth path characterized by zero education and zero growth rate of TFP. Then between period 1 and period 2 the growth rate of TFP becomes positive and the economy shift from the Post-Malthusian to the Modern regime. In particular, starting from period 1, the parameter g – the growth rate of TFP over 20 years – is set in order to get an average annual growth rate of real GDP per capita of about 2%. To this end, we choose $g = 0.15$, which corresponds to an annual TFP growth rate of 0.07%. Then we initialise TFP so that $w_1 = A_1 < \frac{1}{\beta\phi}$ and $w_2 = A_2 = (1+g)A_1 > \frac{1}{\beta\phi}$. This guarantees that the economy shifts from the Post-Malthusian to the Modern regime at time 2 (see equation (14)).

Table 4 summarizes the calibration procedure.

Results from the simulations are reported in Figure 12.

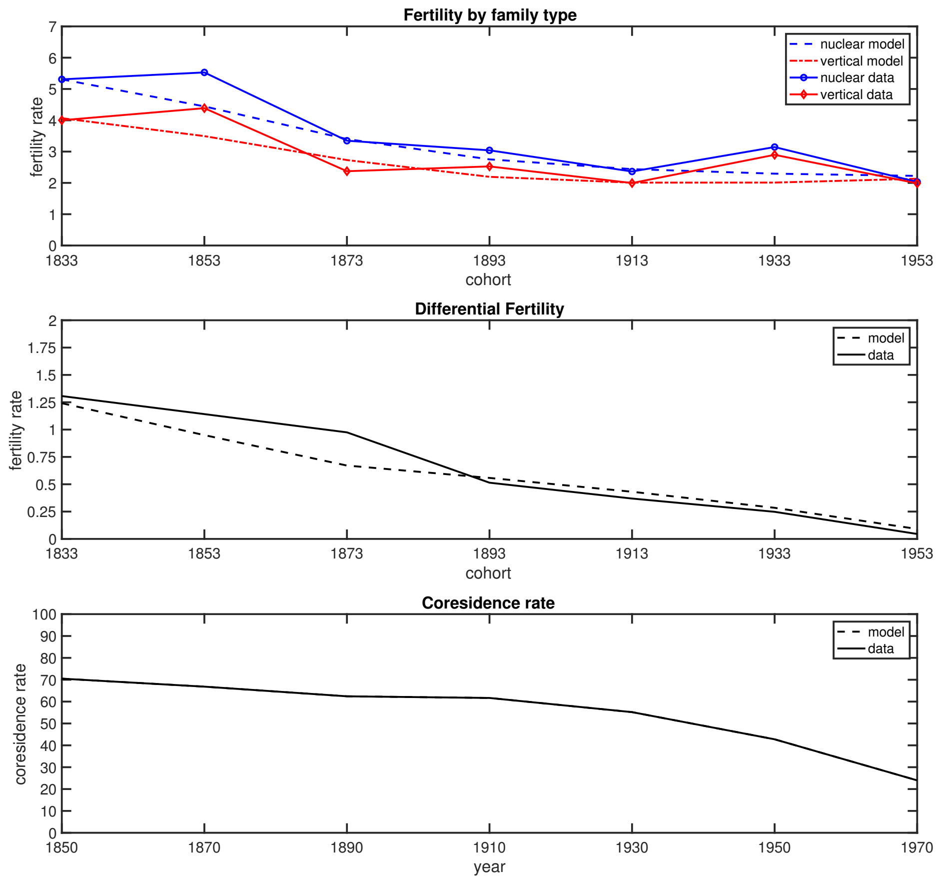


Figure 13: Simulation results. Variant 1: changing economic and cultural factors.

The model reproduces well the qualitative behaviour of the actual data. As wages increase, the intergenerational coresidence rate decreases, the economy experiences a fertility transition, and the differential fertility shrinks. Quantitatively, the model account for *circa* 68% of the drop in the fertility differential between the 1833 and the 1953 cohorts, and for *circa* 32% of the drop in the coresidence rate between 1850 and 1970 (the drop in coresidence rate up to the 1930 is reproduced almost perfectly).

In the benchmark exercise of Figure 12, we assume that the distribution of κ^y is invariant over time. Preferences, however, might have changed in a century-long perspective, making our benchmark exercise somewhat conservative on cultural factors and explaining why the model, in the last part of the simulation horizon (i.e. starting from the 1950), is less effective in reproducing the coresidence pattern. We now assume that the distribution of κ^y changes over time, namely we calibrate μ_t so as to perfectly match the coresidence rate in each period (given σ). Results from the simulations with the modified model are reported in Figure 13. The fitness of the model improves. The model accounts for *circa* 91% of the drop in the fertility differential between the 1833 and the 1953 cohorts, while, of course, mimicking by construction 100% of the drop in the coresidence rate.

Hence, cultural factors help explaining the drop in differential fertility across family types. One can then wonder whether we may dispense with economic factors, and leave it to cultural factors alone to explain the pattern of both differential fertility and family structure. To verify whether this is actually the case, in a third exercise we perform the same exercise of Figure 13 but for the fact that we shut down the growth rate of TFP, preventing the model economy to move away from the initial situation in which education is equal to zero. Results from the simulations under these new assumptions are reported in Figure 14. The model now reproduce almost perfectly the overall drop in the fertility differential between the 1833 and the 1953 cohorts. It does so, however, by generating an increase in the fertility rates, which is

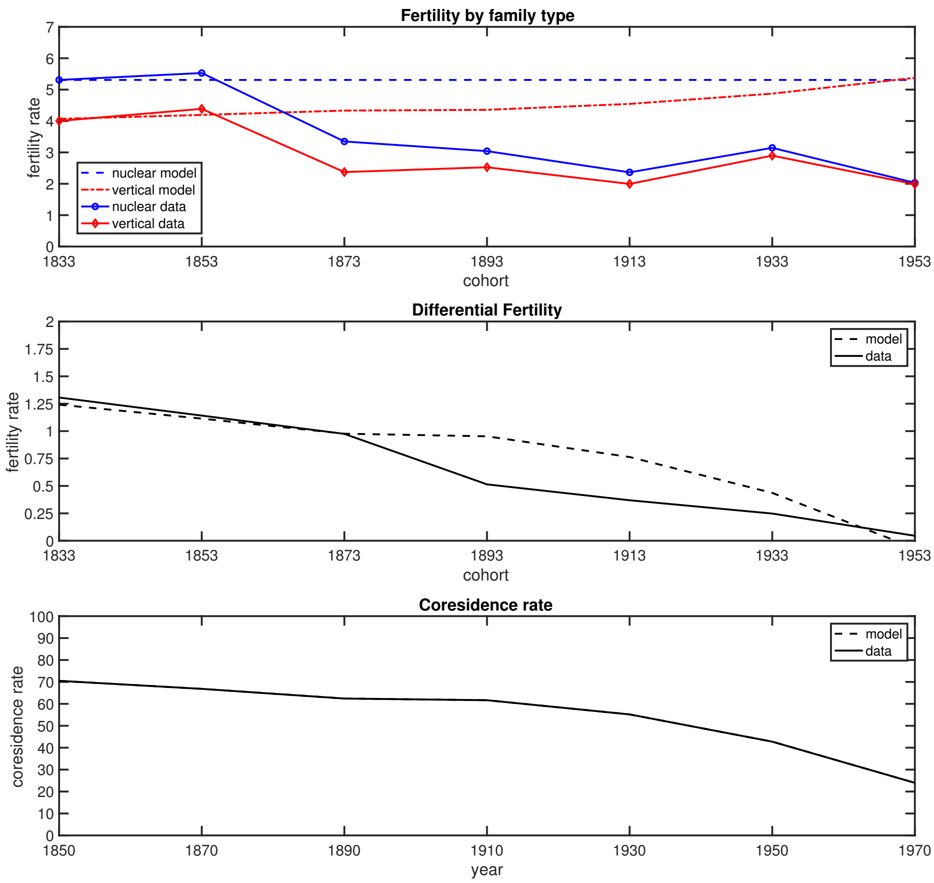


Figure 14: Simulation results. Simulation results. Variant 2: given economic factors and changing cultural factors.

at odds with the data. In other words, this variant of the model completely misses the fertility transition.

We may therefore conclude that economic factors are crucial to account for both the shrinking differential fertility, the fertility transition and the secular change in family structure.

5 Looking at the data through the lens of the theory

In the preceding Sections, we have brought to the fore a new fact – the existence of a cross family differential fertility in the United States and in other European countries – and we have developed a novel theory of endogenous fertility and intergenerational coresidence to rationalise it. We have further argued that under a reasonable, disciplined calibration, the simulated model can match quantitatively well the aggregate dynamics of the cross-family differential fertility, while at the same time being compatible with the fertility transition and the secular change in family structure in the United States. This is reassuring about the empirical suitability of our model.

An additional step to assess the correspondence of our theory to the data is to study its empirical implications. Looking at the expression of $n^*_{c,t}$ from Equation (14), one salient empirical implication of the theory is that completed fertility in vertical families should be a positive function of the young's bargaining power, θ, and the overall family income, $h^y + h^o$, and a negative function of the income of the young, h^y.

While a clearcut empirical counterpart to all the variables of Equation (14) does not exist, we do have proxies that we may arguably rely on to deliver some suggestive evidence. First, we know from the Census whether the woman or her husband were "head of the family", or whether her parents/in-laws were. In accordance with Ruggles (2016), we interpret family headship as conductive to a position of strength in the intra-family bargaining process.[29] This will be our (imperfect) empirical proxy for θ. For what concerns income, as mentioned several times in the previous Sections, we rely on occupational income scores. To reconstruct the income of the young, we are going to sum the occupational income score of the woman and her husband for each vertical family. To have the family income, we sum instead the occupational income score of each member of the vertical family.

Based on these data, we regress completed fertility of woman i in a vertical family on a dummy *Head*, indicating whether she (or her husband) is head of the family; on the family income, *FamInc*; and on the income of the young, *YoungInc*:

$$CEB_i = \beta_0 + \beta_1 Head_i + \beta_2 FamInc_i + \beta_3 YoungInc_i + \vartheta_c + \gamma_s + \epsilon_i. \tag{34}$$

We shall also control for cohort and state fixed effects, ϑ_c, and γ_s. Results are shown in Column (1) of Table 5.

Interestingly, the fertility of women in vertical families is positively, significantly and strongly affected by whether they (or their husbands) were registered as head of the family, which we interpret as evidence that the intra-family bargaining at the heart of our model mattered. In fact, this carries the implication that a strong (weak) bargaining position of the young allowed women in vertical families to have more (less) children. The income variables have the expected sign: positive for the family income (direct income effect); and negative for

[29]"We should not idealize these traditional families. They were organized according to patriarchal tradition; the master of the household had a legal right to command the obedience of his wife and children and to use corporal punishment to correct insubordination [...]. In most states, husbands owned the value of their wives' labor, as well as most property women brought into marriage [...]. For 180 years, the authority of the patriarch was enshrined in the decennial census, which explicitly identified the head of each household; not until 1980 was the household head concept abandoned [...]."

	(1) CEB	(2) n of children	(3) n of children ≤ 5
Head or head's wife	0.96***	0.91***	0.22***
	(0.045)	(0.013)	(0.007)
Family income	0.02***	0.01***	-0.00
	(0.001)	(0.000)	(0.000)
Income of the young	-0.04***	-0.03***	-0.01***
	(0.001)	(0.000)	(0.000)
Age		0.03***	-0.04***
		(0.001)	(0.000)
Constant	3.77***	1.71***	2.05***
	(1.030)	(0.075)	(0.034)
Observations	27,601	118,152	118,152
R-squared	0.184	0.146	0.161
Cohort FE	Yes	No	No
Year FE	No	Yes	Yes
State FE	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: OLS estimates. Fertility in vertical families.
Results from an OLS regression of different measures of fertility on household's headship, income and age. Column (1): dependent variable, children ever born (CEB); unit of observation: married woman (various ages, see Section 2.1) living in vertical families (with employed husband). Column (2): dependent variable, number of own children; unit of observation: married woman aged 20-49 living in vertical families (with employed husband). Column (3): dependent variable, number of own children aged 5-; unit of observation: married woman aged 20-49 living in vertical families (with employed husband). CEB indicates how many children a woman had throughout her life at the moment of the Census interview. Number of own children indicates how many coresiding children a woman had at the moment of the Census interview. Number of own children aged 5- indicates how many coresiding children aged 5 years or less a woman had at the moment of the Census interview. Head or head's wife, dummy variables equal to 1 whenever the woman or her husband were "head of the family". Family income, sum of the occupational income score of each family member. Income of the young, sum of the occupational income score of the woman and her husband. Source: our calculations from IPUMS.

the income of the young (substitution effect). They are, however, minor from a quantitative perspective.

Although our theory is about planned fertility, and hence only completed fertility is relevant in the framework and in the empirical exercise, one may want to see whether the empirical relationship singled out here above resists changes in the way in which one measures fertility. In Column (2) of Table 5, we report results obtained when we regress the number of own children in the household in the Census year against our main regressors (plus age of the woman). They show that the sign and relative magnitude of headship and income do not change. We repeat the same exercise in Column (3), where our dependent variable becomes the number of children aged 5 or less present in the household at moment of the Census. Here results hold good again, with the exception of the coefficient associated with family income, which loses significance. In Tables J.1, J.2 and J.3 in the Appendix, we show that the main results of this analysis extend to the inclusion of the whole battery of controls considered in the other regressions of the paper.

To sum up, this short investigation about the empirical implications of the model suggests that intergenerational bargaining had a major effect on fertility of women in vertical families. This lends credibility to our explanation of the cross family differential fertility, which hinges on an income effect due to the relative family income and, in particular, its allocation among family members.

6 Conclusions

In this paper, we carried out a historical analysis of fertility by family type in the United States between the 19th and 20th century.

Our contribution is twofold. First, we brought to the fore a hitherto overlooked phenomenon in demographic economics: married women living in extended vertical families tend to have fewer children than those living in nuclear families. This cross-family fertility differential is stronger at the beginning of the observation period and slowly fades away over time. It is independent of the way we measure fertility, and is common to the United States and a set of European countries for which historical data exist.

Second, after dismissing potential alternative mechanisms, we propose a novel theory to rationalise this puzzling new fact. In our theory, which we label the "relative income hypothesis", the emergence of a fertility differential in favour of nuclear families is a possible by-product of the coresidence choice. In particular, a positive fertility differential in favour of the nuclear family emerges when the amount of resources allocated to the young under coresidence is lower than the amount they would enjoy in a nuclear family. This income effect hinges on the interplay between the relative income of the young (economic factors) and their preferences for intergenerational coresidence (cultural factors). We present both an analytical model spelling out the theoretical mechanism in detail, and a full-fledged dynamic general equilibrium model, exploring their quantitative implications. Simulations from a calibrated version of the model show that, using only variations in economic factors, the model has the right qualitative behaviour and accounts for *circa* 68% of the drop in the cross-family fertility differential for the cohorts of women born between 1833 and 1953. Adding variations in cultural factors as well increases the data-mimicking ability of the model from 68% to 91%. When economic factors are shut down and the model is only driven by cultural factors, however, it completely misses the fertility transition. Taken together, results from our simulation suggest that economic factors are crucial for a unified account of the shrinking fertility differential by family type, the fertility transition, and the secular change in family structure in the United States.

Within the limitations of available data, we have investigated the empirical pertinence of our proposed mechanism, by taking a testable implication of the model to the data. In particular, the model predicts that the fertility of women living in vertical families should depend on their (and their husbands') bargaining position vis-à-vis their parents/in-laws. Interpreting registered household headship as evidence of the latter, we found that the empowerment of the young generation (*i.e.* being the head of the household) leads to almost one more child per woman. This result, coupled with the performance of the quantitative model, supports the relative income hypothesis as a major candidate for explaining the actual fertility differential between vertical and nuclear families in the United States.

This article points to a new fact – the cross-family fertility differential – and offers a novel theoretical explanation for it. An interesting ensuing research question is the potential impact of the cross-family fertility differential on economic outcomes in general, and on the timing of the demographic transition in particular. The model proposed above, however, cannot tackle such an issue: in our model, the education expenditure does not depend on the family structure, which implies that, by construction, the model cannot admit differential timing of the demographic transition across family types. This was done for the sake of parsimony. In principle, however, our theory needs no limitation of the sort, and could be suitably extended to study the impact of family structure on the demographic transition. This is currently at the top of our research agenda.

References

Aaronson, Daniel, Rajeev Dehejia, Andrew Jordan, Cristian Pop-Eleches, Cyrus Samii, and Karl Schulze, "The Effect of Fertility on Mothers' Labor Supply over the Last Two Centuries," *The Economic Journal*, 08 2020, *131* (633), 1–32.

Ager, Philipp and Francesco Cinnirella, "Froebel's Gifts: How the Kindergarten Movement Changed the American Familiy," Working Paper 8504, CESifo 2020.

Alesina, Alberto and Paola Giuliano, "Family ties," in "Handbook of economic growth," Vol. 2, Elsevier, 2014, pp. 177–215.

Anderson, Siwan and Chris Bidner, "An Institutional Perspective on the Economics of the Family," *Handbook of the Economics of the Family*, 2023, *1* (1), 443–500.

Bahrami-Rad, Duman, Jonathan Beauchamp, Joseph Henrich, and Jonathan Schulz, "Kin-based institutions and economic development," 2024.

Bau, Natalie and Raquel Fernández, "Culture and the family," *Handbook of the Economics of the Family*, 2023, *1* (1), 1–48.

Baudin, Thomas, Bram De Rock, and Paula Gobbi, "Economics and Family Structures," in "Oxford Research Encyclopedia of Economics and Finance," Oxford University Press, 2023.

_ , David de la Croix, and Paula Gobbi, "Fertility and childlessness in the United States," *American Economic Review*, 2015, *105* (6), 1852–1882.

Becker, Gary S, "An economic analysis of fertility," in "Demographic and economic change in developed countries," Columbia University Press, 1960, pp. 209–240.

_ , *A treatise on the family: Enlarged edition*, Harvard university press, 1991.

_ and H Gregg Lewis, "On the Interaction between the Quantity and Quality of Children," *Journal of political Economy*, 1973, *81* (2, Part 2), S279–S288.

_ and Robert J Barro, "A reformulation of the economic theory of fertility," *The quarterly journal of economics*, 1988, *103* (1), 1–25.

Becker, Sascha O, Francesco Cinnirella, and Ludger Woessmann, "The trade-off between fertility and education: evidence from before the demographic transition," *Journal of Economic Growth*, 2010, *15* (3), 177–204.

Bezin, Emeline, Bastien Chabé-Ferret, and David de la Croix, "Strategic Fertility, Education Choices, and Conflicts in Deeply Divided Societies," *Journal of the European Economic Association*, 04 2024, p. jvae027.

Bleakley, Hoyt and Fabian Lange, "Chronic disease burden and the interaction of education, fertility, and growth," *The review of economics and statistics*, 2009, *91* (1), 52–65.

Boldrin, Michele and Larry E. Jones, "Mortality, Fertility, and Saving in a Malthusian Economy," *Review of Economic Dynamics*, October 2002, *5* (4), 775–814.

Borderías, Cristina and Llorenç Ferrer-Alòs, "The stem family and industrialization in Catalonia (1900–1936)," *The History of the Family*, 2017, *22* (1), 34–56.

Browning, Martin, Pierre-André Chiappori, and Yoram Weiss, *Economics of the Family*, Cambridge, UK: Cambridge University Press, 2014.

Caldwell, John C., "Toward a Restatement of Demographic Transition Theory," *Population and Development Review*, 1976, *2*, 321–366.

— , "A Theory of Fertility: From High Plateau to Destabilization," *Population and Development Review*, 1978, *4*, 553–577.

Chesnais, Jean-Claude, *The demographic transition: stages, patterns, and economic implications: a longitudinal study of sixty-seven countries covering the period 1720-1984*, Oxford University Press, 1992.

Chiappori, Pierre-André, "Collective Models of Household Behavior: An Introduction," *European Economic Review*, 1992, *36*, 355–364.

Coskun, Sena and Husnu C. Dalgic, "The emergence of procyclical fertility: The role of breadwinner women," *Journal of Monetary Economics*, 2024, *142*, 103523.

Cox, Donald and Marcel Fafchamps, "Extended family and kinship networks: economic insights and evolutionary directions," *Handbook of development economics*, 2007, *4*, 3711–3784.

Davis, Susan R, Irene Lambrinoudaki, Maryann Lumsden, Gita D Mishra, Lubna Pal, Margaret Rees, Nanette Santoro, and Tommaso Simoncini, "Menopause," *Nat Rev Dis Primers*, Apr 2015, *1*, 15004.

de la Croix, David, *Fertility, education, growth, and sustainability*, Cambridge University Press, 2013.

— **and Faustine Perrin**, "How far can economic incentives explain the French fertility and education transition?," *European Economic Review*, 2018, *108*, 221–245.

— **and Matthias Doepke**, "Inequality and growth: why differential fertility matters," *American Economic Review*, 2003, *93* (4), 1091–1113.

Doepke, Matthias, "Accounting for fertility decline during the transition to growth," *Journal of Economic Growth*, 2004, *9* (3), 347–383.

— **and Michèle Tertilt**, "Families in macroeconomics," *Handbook of Macroeconomics*, 2016, *2*, 1789–1891.

— **, Anne Hannusch, Fabian Kindermann, and Michèle Tertilt**, "The economics of fertility: A new era," in "Handbook of the Economics of the Family," Vol. 1, Elsevier, 2023, pp. 151–254.

Duranton, Gilles, Andrés Rodríguez-Pose, and Richard Sandall, "Family types and the persistence of regional disparities in Europe," *Economic geography*, 2009, *85* (1), 23–47.

Ettner, Susan L., "The Impact of "Parent Care" on Female Labor Supply Decisions," *Demography*, 1995, *32* (63-80).

Galor, Oded, *Unified Growth Theory*, Princeton University Press, 2011.

— , *The Journey of Humanity. The Origins of Wealth and Inequality*, Penguin Random House LLC, 2022.

— **and David N. Weil**, "The Gender Gap, Fertility, and Growth," *American Economic Review*, June 1996, *86* (3), 374–387.

— **and** — , "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond," *American Economic Review*, 2000, *90*, 806–828.

— **and Omer Moav**, "Natural selection and the origin of economic growth," *The Quarterly Journal of Economics*, 2002, *117* (4), 1133–1191.

— **and Stelios Michalopoulos**, "Evolution and the growth process: Natural selection of entrepreneurial traits," *Journal of Economic Theory*, 2012, *147* (2), 759–780.

Gay, Victor, Paula Gobbi, and Marc Goñi, "Revolutionary transition: Inheritance change and fertility decline," *Journal of Political Economy*, forthcoming.

Ghosh, Arkadev, Sam Il Myoung Hwang, and Munir Squires, "Economic consequences of kinship: Evidence from US bans on cousin marriage," *The Quarterly Journal of Economics*, 2023, *138* (4), 2559–2606.

Greenwood, Jeremy and Nezih Guner, "Social Change: the Sexual Revolution," *International Economic Review*, 2010, *51* (4), 893–923.

Hacker, J. David and Evan Roberts, "Fertility declilne in the United States, 1850-1930: New evidence from complete-count datasets," *Annales de démographie historique*, 2019, *138* (2), 143–177.

Jones, Larry E and Michele Tertilt, "An economic history of fertility in the United States: 1826–1960," in "Frontiers of family economics," Emerald Group Publishing Limited, 2008.

Kaplan, Greg, "Moving Back Home: Insurance Against Labor Market Risk," *Journal of Political Economy*, 2012, *120*, 446–512.

Kim, Peter S., John S. McQueen, James E. Coxworth, and Kristen Hawkes, "Grandmothering drives the evolution of longevity in a probabilistic model," *Journal of Theoretical Biology*, 2014, *353*, 84–94.

Kotlikoff, Laurence J. and John Morris, "Why Don't the Elderly Live with Their Children? A New Look," in D. A. Wise, ed., *Issues on the Economics of Aging*, National Bureau of Economic Research, University of Chicago Press, USA, 1990, pp. 149–172.

Lagerlöf, Nils-Petter, "The Galor–Weil model revisited: A quantitative exercise," *Review of Economic Dynamics*, 2006, *9* (1), 116–142.

Laslett, Peter, "Introduction: the history of the family," in P. Laslett and R. Wall, eds., *Household and Family in Past Time*, Cambridge University Press, 1972, chapter 1, pp. 1–90.

Le Play, Frédéric, *L'organisation de la famille suivant le vraie modèle signalé par l'histoire de toutes les races et de tous les temps*, Mâme, 1871.

Madsen, Jakob and Holger Strulik, "Testing unified growth theory: Technological progress and the child quantity-quality tradeoff," *Quantitative Economics*, 2023, *14* (1), 235–275.

Pensieroso, Luca and Alessandro Sommacal, "Economic Development and the Family Structure: from *Pater Familias* to the Nuclear Family," *European Economic Review*, 2014, *71*, 80–100.

— **and** — , "Agriculture to Industry: the End of Intergenerational Coresidence," *Review of Economic Dynamics*, 2019, *34*, 87–102.

Ruggles, Steven, "The Decline of Intergenerational Coresidence in the United States, 1850 to 2000," *American Sociological Review*, 2007, *72*, 964–989.

— , "Marriage, family systems, and economic opportunity in the USA since 1850," *Gender and couple relationships*, 2016, pp. 3–41.

__ , **Lara Cleveland, Rodrigo Lovaton, Sula Sarkar, Matthew Sobek, Derek Burk, Dan Ehrlich, Quinn Heimann, and Jane Lee**, "Integrated Public Use Microdata Series, International: Version 7.5," 2024.

__ , **Sarah Flood, Matthew Sobek, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Renae Rodgers, and Megan Schouweiler**, "IPUMS USA: Version 15," 2024.

Salcedo, Alejandrina, Todd Schoellman, and Michèle Tertilt, "Families as Roommates: Changes in U.S. Household Size from 1850 to 2000," *Quantitative Economics*, 2012, *3*, 133–175.

Todd, Emmanuel, *La troisième planète: structures familiales et systèmes idéologiques*, Editions du Seuil, 1983.

__ , *L'origine des systèmes familiaux*, Vol. 1, Gallimard Paris, 2011.

Turner, Chad, Robert Tamura, Sean E. Mulholland, and Scott Baier, "Education and Income of the States of the United States:1840-2000," *Journal of Economic Growth*, 2006, *12*, 101–158.

Watkins, Aja, "Reevaluating the grandmother hypothesis," *History and Philosophy of the Life Science*, 2021, *43*, 103.

Wolf, Douglas A and Beth J Soldo, "Household composition choices of older unmarried women," *Demography*, 1988, *25* (3), 387–403.

Appendix to: *Intergenerational Coresidence and Fertility during the American Demographic Transition: Theory and Evidence*

Luca Pensieroso[1], Alessandro Sommacal[2], Gaia Spolverini [3]

[1]IRES/LIDAM, UCLouvain
[2]University of Verona
[3]Universidad Pública de Navarra

A Zooming in on intergenerational coresidence: details

In this Section, we investigate specific features of intergenerational coresidence.

Figure A.1: Composition by gender of the coresiding grandparents. Percentage of women in vertical families living with each entry by cohort.
Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman (various ages) in vertical families (with employed husband). See Section 2 for details. Family links are reconstructed using the variable "relate" in the Census. Source: our calculations from IPUMS.

In Figure A.1, we look at the composition of vertical families by gender and kinship, for the cohorts of women we consider in our analysis. The vertical axis measures the percentage of women living in vertical families who were coresiding with their own mother, father, mother-in-law *et cetera*. Figure A.1 shows that most of the woman's coresiding parents/in-laws were typically female parents coresiding with either their own adult daughter/daughter-in-law. However, coresidence with male parents represented a non-negligible percentage of the total extended vertical family (on average about 29%). Interestingly, the percentage of women coresiding only with older women decreases significantly for the last two cohorts, *i.e.* those for which the women that constitute our unit of observation are younger. This suggests the possibility that vertical families were characterised by the presence of both elderly parents/in-laws during the woman's fertile period, while the dominance of the female component of the coresiding parents/in-laws we observe in most cohorts may be due, at least in part, to the fact that women aged 40-49 or more were already old enough to have widowed parents/in-laws. To verify that this was indeed the case, we did the analysis by year instead of by cohort, and consider women aged 20-29 who were living in vertical families at the moment in which we observe them in the Census. Results are reported in Figure A.2 and show convincingly that about half (55%) of those women were living with at least one between the father or the father-in-law. No clear pattern emerges as to the relative frequency of natural *vs* in-law parents.

We now wish to enquire about the employment status of the coresiding grandparents. To this end, in Figure A.3, we report for each Census year the percentage of the coresiding parents/in-laws living in vertical families who have a valid occupation – both aggregate, and

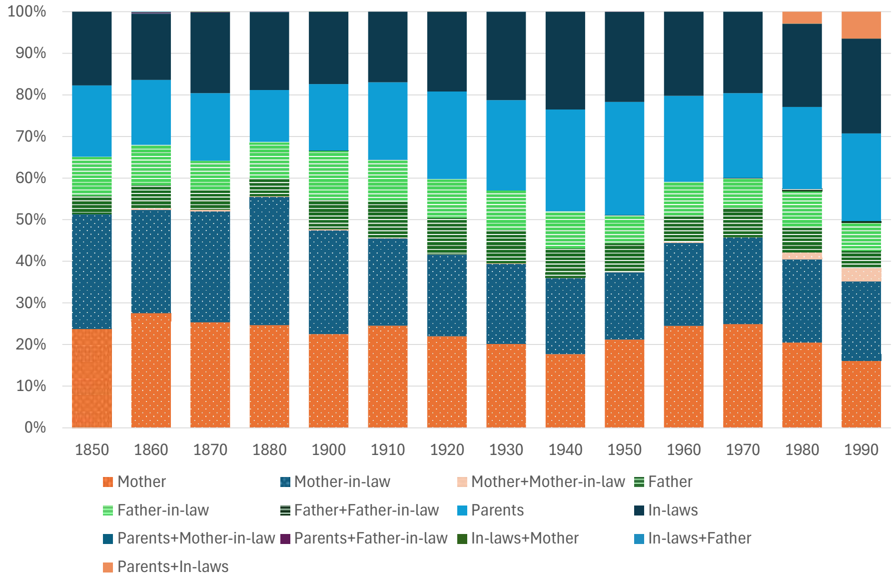


Figure A.2: Composition by gender of the coresiding grandparents. Percentage of women aged 20-29 in vertical families living with each entry by year.
Unit of observation: married woman aged 20-29 in vertical families (with employed husband). Family links are reconstructed using the variable "relate" in the Census. Source: our calculations from IPUMS. Data for 1890 are missing.

by gender. We also make a distinction between those who are registered as "Head of the family/household" in the Census, and those who are not. Three patterns emerge. First, as expected, men were far more often employed than women. Second, the employment rate is significantly higher when the coresiding parent/in-law is registered in the Census as head of the family. Third, when the coresiding parents/in-laws are registered as head of the family, their employment rate is relatively high.

To understand whether being in a vertical family is associated with more or less employment for the elderly, in Figure A.4 we report the employment rate among elderly persons (*i.e.* those who are 65 years old or more), both in the aggregate and when being head of a vertical family. We decompose the analysis by gender. Interestingly, coresiding elderly who are head of the family tend to work more than the average population of the same age, with the partial exception of women in the last years of the sample.

Overall, the employment analysis here above shows convincingly that coresiding parents/in-laws in vertical families were typically active on the labour market, especially when head of the family.

To grasp the overall socio-economic status of the coresiding parent/in-law, then, it becomes important to assess how many of them were reported as head of the family by the Census officers. Table A.1 shows that in the vast majority of the cases, the coresiding parent/in-law was the head of the family. This suggests they were active in the labour market, reasonably in good health, and, as argued by Ruggles (2016, 2007), most likely in firm control of the destiny of their household.

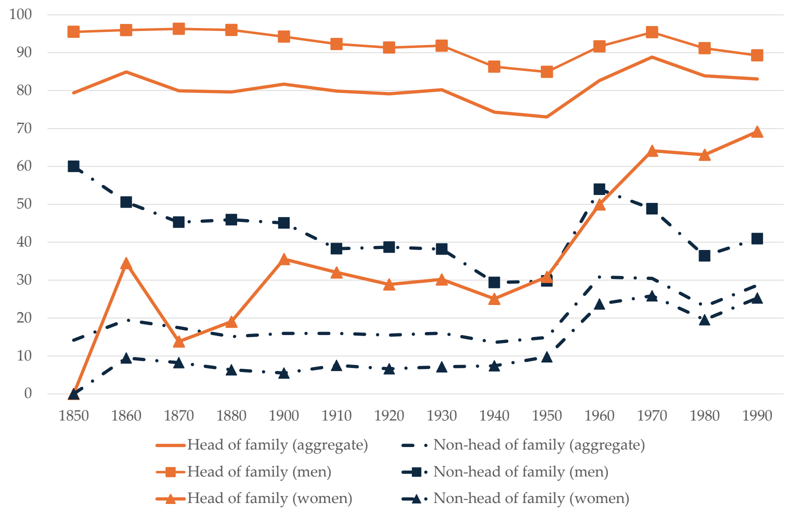


Figure A.3: Employment rate among grandparents in vertical families.
Percentage of employed coresiding grandparents, on aggregate, by gender, and by headship status. Employment is defined as having a valid occupational income score. Source: our calculations from IPUMS. Data for 1890 are missing.

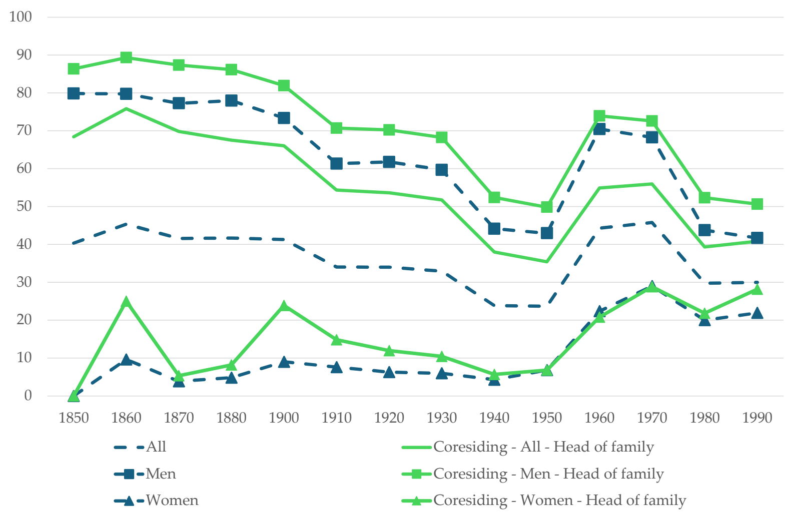


Figure A.4: Employment rate among the elderly (65+).
Percentage of employed elderly(65+), on aggregate, by gender, and by headship status (for coresiding elderly). Employment is defined as having a valid occupational income score. Source: our calculations from IPUMS. Data for 1890 are missing.

Year	Parents/in-laws	Adult child
1850	80.89	19.11
1860	80.12	19.88
1870	78.94	21.06
1880	82.61	17.39
1900	81.69	18.31
1910	80.56	19.44
1920	79.17	20.83
1930	79.20	20.80
1940	81.22	18.78
1950	73.47	26.53
1960	74.36	25.64
1970	81.25	18.75
1980	85.65	14.35
1990	88.05	11.95

Table A.1: Head of the family as percentage of vertical families. Percentage of parents/in-laws and adult child registered as head of the family in the Census. Source: our calculations from IPUMS. Data for 1890 are missing

B Descriptive statistics: all cohorts

In this Section, we provide a thorough characterisation of family types in socio-economic and demographic terms.

Table B.1 details the percentage of women living in each family type who: 1) were white (as opposed to black); 2) lived in urban area (as opposed to rural area); 3) lived in a dwelling that was owned by the household (as opposed to rented); 4) were in the labour force; 5) were childless; 6) had a husband with high (*i.e.*, above median) income.[30] It turns out that, especially in the early cohorts, vertical families were more likely than nuclear families to own their own dwelling and to be childless. Early cohorts of vertical families were living more in rural areas, but this pattern reverted soon, and mid-to-late cohorts were more urban (than nuclear families). For most of the period, there was no obvious racial or income gap between vertical and nuclear families. Starting from the 1948 cohort, however, vertical families tended to be slightly poorer and less widespread among white persons.

On the other hand, horizontal families were more likely to be black and poor than nuclear families. Women in horizontal families participated slightly more in thelabour force at the beginning of the sample, but this pattern reverted in the mid-to-late cohorts. They were also less likely to be childless.

Table B.2 focuses on the incidence of family types by migration status. Except for the early cohorts, vertical families were more widespread than nuclear families among non-natives, both first- and second-generation migrants. In the early cohorts, instead, nuclear families were more widespread.

Horizontal families were significantly less widespread among second generation migrants than nuclear (and *a fortiori* vertical) families. They were more frequent among natives.

Table B.3 shows the percentage of women reaching a given level of education by family arrangement. At the beginning of the sample, vertical families had an edge over nuclear and, especially, horizontal families in terms of women's education. However, the situation reverted by the end of the sample, when women in nuclear families tended to reach higher grades more frequently. Women in horizontal families were systematically less educated than the others.

Table B.4 reports the average age at first marriage for women belonging to different family types. The numbers show that women living in vertical families married about one (two) year(s) later than women in nuclear (horizontal) families.

Another possible way to characterise the family structure is to study its geographic dimension. Are different types of family more concentrated in specific areas of the United States? Did this concentration change over time? Figures B.1-to-B.3 provides an answer to these questions. They show convincingly that vertical families were an East, North-East phenomenon, Nuclear families a West, North-West phenomenon, and Horizontal families mostly a South, South-East phenomenon.

In synthesis, the descriptive analysis suggests that vertical and nuclear families were not very different under most socio-economic and demographic factors. The more systematic differences were in terms of geographic location, degree of dwelling ownership and childlessness, and age at first marriage. Differences in terms of education in favour of vertical families reversed over time. On the other hand, horizontal families were wholly distinct from

[30]Individual income data are not available for the Censuses before 1940. Hence, we follow Jones and Tertilt (2008) and use the occupational income score (OIS) in its stead. OIS is a constructed variable assigning each occupation in all years the median total income – in hundreds of dollars – of each occupation in 1950. By assigning the same score to the same occupations in all years, this variable implicitly assumes that workers in the same occupations are equally rich in relative terms across years. We use the husband's income due to the low female labour force participation in the early cohorts, as visible from Table B.1, and under the presumption that the man was the household's main breadwinner in the historical period under consideration.

		White	Urban	Owner	Active	Childless	High income
	Nuclear	93.9	28.2	73.2	1.6	12.0	48.5
1833	Vertical	100.0	50.1	87.5		12.6	87.5
	Horizontal	88.5	27.4	73.0	1.4	6.0	41.6
	Nuclear	93.6	31.4	72.2	2.2	10.5	49.8
1838	Vertical	97.4	25.6	74.4		10.3	53.8
	Horizontal	85.0	26.5	67.7	2.3	5.8	43.2
	Nuclear	93.7	33.4	68.0	2.6	9.4	52.5
1843	Vertical	91.1	27.4	72.6	3.7	11.8	47.4
	Horizontal	85.2	30.7	65.8	3.9	6.6	44.8
	Nuclear	92.2	36.8	63.3	3.1	9.1	53.0
1848	Vertical	92.3	27.5	71.8	3.5	11.5	42.9
	Horizontal	81.9	32.9	59.6	5.1	7.6	46.2
	Nuclear	91.6	37.6	57.7	3.4	8.4	41.7
1853	Vertical	92.7	33.1	65.4	2.9	14.8	42.2
	Horizontal	79.1	33.1	54.3	6.2	8.4	36.1
	Nuclear	92.3	39.4	53.2	3.2	7.9	44.5
1858	Vertical	92.2	36.2	61.4	3.4	12.0	44.8
	Horizontal	80.9	36.5	51.4	5.8	10.6	40.3
	Nuclear	92.8	45.6	59.0	7.9	8.3	49.0
1863	Vertical	93.2	44.4	63.7	7.6	15.3	53.7
	Horizontal	82.5	42.9	54.5	11.9	8.4	42.9
	Nuclear	92.4	46.3	53.6	8.2	8.8	50.4
1868	Vertical	93.5	46.1	61.4	9.1	13.3	55.3
	Horizontal	83.5	47.9	49.3	12.8	10.8	47.3
	Nuclear	95.0	47.0	68.9	3.0	16.9	46.9
1873	Vertical	84.7	30.5	49.2		32.2	64.4
	Horizontal	88.3	38.6	63.9	2.6	8.2	45.7
	Nuclear	96.8	50.9	67.0	4.6	17.2	48.5
1878	Vertical	95.8	53.5	64.8	13.1	23.0	57.7
	Horizontal	88.3	43.0	66.5	4.8	9.4	44.0
	Nuclear	96.3	51.8	64.1	5.9	17.2	51.2
1883	Vertical	95.4	58.5	58.5	6.5	25.5	59.9
	Horizontal	85.2	48.3	62.9	5.8	9.7	41.2
	Nuclear	95.4	55.1	58.6	8.2	15.1	42.2
1888	Vertical	95.7	49.7	64.8	8.8	22.1	47.9
	Horizontal	86.8	51.6	58.3	9.7	11.7	43.2
	Nuclear	94.6	56.8	54.5	10.3	14.2	45.7
1893	Vertical	93.8	59.6	67.2	17.3	18.4	50.5
	Horizontal	86.1	50.4	52.7	11.9	12.7	39.4
	Nuclear	94.2	57.2	48.4	12.1	14.5	48.3
1898	Vertical	94.3	63.3	58.5	18.4	19.1	56.6
	Horizontal	81.9	52.9	47.4	15.1	12.6	40.5
	Nuclear	94.5			24.6	18.2	54.8
1903	Vertical	93.1			25.3	24.8	59.2
	Horizontal	81.1			23.4	13.8	42.8
	Nuclear	94.3			26.2	19.6	49.3
1908	Vertical	93.0			31.2	24.1	51.9
	Horizontal	79.4			27.1	15.4	37.9
	Nuclear	94.0	70.2	75.0	40.8	17.1	51.1
1913	Vertical	92.1	74.1	83.9	45.1	21.5	53.0
	Horizontal	76.7	64.1	70.4	36.9	14.3	39.4
	Nuclear	93.7	70.4	74.5	38.9	12.7	52.2
1918	Vertical	92.0	73.7	83.4	45.9	16.0	51.9
	Horizontal	74.0	63.1	65.8	39.6	11.3	37.9
	Nuclear	93.3	73.8	81.7	48.0	9.9	54.3
1923	Vertical	92.7	76.3	87.1	52.0	12.9	54.1
	Horizontal	76.5	70.9	76.3	47.4	7.0	41.9
	Nuclear	92.0	72.8	81.0	47.1	7.8	51.0
1928	Vertical	90.4	76.0	86.7	52.7	11.1	50.5
	Horizontal	72.7	68.0	70.8	48.3	5.4	35.9
	Nuclear	92.0		88.7	58.1	6.8	53.3
1933	Vertical	88.5		89.4	59.2	9.3	53.6
	Horizontal	71.2		82.4	53.2	4.1	40.0
	Nuclear	90.8		87.2	61.7	6.4	54.1
1938	Vertical	85.5		89.2	67.1	8.9	50.7
	Horizontal	72.5		79.6	57.8	4.3	39.2
	Nuclear	89.2	69.0	88.1	73.3	8.3	51.9
1943	Vertical	80.4	77.5	91.5	71.4	10.4	49.9
	Horizontal	67.5	73.7	80.2	64.8	4.6	37.9
	Nuclear	87.8	69.5	86.0	76.0	10.4	57.9
1948	Vertical	74.9	77.7	87.3	75.6	12.7	51.3
	Horizontal	65.2	73.5	75.3	71.5	5.0	43.2
	Nuclear	87.1	70.4	80.9	73.1	12.3	55.8
1953	Vertical	68.3	80.9	84.2	74.9	13.0	47.1
	Horizontal	58.5	79.3	68.5	71.3	8.6	41.0
	Nuclear	86.3	72.0	73.0	70.0	16.6	55.5
1958	Vertical	68.0	81.4	78.7	69.8	17.0	47.0
	Horizontal	59.6	83.4	59.5	66.7	14.2	40.8

Table B.1: Descriptive statistics (all cohorts), variables: White, Urban, Owner, Active, Childless, High income.

Percentage of women, by cohort and family structure, with the following characteristics: white, living an urban location, with the housing unit owned by its inhabitants, active in the labour force, childless, with income above the median occupational income score of the cohort. Various cohorts. Source: our calculations from IPUMS.

		Origin		
		Native	2nd gen	Foreign
1833	Nuclear	59.9	5.6	34.5
	Vertical	62.3		37.7
	Horizontal	70.5	4.7	24.9
1838	Nuclear	60.4	6.4	33.1
	Vertical	71.8	10.2	18.0
	Horizontal	72.0	5.8	22.2
1843	Nuclear	62.6	7.2	30.2
	Vertical	74.8	11.8	13.3
	Horizontal	73.5	6.9	19.6
1848	Nuclear	60.7	9.4	30.0
	Vertical	69.0	10.5	20.6
	Horizontal	74.8	7.6	17.6
1853	Nuclear	60.4	13.9	25.7
	Vertical	70.5	13.5	16.0
	Horizontal	71.4	12.3	16.4
1858	Nuclear	58.2	18.4	23.3
	Vertical	65.7	21.4	12.9
	Horizontal	69.1	15.6	15.3
1863	Nuclear	54.7	19.1	26.2
	Vertical	66.8	20.1	13.1
	Horizontal	64.8	15.5	19.7
1868	Nuclear	55.9	19.4	24.7
	Vertical	64.1	20.2	15.7
	Horizontal	58.8	19.0	22.2
1873	Nuclear	60.2	18.3	21.5
	Vertical	83.0	7.5	9.4
	Horizontal	64.8	18.9	16.3
1878	Nuclear	57.4	17.2	25.3
	Vertical	73.1	17.9	9.0
	Horizontal	66.7	17.3	16.0
1883	Nuclear	58.7	18.2	23.1
	Vertical	77.7	11.6	10.7
	Horizontal	70.9	10.4	18.7
1888	Nuclear	58.3	17.3	24.4
	Vertical	69.6	22.1	8.3
	Horizontal	64.3	16.1	19.7
1893	Nuclear	60.3	19.1	20.5
	Vertical	73.1	18.0	9.0
	Horizontal	67.2	13.3	19.5
1898	Nuclear	63.9	18.9	17.2
	Vertical	70.4	19.6	10.1
	Horizontal	71.7	15.1	13.2
1903	Nuclear	66.2	19.6	14.2
	Vertical	69.6	22.5	7.9
	Horizontal	71.3	17.4	11.3
1908	Nuclear	69.3	21.6	9.1
	Vertical	70.3	21.9	7.8
	Horizontal	76.1	15.1	8.8
1913	Nuclear	68.3	25.1	6.6
	Vertical	67.5	27.2	5.3
	Horizontal	76.7	17.2	6.2
1918	Nuclear	71.4	24.0	4.6
	Vertical	67.8	28.8	3.4
	Horizontal	79.2	17.0	3.7
1923	Nuclear	73.1	20.6	6.3
	Vertical	69.1	23.9	6.9
	Horizontal	79.1	14.3	6.6
1928	Nuclear	75.8	17.3	6.9
	Vertical	70.0	22.1	7.8
	Horizontal	81.8	11.7	6.5

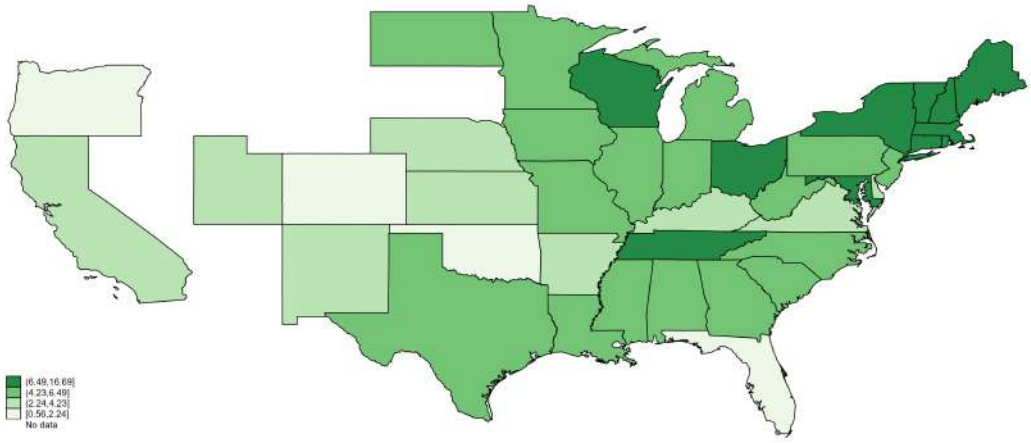
Table B.2: Descriptive statistics (all cohorts), variable: nativity status.
Percentage of women, by cohort and family structure, with the following characteristics: native-born, second-generation immigrant, foreign-born. Various cohorts. Source: our calculations from IPUMS.

		Education			
		up to grade 4	grade 5-8	grade 9-12	some college
1873	Nuclear	16.1	58.7	19.2	6.0
	Vertical	5.1	84.7	10.2	
	Horizontal	20.5	57.4	16.5	5.7
1878	Nuclear	15.7	56.9	21.4	5.9
	Vertical	15.5	53.1	24.9	6.6
	Horizontal	20.0	60.1	17.0	2.9
1883	Nuclear	13.2	57.1	24.1	5.6
	Vertical	8.6	43.8	35.7	11.9
	Horizontal	22.7	55.6	18.0	3.7
1888	Nuclear	15.5	54.1	23.9	6.5
	Vertical	9.1	52.9	29.0	8.9
	Horizontal	21.5	55.3	18.4	4.8
1893	Nuclear	12.8	51.6	28.0	7.7
	Vertical	6.8	46.3	37.0	10.0
	Horizontal	19.4	53.7	22.5	4.3
1898	Nuclear	10.5	49.6	31.2	8.7
	Vertical	3.7	45.3	40.6	10.4
	Horizontal	18.8	58.1	18.9	4.3
1903	Nuclear	7.7	40.4	37.9	14.0
	Vertical	4.7	40.5	40.6	14.2
	Horizontal	15.5	50.9	27.2	6.3
1908	Nuclear	5.2	34.7	44.8	15.3
	Vertical	5.1	28.9	48.5	17.5
	Horizontal	11.2	48.0	34.6	6.3
1913	Nuclear	3.4	30.0	51.3	15.4
	Vertical	3.3	26.1	54.8	15.8
	Horizontal	9.8	42.8	40.4	7.0
1918	Nuclear	2.7	22.3	59.2	15.9
	Vertical	2.6	21.0	61.9	14.5
	Horizontal	8.1	37.9	47.5	6.6
1923	Nuclear	1.9	15.0	63.8	19.3
	Vertical	2.1	13.4	66.4	18.1
	Horizontal	5.4	27.1	58.1	9.3
1928	Nuclear	1.8	12.4	65.5	20.4
	Vertical	1.8	12.8	68.5	16.9
	Horizontal	5.5	23.9	62.1	8.5
1933	Nuclear	1.6	8.6	63.8	26.0
	Vertical	2.0	8.7	64.7	24.7
	Horizontal	4.2	18.1	64.8	12.8
1938	Nuclear	1.3	6.5	62.3	29.9
	Vertical	1.6	9.4	61.2	27.8
	Horizontal	4.4	15.4	66.0	14.1
1943	Nuclear	1.0	3.0	47.9	48.1
	Vertical	1.6	4.6	50.9	42.9
	Horizontal	4.4	9.3	58.8	27.6
1948	Nuclear	0.8	2.3	40.6	56.3
	Vertical	2.1	4.0	47.4	46.5
	Horizontal	4.3	7.3	54.1	34.4
1953	Nuclear	0.7	1.9	38.3	59.1
	Vertical	1.6	5.2	40.6	52.6
	Horizontal	4.4	8.1	50.4	37.1
1958	Nuclear	0.7	1.8	40.0	57.5
	Vertical	2.6	4.3	46.8	46.3
	Horizontal	6.5	9.2	44.0	40.3

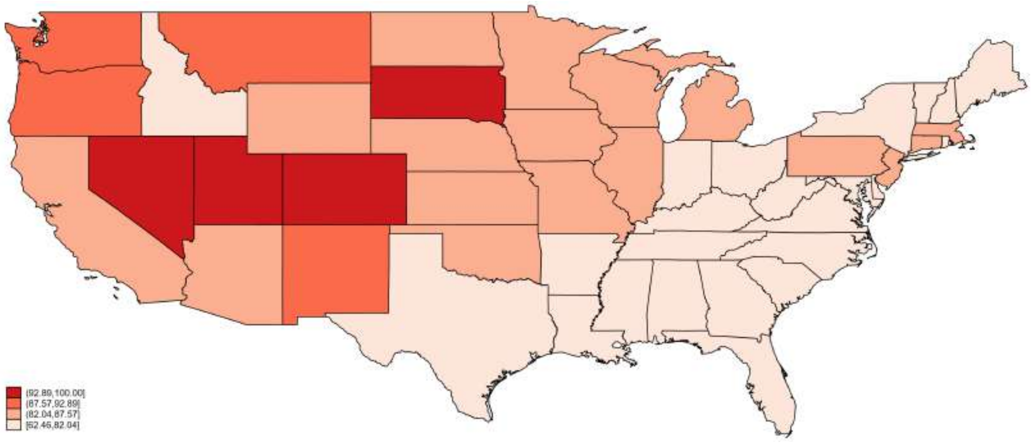
Table B.3: Descriptive statistics (all cohorts), variable: Education.
Percentage of women, by cohort and family structure, with the following education levels: up to grade 4, grade 5-8, grade 9-12, and some college. Various cohorts. Source: our calculations from IPUMS.

		Mean
	Nuclear	24.0
1873	Vertical	24.2
	Horizontal	22.7
	Nuclear	23.1
1878	Vertical	23.4
	Horizontal	21.7
	Nuclear	23.1
1883	Vertical	23.2
	Horizontal	21.6
	Nuclear	22.4
1888	Vertical	23.1
	Horizontal	21.6
	Nuclear	22.1
1893	Vertical	23.2
	Horizontal	21.1
	Nuclear	21.6
1898	Vertical	22.4
	Horizontal	20.5
	Nuclear	22.7
1913	Vertical	23.6
	Horizontal	21.4
	Nuclear	22.1
1918	Vertical	22.8
	Horizontal	20.7
	Nuclear	21.1
1933	Vertical	21.9
	Horizontal	20.3
	Nuclear	20.9
1938	Vertical	21.8
	Horizontal	19.9

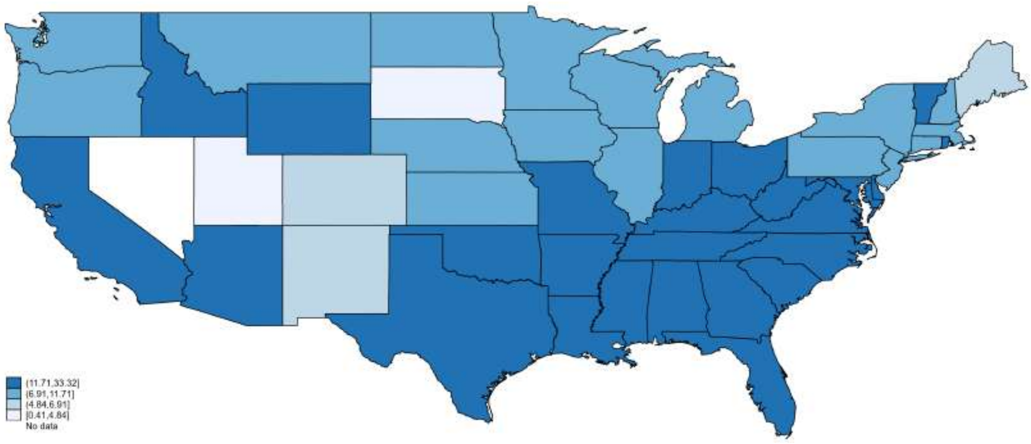
Table B.4: Descriptive statistics (all cohorts), variable: Age at first marriage.
Mean age at first marriage by cohort and family structure. Various cohorts. Source: our calculations from IPUMS.



(a) Vertical

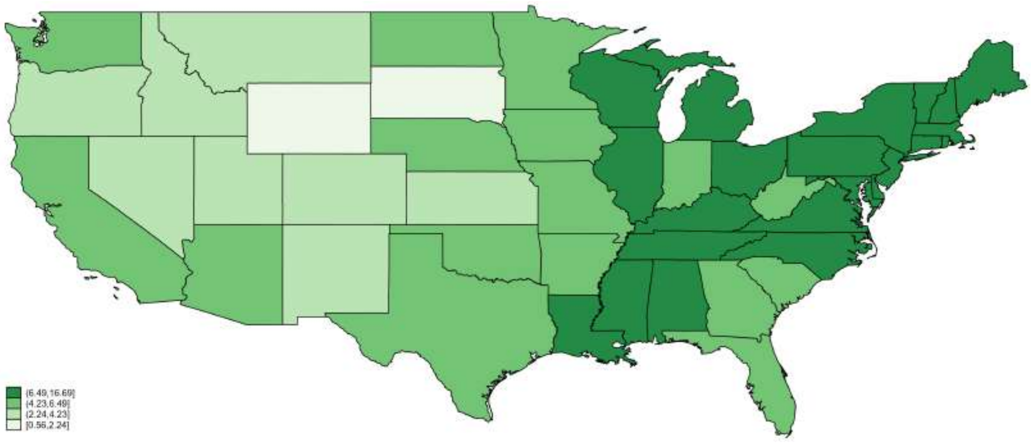


(b) Nuclear

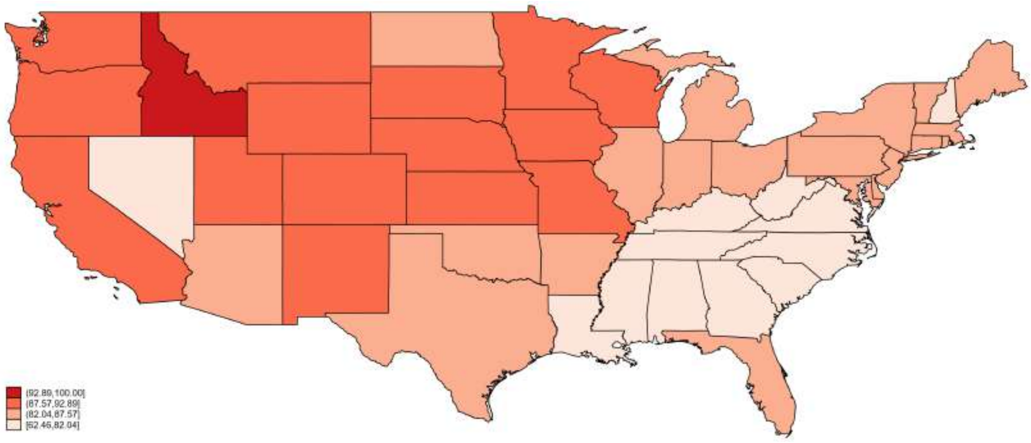


(c) Horizontal

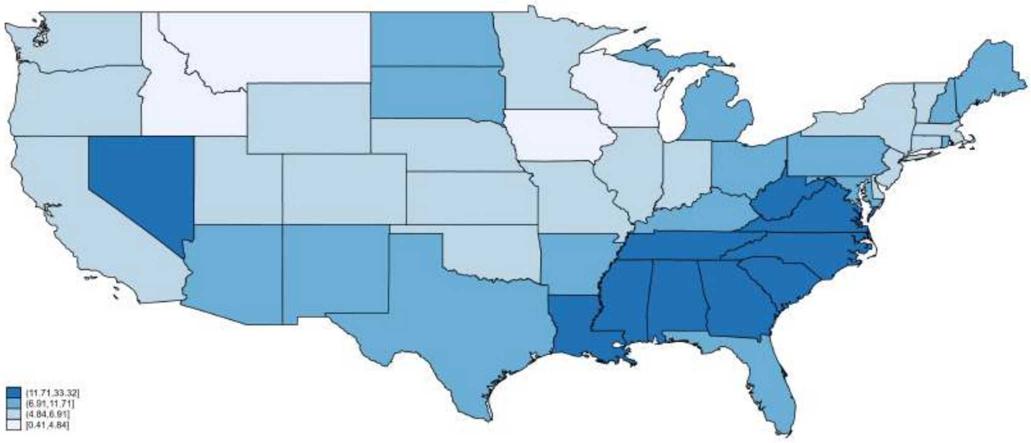
Figure B.1: Incidence of family types by U.S. State, 1853
Percentage of women residing in vertical, nuclear and horizontal families across US states. 1853 cohort. Source: our calculations from IPUMS.



(a) Vertical

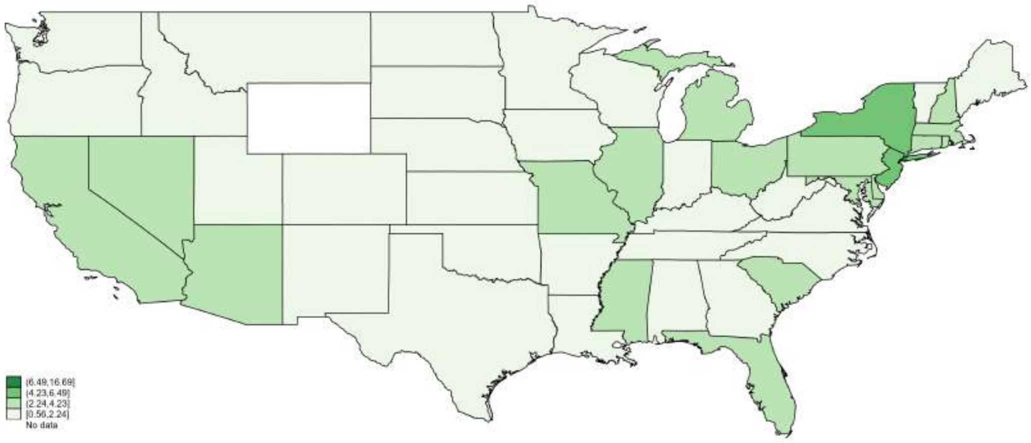


(b) Nuclear

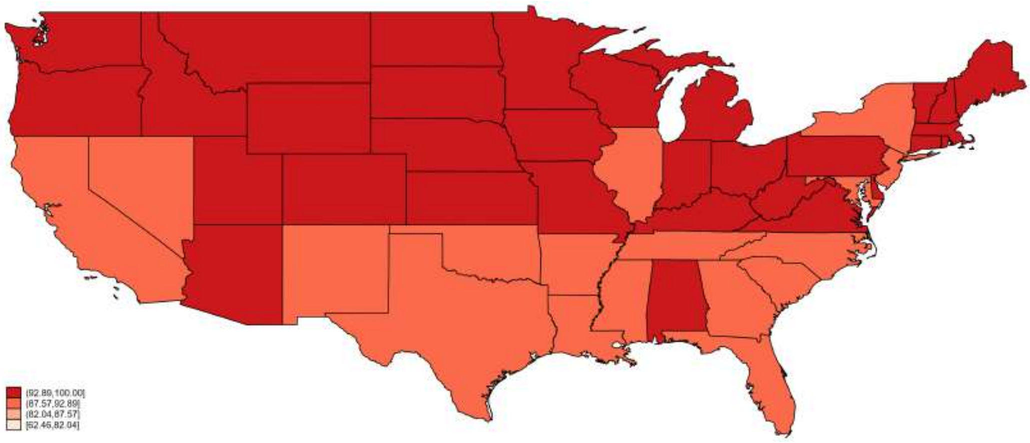


(c) Horizontal

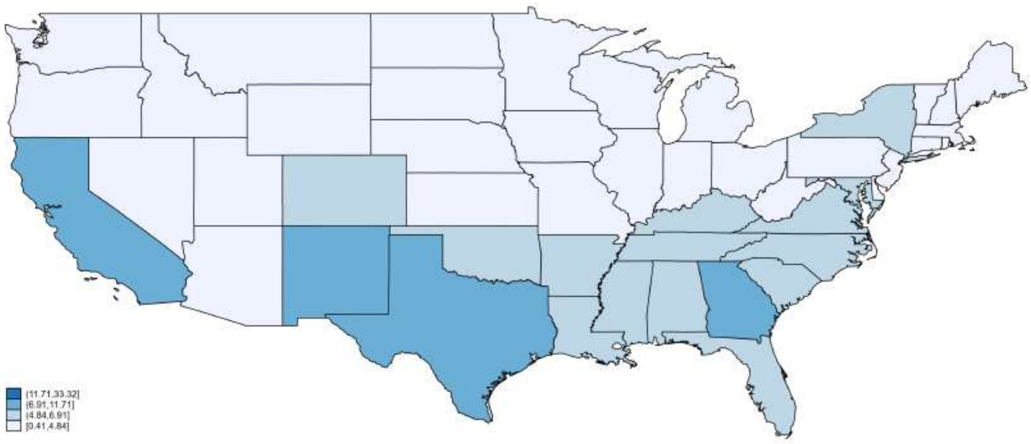
Figure B.2: Incidence of family types by U.S. State, 1913
Percentage of women residing in vertical, nuclear and horizontal families across US states. 1913 cohort. Source: our calculations from IPUMS.



(a) Vertical



(b) Nuclear



(c) Horizontal

Figure B.3: Incidence of family types by U.S. State, 1948
Percentage of women residing in vertical, nuclear and horizontal families across US states. 1948 cohort. Source: our calculations from IPUMS.

the other two. They tended to be poorer, more widespread among black persons, with less childless and/or educated women.

C CEB by family type for different subsamples

Since more (married) women in vertical families are childless, considering the intensive *vs* the extensive margin of fertility is worthwhile. In Figure C.1, we show that our main findings hold also at the intensive margin, meaning that among the women who had at least one child, the fertility of those living in a nuclear families was higher than that of those living in a vertical one.

Splitting the sample by the urban/rural location (Figures C.2 and C.3), or by whether the household was owning or renting its dwelling (Figures C.4 and C.5) confirms the robustness of our fact in those more homogeneous subsamples. In other words, among the women living in an urban (rural) area, the fertility of those living in a nuclear families was higher than that of those living in a vertical one. The same holds true for those women whose family owns (rent) its dwelling.

When it comes to heterogeneity along more cultural dimensions, things change slightly, subject to the caveat that we have (sometimes significantly) less data for those variables. The positive fertility differential in favour of nuclear family holds good for white women (Figure C.6), and for women of native background (Figure C.8). It also holds good for families with migration background, although to a lesser extent (Figure C.9). The pattern is less striking for black women, with a small positive fertility differential in the grey-highlighted cohorts (Figure C.7).

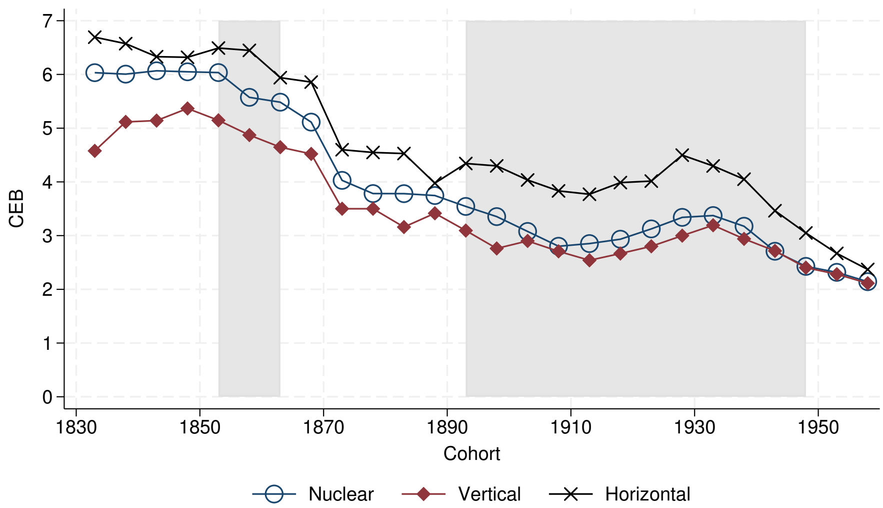


Figure C.1: CEB by cohort and family type: intensive margin.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband and at least 1 child. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

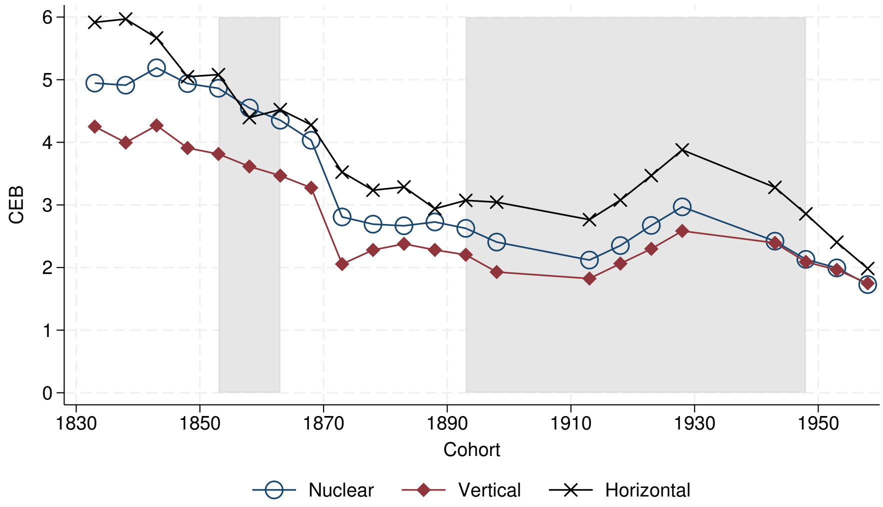


Figure C.2: CEB by cohort and family type: Married women living in an urban area and with employed husbands.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband living in an urban area. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

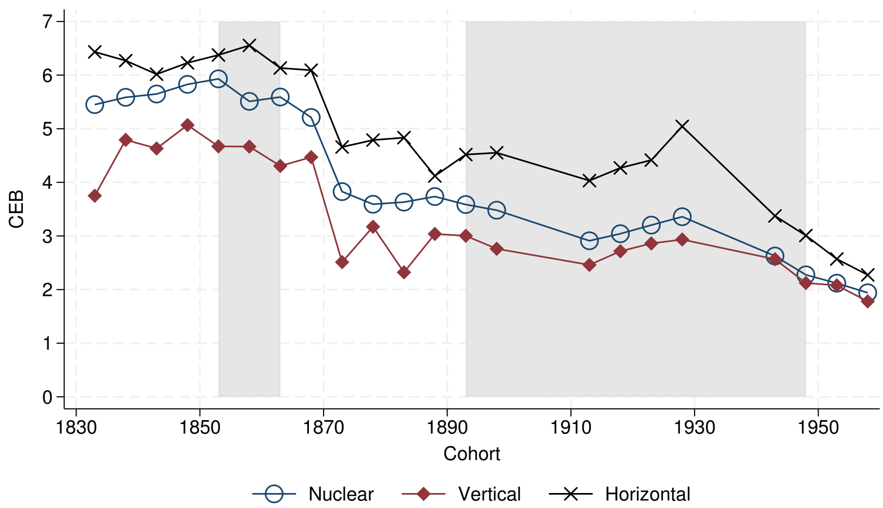


Figure C.3: CEB by cohort and family type: Married women living in a rural area and with employed husbands.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband living in a rural area. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

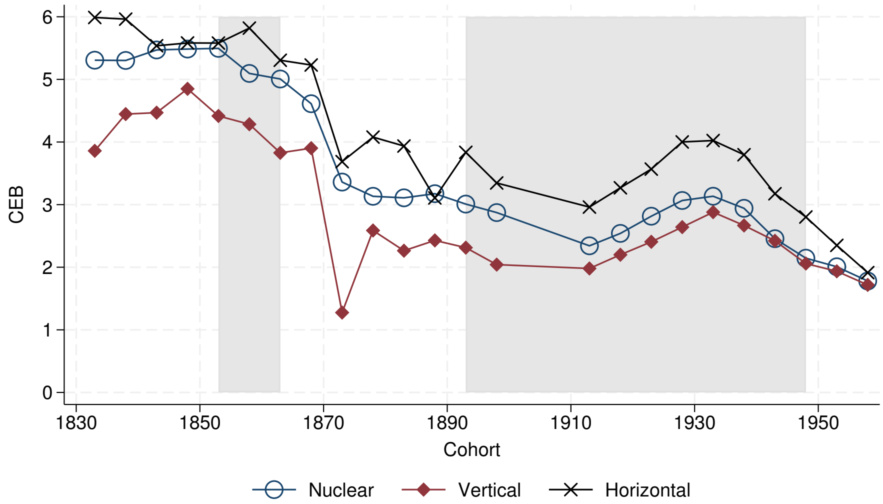


Figure C.4: CEB by cohort and family type: married women with employed husbands who are dwelling owners.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband who are dwelling owners. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

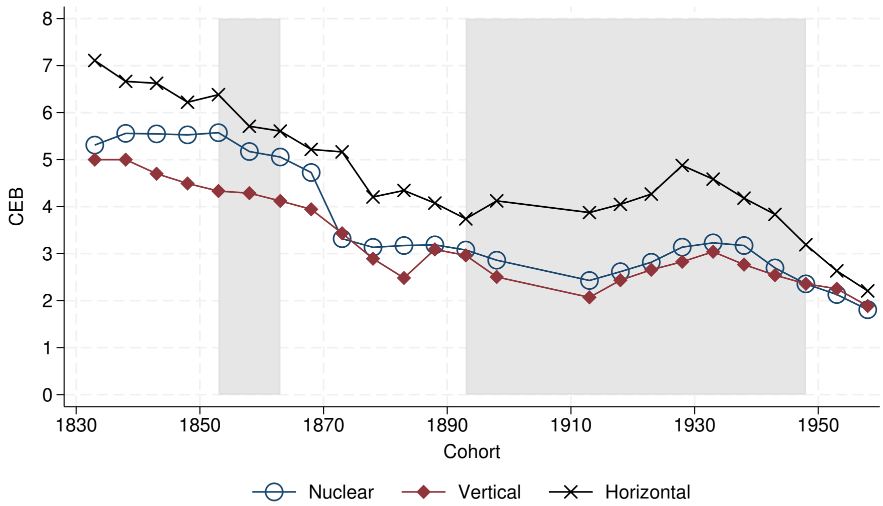


Figure C.5: CEB by cohort and family type: married women with employed husbands who are renters.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: married woman with employed husband who are renters. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

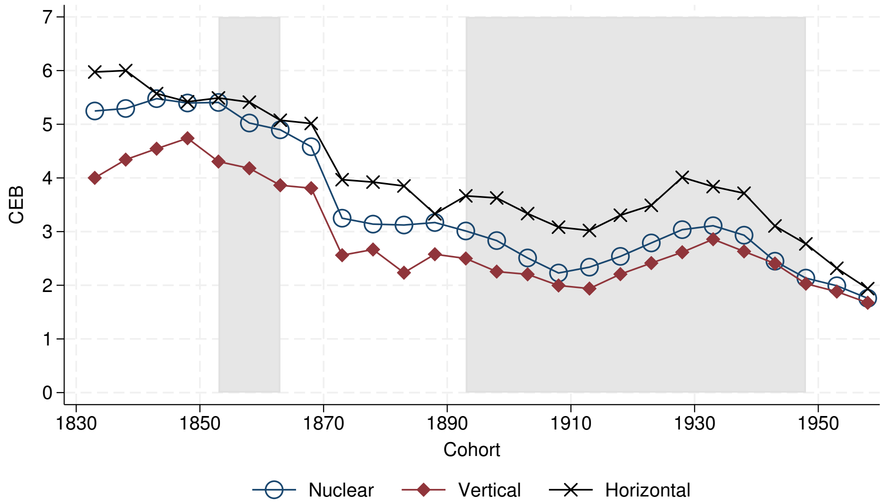


Figure C.6: CEB by cohort and family type: white married women with employed husbands. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: white married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

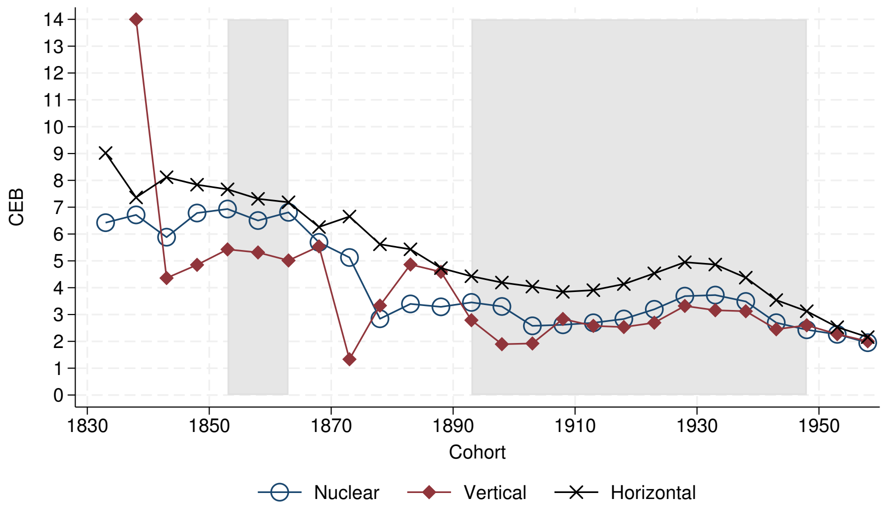


Figure C.7: CEB by cohort and family type: black married women with employed husbands. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: black married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

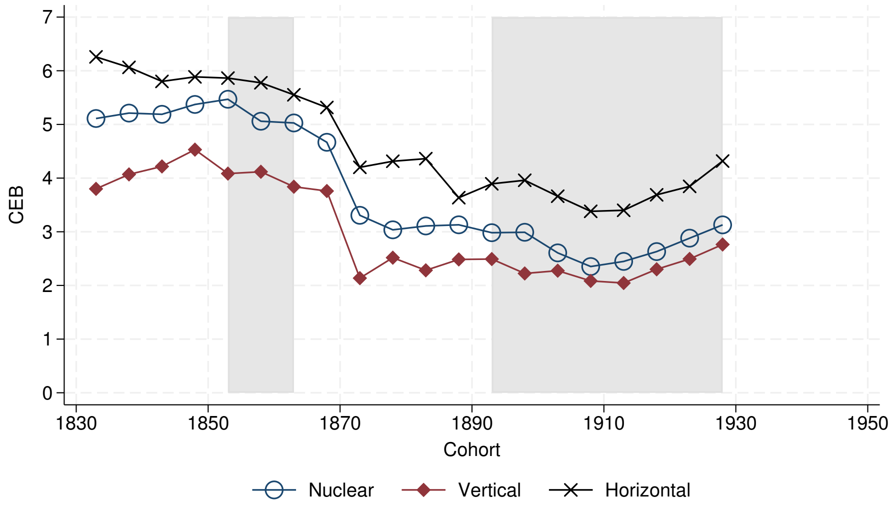


Figure C.8: CEB by cohort and family type: Native-born married women with both parents native-born and with employed husbands.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: native-born married woman with employed husband and both parents native-born. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

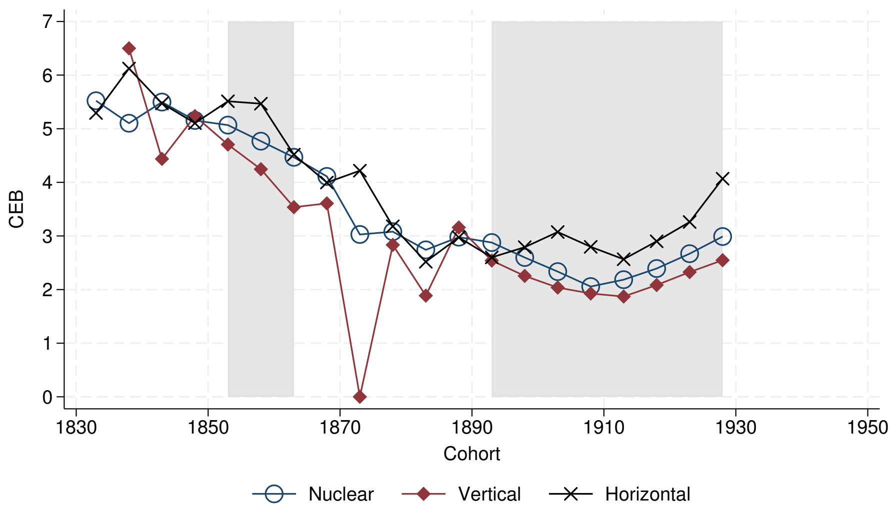


Figure C.9: CEB by cohort and family type: Native-born married women with at least one parent foreign-born and with employed husbands.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: native-born married woman with employed husband and at least one parent foreign-born. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

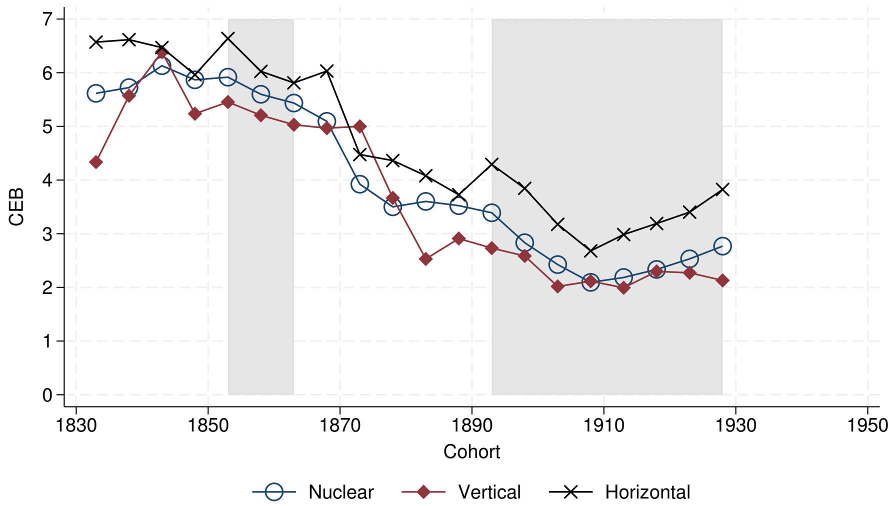


Figure C.10: CEB by cohort and family type: Foreign-born married women with employed husbands.
Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Each cohort covers five (birth) years and it is labeled with its midpoint. Unit of observation: foreign-born married woman with employed husband. Grey areas: women aged 40-49. White areas: women of various age. Source: our calculations from IPUMS.

D Robustness: childlessness

Since we have shown that childlessness differs among family types (see Table B.1), in this Section we investigate whether the differential fertility between vertical and nuclear families persists also when we limit to the intensive margin of fertility only. In order to do so, we exclude the sample of childless women from our analysis and run Equation (1) on the modified sample. Results are shown in Table D.1. The coefficients associated with the vertical dummy diminish, but remain sizeable and significant: -0.27 in Column (1), -0.22 in Column (11). This suggests that, although the observed differential childlessness across family types may contribute to explain the observed differential fertility, its role is likely to be quantitatively minor.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.27***	-0.29***	-0.29***	-0.27***	-0.27***	-0.26***	-0.28***	-0.36***	-0.38***	-0.21***	-0.22***	-0.30***	-0.23***	-0.23***
	(0.017)	(0.017)	(0.019)	(0.017)	(0.017)	(0.017)	(0.030)	(0.023)	(0.023)	(0.018)	(0.037)	(0.019)	(0.037)	(0.020)
Extended horizontal	0.72***	0.62***	0.66***	0.68***	0.67***	0.71***	0.67***	0.70***	0.69***	0.63***	0.42***	0.53***	0.46***	0.50***
	(0.020)	(0.020)	(0.023)	(0.021)	(0.020)	(0.020)	(0.038)	(0.028)	(0.028)	(0.023)	(0.047)	(0.023)	(0.047)	(0.026)
White		-0.66***									-0.68***	-0.60***	-0.79***	-0.48***
		(0.014)									(0.059)	(0.015)	(0.059)	(0.015)
Urban			-0.43***								-0.56***	-0.40***	-0.59***	-0.34***
			(0.009)								(0.024)	(0.009)	(0.024)	(0.010)
Owner				-0.26***							-0.18***	-0.20***	-0.22***	-0.13***
				(0.010)							(0.025)	(0.011)	(0.025)	(0.012)
High income					-0.45***						-0.33***	-0.34***	-0.41***	-0.19***
					(0.007)						(0.021)	(0.008)	(0.021)	(0.008)
Active						-0.34***					-0.48***	-0.38***	-0.52***	-0.33***
						(0.006)					(0.018)	(0.007)	(0.018)	(0.007)
Age at first marriage							-0.10***				-0.09***		-0.10***	
							(0.002)				(0.003)		(0.003)	
Foreign born								0.46***			0.41***		0.56***	
								(0.022)			(0.042)		(0.041)	
Foreign parent									-0.17***		0.01		0.07***	
									(0.014)		(0.025)		(0.025)	
Educational attainment										-0.15***	-0.10***			-0.11***
										(0.001)	(0.004)			(0.002)
Constant	6.39***	6.95***	6.46***	6.53***	6.57***	6.40***	6.45***	6.61***	6.68***	4.60***	7.65***	7.25***	7.79***	5.18***
	(0.093)	(0.094)	(0.094)	(0.093)	(0.093)	(0.093)	(0.121)	(0.102)	(0.102)	(0.101)	(0.153)	(0.095)	(0.153)	(0.103)
Observations	555,962	555,962	458,173	539,145	555,962	555,962	174,374	261,183	261,183	493,882	94,406	458,173	94,406	396,093
R-squared	0.196	0.203	0.234	0.212	0.206	0.200	0.089	0.172	0.170	0.122	0.160	0.253	0.151	0.154
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D.1: Dependent variable: children ever born, women with at least 1 child.
Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with at least 1 child (with an employed husband). "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

E Robustness: regression with clustered SE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.34***	-0.36***	-0.36***	-0.35***	-0.34***	-0.33***	-0.32***	-0.44***	-0.46***	-0.28***	-0.25***	-0.36***	-0.26***	-0.28***
	(0.042)	(0.039)	(0.044)	(0.044)	(0.041)	(0.043)	(0.043)	(0.039)	(0.039)	(0.036)	(0.043)	(0.039)	(0.043)	(0.034)
Extended horizontal	0.74***	0.67***	0.69***	0.71***	0.70***	0.74***	0.67***	0.72***	0.71***	0.65***	0.48***	0.58***	0.52***	0.55***
	(0.053)	(0.040)	(0.053)	(0.052)	(0.048)	(0.053)	(0.064)	(0.058)	(0.059)	(0.041)	(0.050)	(0.036)	(0.052)	(0.036)
White		-0.49***									-0.28***	-0.49***	-0.37***	-0.36***
		(0.061)									(0.086)	(0.051)	(0.086)	(0.044)
Urban			-0.50***								-0.60***	-0.45***	-0.63***	-0.38***
			(0.040)								(0.035)	(0.034)	(0.038)	(0.020)
Owner				-0.17***							-0.13**	-0.13***	-0.16***	-0.04
				(0.048)							(0.053)	(0.035)	(0.054)	(0.046)
High income					-0.44***						-0.31***	-0.35***	-0.38***	-0.18***
					(0.035)						(0.024)	(0.022)	(0.028)	(0.010)
Active						-0.47***					-0.58***	-0.50***	-0.61***	-0.44***
						(0.014)					(0.025)	(0.013)	(0.024)	(0.013)
Age at first marriage							-0.12***				-0.12***		-0.12***	
							(0.003)				(0.004)		(0.004)	
Foreign born								0.48***			0.50***		0.63***	
								(0.066)			(0.087)		(0.087)	
Foreign parent									-0.13***		0.08***		0.13***	
									(0.030)		(0.026)		(0.029)	
Educational attainment										-0.16***	-0.09***			-0.13***
										(0.009)	(0.007)			(0.006)
Constant	5.78***	6.20***	5.86***	5.85***	5.96***	5.79***	6.54***	5.97***	6.06***	4.03***	7.42***	6.49***	7.50***	4.47***
	(0.127)	(0.140)	(0.129)	(0.141)	(0.131)	(0.128)	(0.138)	(0.121)	(0.121)	(0.134)	(0.190)	(0.151)	(0.195)	(0.160)
Observations	628,094	628,094	520,477	607,323	628,094	628,094	199,366	298,605	298,605	559,923	113,367	520,477	113,367	452,306
R-squared	0.161	0.165	0.192	0.171	0.169	0.168	0.116	0.150	0.148	0.107	0.174	0.210	0.169	0.131
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered by state in parenthesis
*** $p<0.01$; ** $p<0.05$; * $p<0.1$

Table E.1: OLS estimates. Dependent variable: children ever born. Standard errors clustered by state.

Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with an employed husband. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.27***	-0.29***	-0.29***	-0.27***	-0.27***	-0.26***	-0.28***	-0.36***	-0.38***	-0.21***	-0.22***	-0.30***	-0.23***	-0.23***
	(0.036)	(0.032)	(0.037)	(0.036)	(0.034)	(0.036)	(0.041)	(0.035)	(0.035)	(0.031)	(0.044)	(0.031)	(0.044)	(0.028)
Extended horizontal	0.72***	0.62***	0.66***	0.68***	0.67***	0.71***	0.67***	0.70***	0.69***	0.63***	0.42***	0.53***	0.46***	0.50***
	(0.050)	(0.036)	(0.050)	(0.048)	(0.045)	(0.050)	(0.064)	(0.055)	(0.056)	(0.038)	(0.046)	(0.032)	(0.047)	(0.031)
White		-0.66***									-0.68***	-0.60***	-0.79***	-0.48***
		(0.065)									(0.088)	(0.054)	(0.088)	(0.050)
Urban			-0.43***								-0.56***	-0.40***	-0.59***	-0.34***
			(0.037)								(0.032)	(0.030)	(0.036)	(0.021)
Owner				-0.26***							-0.18***	-0.20***	-0.22***	-0.13***
				(0.045)							(0.050)	(0.031)	(0.052)	(0.043)
High income					-0.45***						-0.33***	-0.34***	-0.41***	-0.19***
					(0.036)						(0.026)	(0.024)	(0.030)	(0.011)
Active						-0.34***					-0.48***	-0.38***	-0.52***	-0.33***
						(0.014)					(0.023)	(0.011)	(0.022)	(0.010)
Age at first marriage							-0.10***				-0.09***		-0.10***	
							(0.004)				(0.005)		(0.005)	
Foreign born								0.46***			0.41***		0.56***	
								(0.066)			(0.096)		(0.097)	
Foreign parent									-0.17***		0.01		0.07**	
									(0.030)		(0.029)		(0.031)	
Educational attainment										-0.15***	-0.10***			-0.11***
										(0.010)	(0.007)			(0.007)
Constant	6.39***	6.95***	6.46***	6.53***	6.57***	6.40***	6.45***	6.61***	6.68***	4.60***	7.65***	7.25***	7.79***	5.18***
	(0.137)	(0.156)	(0.139)	(0.147)	(0.141)	(0.137)	(0.141)	(0.134)	(0.132)	(0.140)	(0.192)	(0.162)	(0.199)	(0.165)
Observations	555,962	555,962	458,173	539,145	555,962	555,962	174,374	261,183	261,183	493,882	94,406	458,173	94,406	396,093
R-squared	0.196	0.203	0.234	0.212	0.206	0.200	0.089	0.172	0.170	0.122	0.160	0.253	0.151	0.154
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered by state in parenthesis
*** p<0.01; ** p<0.05; * p<0.1

Table E.2: OLS estimates. Dependent variable: children ever born, women with at least 1 child. Standard errors clustered by state.

Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with at least 1 child (with an employed husband). "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.34***	-0.36***	-0.36***	-0.35***	-0.34***	-0.33***	-0.32***	-0.44***	-0.46***	-0.28***	-0.25***	-0.36***	-0.26***	-0.28***
	(0.072)	(0.066)	(0.085)	(0.080)	(0.067)	(0.071)	(0.063)	(0.058)	(0.066)	(0.054)	(0.045)	(0.072)	(0.049)	(0.051)
Extended horizontal	0.74***	0.67***	0.69***	0.71***	0.70***	0.74***	0.67***	0.72***	0.71***	0.65***	0.48***	0.58***	0.52***	0.55***
	(0.075)	(0.067)	(0.082)	(0.078)	(0.072)	(0.074)	(0.106)	(0.092)	(0.095)	(0.070)	(0.085)	(0.069)	(0.084)	(0.075)
White		-0.49***									-0.28*	-0.49***	-0.37**	-0.36***
		(0.073)									(0.130)	(0.062)	(0.117)	(0.059)
Urban			-0.50***								-0.60***	-0.45***	-0.63***	-0.38***
			(0.094)								(0.049)	(0.068)	(0.056)	(0.076)
Owner				-0.17***							-0.13**	-0.13***	-0.16**	-0.04
				(0.051)							(0.048)	(0.042)	(0.050)	(0.052)
High income					-0.44***						-0.31***	-0.35***	-0.38***	-0.18***
					(0.077)						(0.070)	(0.064)	(0.084)	(0.046)
Active						-0.47***					-0.58***	-0.50***	-0.61***	-0.44***
						(0.047)					(0.079)	(0.044)	(0.075)	(0.049)
Age at first marriage							-0.12***				-0.12***		-0.12***	
							(0.010)				(0.010)		(0.011)	
Foreign born								0.48***			0.50**		0.63***	
								(0.162)			(0.157)		(0.173)	
Foreign parent									-0.13***		0.08		0.13*	
									(0.042)		(0.053)		(0.059)	
Educational attainment										-0.16***	-0.09***			-0.13***
										(0.013)	(0.020)			(0.012)
Constant	5.78***	6.20***	5.86***	5.85***	5.96***	5.79***	6.54***	5.97***	6.06***	4.03***	7.42***	6.49***	7.50***	4.47***
	(0.079)	(0.112)	(0.101)	(0.102)	(0.101)	(0.081)	(0.293)	(0.081)	(0.098)	(0.090)	(0.260)	(0.157)	(0.259)	(0.148)
Observations	628,094	628,094	520,477	607,323	628,094	628,094	199,366	298,605	298,605	559,923	113,367	520,477	113,367	452,306
R-squared	0.161	0.165	0.192	0.171	0.169	0.168	0.116	0.150	0.148	0.107	0.174	0.210	0.169	0.131
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered by state and cohort in parenthesis
*** $p<0.01$; ** $p<0.05$; * $p<0.1$

Table E.3: OLS estimates. Dependent variable: children ever born. Standard errors clustered by state and cohort.

Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with an employed husband. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.27***	-0.29***	-0.29***	-0.27***	-0.27***	-0.26***	-0.28***	-0.36***	-0.38***	-0.21***	-0.22***	-0.30***	-0.23***	-0.23***
	(0.061)	(0.055)	(0.072)	(0.067)	(0.057)	(0.061)	(0.066)	(0.055)	(0.062)	(0.055)	(0.048)	(0.058)	(0.052)	(0.050)
Extended horizontal	0.72***	0.62***	0.66***	0.68***	0.67***	0.71***	0.67***	0.70***	0.69***	0.63***	0.42***	0.53***	0.46***	0.50***
	(0.074)	(0.061)	(0.081)	(0.077)	(0.070)	(0.074)	(0.113)	(0.095)	(0.097)	(0.068)	(0.088)	(0.064)	(0.089)	(0.066)
White		-0.66***									-0.68***	-0.60***	-0.79***	-0.48***
		(0.110)									(0.154)	(0.106)	(0.144)	(0.102)
Urban			-0.43***								-0.56***	-0.40***	-0.59***	-0.34***
			(0.089)								(0.042)	(0.062)	(0.048)	(0.072)
Owner				-0.26***							-0.18***	-0.20***	-0.22***	-0.13**
				(0.049)							(0.046)	(0.037)	(0.047)	(0.047)
High income					-0.45***						-0.33***	-0.34***	-0.41***	-0.19***
					(0.079)						(0.073)	(0.063)	(0.081)	(0.047)
Active						-0.34***					-0.48***	-0.38***	-0.52***	-0.33***
						(0.028)					(0.068)	(0.027)	(0.063)	(0.032)
Age at first marriage							-0.10***				-0.09***		-0.10***	
							(0.010)				(0.012)		(0.012)	
Foreign born								0.46***			0.41**		0.56**	
								(0.156)			(0.156)		(0.167)	
Foreign parent									-0.17***		0.01		0.07	
									(0.039)		(0.060)		(0.064)	
Educational attainment										-0.15***	-0.10***			-0.11***
										(0.014)	(0.016)			(0.012)
Constant	6.39***	6.95***	6.46***	6.53***	6.57***	6.40***	6.45***	6.61***	6.68***	4.60***	7.65***	7.25***	7.79***	5.18***
	(0.074)	(0.145)	(0.095)	(0.094)	(0.097)	(0.076)	(0.285)	(0.081)	(0.095)	(0.092)	(0.211)	(0.187)	(0.203)	(0.191)
Observations	555,962	555,962	458,173	539,145	555,962	555,962	174,374	261,183	261,183	493,882	94,406	458,173	94,406	396,093
R-squared	0.196	0.203	0.234	0.212	0.206	0.200	0.089	0.172	0.170	0.122	0.160	0.253	0.151	0.154
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered by state and cohort in parenthesis

*** p<0.01; ** p<0.05; * p<0.1

Table E.4: OLS estimates. Dependent variable: children ever born, women with at least 1 child. Standard errors clustered by state and cohort.

Results from an OLS regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with at least 1 child (with an employed husband). "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

F Robustness: Poisson regression

Tables 1 and D.1 shows the results of the estimation of a linear regression model. Given that the dependent variable, i.e. children ever born, is a count variable, it is interesting to see if the results are robust to the estimation of a Poisson model. Results of Poisson regressions are presented in Tables F.1 and F.2.

Table F.1 shows that belonging to an extended vertical (horizontal) family induces a percentage change in the expected number of children ever born that goes from -11% (+13%) to -17% (+21%), depending on the set of covariates included in the analysis. In Table F.2, where we consider the intensive margin only, the same effect is between -7% (+10%) and -11% (+18%).

These numbers are comparable with the average semielasticities that can computed for the linear regression model. The average semielasticities implied by Table 1 and D.1 goes from -10% (+18%) to -15% (+29%) and from -7% (+14%) and -11% (+25%) respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.13***	-0.14***	-0.14***	-0.13***	-0.13***	-0.13***	-0.12***	-0.16***	-0.17***	-0.11***	-0.11***	-0.13***	-0.11***	-0.12***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)	(0.009)	(0.009)	(0.007)	(0.015)	(0.007)	(0.015)	(0.009)
Extended horizontal	0.21***	0.19***	0.19***	0.20***	0.20***	0.21***	0.19***	0.19***	0.19***	0.20***	0.13***	0.16***	0.14***	0.17***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.010)	(0.007)	(0.007)	(0.007)	(0.012)	(0.006)	(0.012)	(0.008)
White		-0.16***									-0.07***	-0.16***	-0.10***	-0.13***
		(0.004)									(0.015)	(0.005)	(0.015)	(0.005)
Urban			-0.17***								-0.19***	-0.14***	-0.20***	-0.14***
			(0.003)								(0.008)	(0.003)	(0.008)	(0.004)
Owner				-0.06***							-0.04***	-0.05***	-0.05***	-0.02***
				(0.003)							(0.008)	(0.004)	(0.008)	(0.004)
High income					-0.15***						-0.11***	-0.12***	-0.13***	-0.07***
					(0.002)						(0.007)	(0.003)	(0.007)	(0.003)
Active						-0.18***					-0.23***	-0.20***	-0.24***	-0.18***
						(0.003)					(0.007)	(0.003)	(0.007)	(0.003)
Age at first marriage							-0.05***				-0.05***		-0.05***	
							(0.001)				(0.001)		(0.001)	
Foreign born								0.15***			0.18***		0.22***	
								(0.006)			(0.013)		(0.012)	
Foreign parent									-0.05***		0.03***		0.05***	
									(0.005)		(0.009)		(0.009)	
Educational attainment										-0.06***	-0.03***			-0.05***
										(0.001)	(0.002)			(0.001)
Constant	1.78***	1.92***	1.81***	1.81***	1.84***	1.79***	2.46***	1.83***	1.85***	1.45***	2.73***	2.01***	2.77***	1.60***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.033)	(0.021)	(0.021)	(0.027)	(0.040)	(0.020)	(0.040)	(0.029)
Observations	628,094	628,094	520,477	607,323	628,094	628,094	199,366	298,605	298,605	559,923	113,367	520,477	113,367	452,306
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table F.1: Poisson estimates. Dependent variable: children ever born.
Results from a Poisson regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with an employed husband. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.09***	-0.09***	-0.10***	-0.09***	-0.09***	-0.08***	-0.09***	-0.11***	-0.11***	-0.07***	-0.08***	-0.09***	-0.08***	-0.08***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.007)	(0.007)	(0.006)	(0.013)	(0.006)	(0.013)	(0.007)
Extended horizontal	0.18***	0.16***	0.17***	0.17***	0.17***	0.18***	0.17***	0.16***	0.16***	0.18***	0.10***	0.13***	0.11***	0.14***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.009)	(0.006)	(0.006)	(0.006)	(0.012)	(0.005)	(0.012)	(0.007)
White		-0.19***									-0.16***	-0.18***	-0.19***	-0.16***
		(0.004)									(0.014)	(0.004)	(0.014)	(0.005)
Urban			-0.13***								-0.16***	-0.11***	-0.17***	-0.11***
			(0.003)								(0.007)	(0.003)	(0.007)	(0.003)
Owner				-0.08***							-0.05***	-0.06***	-0.06***	-0.04***
				(0.003)							(0.007)	(0.003)	(0.007)	(0.004)
High income					-0.14***						-0.10***	-0.10***	-0.12***	-0.06***
					(0.002)						(0.006)	(0.002)	(0.006)	(0.003)
Active						-0.12***					-0.15***	-0.13***	-0.17***	-0.12***
						(0.002)					(0.006)	(0.002)	(0.006)	(0.002)
Age at first marriage							-0.03***				-0.03***		-0.03***	
							(0.001)				(0.001)		(0.001)	
Foreign born								0.12***			0.12***		0.17***	
								(0.005)			(0.012)		(0.012)	
Foreign parent									-0.06***		-0.00		0.02**	
									(0.004)		(0.008)		(0.008)	
Educational attainment										-0.05***	-0.03***			-0.04***
										(0.001)	(0.001)			(0.001)
Constant	1.88***	2.03***	1.90***	1.92***	1.93***	1.88***	2.17***	1.92***	1.94***	1.57***	2.45***	2.12***	2.50***	1.75***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.031)	(0.018)	(0.018)	(0.025)	(0.038)	(0.017)	(0.038)	(0.026)
Observations	555,962	555,962	458,173	539,145	555,962	555,962	174,374	261,183	261,183	493,882	94,406	458,173	94,406	396,093
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table F.2: Poisson estimates. Dependent variable: children ever born, women with at least 1 child.

Results from a Poisson regression of children ever born on family structure with cohort and state fixed effects. Children ever born (CEB) indicates how many children a woman had throughout her life at the moment of the Census interview. Unit of observation: married woman with at least 1 child (with an employed husband). "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

G Stability of the family structure

As hinted at in the main text, our reconstruction of completed fertility by family type implicitly assume a high degree of stability of family structure along the woman's reproductive life. We measure, indeed, completed fertility and family links when the woman is 40-to-49, which implies that the woman was living in the same family type when she was actually having children, *i.e.* when she was in her 20-to-40. This, however, might not have always been the case, which may introduce a measurement error in our analysis. In particular, if women living in nuclear families during their fertile period ended up coresiding later in life, for instance with their mothers (in law) after the death of her fathers (in law), their completed fertility could be wrongly associated with vertical families in our reconstruction. By the same token, if women living in extended vertical families during their fertile period ended up in a nuclear family later in life, for instance after the death of the parents (in law), their fertility could be wrongly associated to nuclear families in our reconstruction. In the main text, we have shown that our main fact – women living in nuclear families having more children than those living in vertical families – is robust to different measures of fertility, and therefore does not depend on the family structure stability. Nonetheless, it is still worth exploring the stability of the family structure. In order to do so, we performed the following exercise. For each Census Year t, we averaged among women aged 40-to-49 and computed the aggregate incidence of each family type. Then, we went to the Census Year $t-1$ ($t-2$), averaged among women aged 30-to-39 (20-to-29) and computed the aggregate incidence of each family type, and compare it with the computation in t. Results, reported in Table G.1, show that across all the cohorts, a pattern emerges for vertical families, namely the percentage of women living in vertical families in each cohort is slightly decreasing in their age range. In other terms, some families that were vertical in the first part of the fertile period of the woman become nuclear (or horizontal) families at the end of this period – possibly a result of mortality among the elderly.

		Nuclear	Vertical	Horizontal
1863	35-39	83.31	8.32	8.37
	45-49	81.67	5.88	12.45
1868	30-34	82.85	9.06	8.09
	40-44	82.04	7.51	10.45
1873	25-29	80.49	10.40	9.11
	35-39	82.89	8.42	8.70
	45-49	79.87	6.67	13.46
1878	20-24	78.45	12.63	8.92
	30-34	82.53	9.39	8.08
	40-44	81.82	7.75	10.43
1883	25-29	80.16	10.73	9.12
	35-39	83.02	8.74	8.24
	45-49	80.40	6.46	13.14
1888	20-24	78.35	12.38	9.27
	30-34	82.47	9.77	7.76
	40-44	82.32	7.86	9.82
1893	25-29	80.57	11.19	8.24
	35-39	82.79	9.24	7.97
	45-49	80.51	7.44	12.05
1898	20-24	77.23	14.77	8.00
	30-34	81.92	10.46	7.62
	40-44	82.92	8.77	8.30
1903	25-29	80.23	11.43	8.34
	35-39	83.76	9.28	6.97
	45-49	80.82	8.02	11.16
1908	20-24	76.76	15.44	7.80
	30-34	82.77	11.29	5.94
	40-44	82.62	9.44	7.94
1913	25-29	81.46	11.96	6.58
	35-39	84.69	9.80	5.51
	45-49	85.38	6.84	7.78
1918	20-24	77.65	16.71	5.64
	30-34	85.27	10.08	4.65
	40-44	86.74	7.13	6.14
1923	25-29	84.29	11.17	4.54
	35-39	89.21	6.35	4.44
	45-49	89.13	5.16	5.71
1928	20-24	80.52	14.57	4.91
	30-34	90.54	5.88	3.58
	40-44	90.58	4.70	4.72
1933	25-29	91.00	5.17	3.83
	35-39	92.40	4.05	3.55
	45-49	90.23	3.96	5.81
1938	20-24	89.63	6.34	4.02
	30-34	93.88	3.39	2.72
	40-44	91.61	3.36	5.03
1943	25-29	94.45	2.88	2.67
	35-39	93.54	2.89	3.57
	45-49	90.48	2.86	6.66
1948	20-24	93.04	4.23	2.73
	30-34	94.58	2.68	2.74
	40-44	92.21	2.72	5.07
1953	25-29	94.38	2.57	3.06
	35-39	93.71	2.74	3.55

Table G.1: Family structure by cohort and age.
Percentage of women belonging to a specific family type by cohort for different ages. Source: our calculations from IPUMS.

H Robustness: alternative measure of fertility

This section shows that our benchmark fact is still observable in the data in pure descriptive terms (Figure H.1), and is robust to heterogeneity (Table H.1, once fertility is measured as the number of own children aged 5 or less coresiding with the women in each Census year.[31]

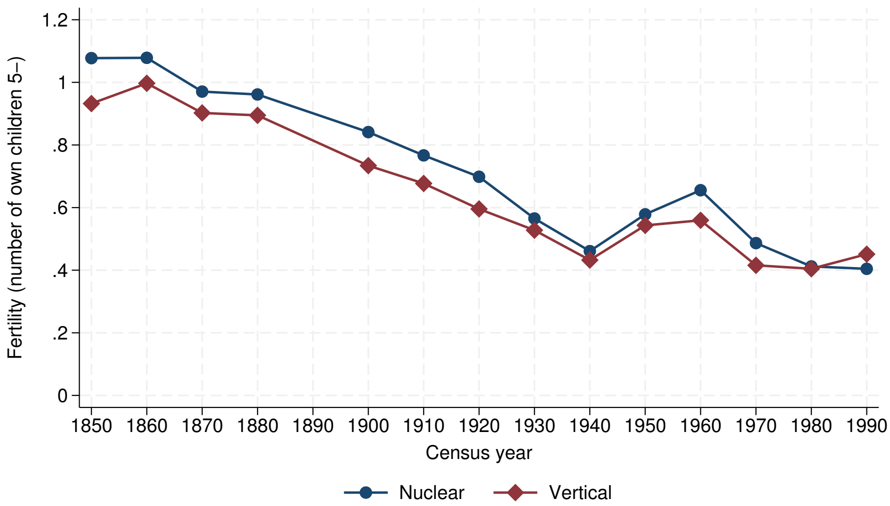


Figure H.1: Number of own children aged 5 or less in the household by family type. Married women (various age) with employed husbands.
Number of own children aged 5 or less indicates how many coresiding children aged 5 or less a woman had at the moment of the Census interview. Unit of observation: married woman with employed husband. Family structure: i) Nuclear, a couple and their children; ii) Vertical, families characterised by intergenerational coresidence, see Section 2.2. Source: our calculations from IPUMS.

The magnitude of the effect is obviously not directly comparable with that of Table 1: in that Table, the dependent variable is a measure of completed fertility and accordingly the effect we find there is somehow the effect in Table H.1 cumulated along the entire fertility period of a woman.

This is also confirmed by an independent work on the U.S. fertility transition by Hacker and Roberts (2019). They document a negative correlation between the presence of mothers/mothers-in-law and other females in the household, and fertility rates measured - as we did in Table H.1 - from the number of co-resident own children aged 5 or below.

[31]Notice that results hold good for our main fact, namely, the differential fertility betwen nuclear and vertical families. As to the impact of the horizontal families on fertility, the evidence of Table H.1 seems to be mixed: in particular the sign of the effect changes across the different specifications.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Extended vertical	-0.09***	-0.09***	-0.11***	-0.10***	-0.09***	-0.08***	-0.08***	-0.11***	-0.11***	-0.06***	-0.07***	-0.10***	-0.08***	-0.06***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.007)	(0.003)	(0.005)	(0.005)
Extended horizontal	-0.01***	-0.01***	-0.01***	0.00	-0.01***	-0.00	0.02***	-0.01*	-0.01*	0.01**	0.02**	-0.01*	0.02***	0.01*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)	(0.009)	(0.003)	(0.006)	(0.005)
Age	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.05***	-0.04***	-0.04***	-0.04***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
White		-0.04***									-0.15***	-0.07***	-0.11***	-0.11***
		(0.002)									(0.008)	(0.003)	(0.006)	(0.003)
Urban			-0.10***								-0.06***	-0.07***	-0.09***	-0.03***
			(0.002)								(0.004)	(0.002)	(0.003)	(0.002)
Owner				0.03***							0.01***	0.03***	0.00	0.04***
				(0.001)							(0.004)	(0.002)	(0.003)	(0.002)
High income					-0.06***						-0.03***	-0.06***	-0.05***	-0.02***
					(0.001)						(0.003)	(0.001)	(0.003)	(0.002)
Active						-0.35***					-0.41***	-0.35***	-0.42***	-0.35***
						(0.001)					(0.003)	(0.001)	(0.003)	(0.002)
Age at first marriage							0.00***				0.01***		0.00***	
							(0.000)				(0.000)		(0.000)	
Foreign born								0.11***			0.03***		0.07***	
								(0.002)			(0.007)		(0.005)	
Foreign parent									-0.01***		0.00		0.01***	
									(0.002)		(0.005)		(0.004)	
Education										-0.04***	-0.03***			-0.01***
										(0.001)	(0.003)			(0.001)
Constant	2.33***	2.36***	2.34***	2.13***	2.34***	2.34***	1.91***	2.28***	2.28***	1.91***	2.18***	2.24***	2.14***	2.00***
	(0.008)	(0.009)	(0.009)	(0.006)	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)	(0.009)	(0.020)	(0.007)	(0.014)	(0.011)
Observations	1,923,955	1,923,955	1,542,493	1,713,982	1,923,955	1,905,568	774,218	1,250,216	1,250,216	1,292,210	306,774	1,404,266	468,927	910,748
R-squared	0.189	0.190	0.190	0.184	0.191	0.220	0.186	0.178	0.177	0.197	0.257	0.214	0.227	0.247
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table H.1: Dependent variable: number of children aged 5 or less in the census year

Results from an OLS regression of the number of children in a census year on family structure with year and state fixed effects. Number of own children aged 5 or less indicates how many coresiding children aged 5 or less a woman had at the moment of the Census interview. "Extended vertical" is a dummy equal to 1 if the woman lives in an extended vertical family. "Extended horizontal" is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1) controls only for age of the woman; Columns (2)-(10), controls added one by one; Column (11), all controls; Column (12)-(14), subset of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

I Robustness: international analysis with alternative measure of fertility

	(1) Denmark	(2) Iceland	(3) Ireland	(4) Norway	(5) Sweden	(6) UK	(7) Pooled
Extended vertical	-0.21***	0.10***	-0.00	-0.09***	-0.09***	-0.11***	-0.10***
	(0.030)	(0.035)	(0.018)	(0.015)	(0.003)	(0.002)	(0.002)
Extended horizontal	-0.32***	-0.14***	0.01	-0.21***	0.13***	-0.10***	-0.09***
	(0.048)	(0.035)	(0.022)	(0.014)	(0.005)	(0.002)	(0.002)
Age	-0.06***	-0.03***	-0.04***	-0.03***	-0.04***	-0.03***	-0.04***
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.99***	1.98***	2.70***	2.26***	2.48***	2.15***	2.55***
	(0.058)	(0.059)	(0.034)	(0.015)	(0.003)	(0.004)	(0.031)
Observations	312,402	7,495	556,860	459,677	1,688,676	16,311,642	19,336,752
R-squared	0.012	0.113	0.004	0.095	0.115	0.097	0.044
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table I.1: OLS estimates. Dependent variable: number of children aged 5 or below in the census year. European countries.

Results from an OLS regression of the number of children in a census year on family structure, with age and year fixed effects. Number of own children aged 5 or below indicates how many coresiding children aged 5 or below a woman had at the moment of the Census interview. Unit of observation: married woman. “Extended vertical” is a dummy equal to 1 if the woman lives in an extended vertical family. “Extended horizontal” is a dummy equal to 1 if the woman lives in an extended horizontal family. Column (1)-(6), various countries. Column (7), all countries, with country fixed effects. Source: our calculations from IPUMS International. Sample: 1787, 1801, 1845, 1880, 1885 for Denmark; 1703, 1729, 1801, 1901, 1910 for Iceland; 1901, 1911 for Ireland; 1801, 1865, 1875, 1900, 1910 for Norway; 1880, 1890, 1900, 1910 for Sweden; 1851, 1861, 1871, 1881, 1891, 1901, 1911 for the UK.

J The data through the lens of the theory: additional analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Head or head's wife	1.00***	1.00***	1.06***	1.03***	0.99***	0.86***	1.15***	1.16***	0.85***	0.87***	1.05***	0.87***	0.86***	0.87***
	(0.044)	(0.044)	(0.049)	(0.045)	(0.044)	(0.087)	(0.069)	(0.069)	(0.044)	(0.105)	(0.048)	(0.104)	(0.049)	(0.105)
Family income	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***	0.03***	0.03***	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Income of the young	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.05***	-0.05***	-0.03***	-0.03***	-0.04***	-0.03***	-0.03***	-0.03***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
White		-0.23***								-0.27*	-0.29***	-0.29*	-0.26***	-0.27*
		(0.058)								(0.163)	(0.060)	(0.162)	(0.061)	(0.163)
Urban			-0.46***							-0.55***	-0.50***	-0.55***	-0.44***	-0.55***
			(0.044)							(0.077)	(0.045)	(0.078)	(0.049)	(0.077)
Owner				-0.10**						-0.20**	-0.12**	-0.22**	-0.13**	-0.20**
				(0.048)						(0.086)	(0.052)	(0.087)	(0.058)	(0.086)
Active					-0.07**					-0.19***	-0.17***	-0.18***	-0.23***	-0.19***
					(0.035)					(0.065)	(0.037)	(0.065)	(0.038)	(0.065)
Age at first marriage						-0.09***				-0.08***		-0.09***		
						(0.005)				(0.005)		(0.005)		
Foreign born							0.35***			0.33**		0.38**		
							(0.080)			(0.149)		(0.147)		
Foreign parent								0.01		0.16*		0.18**		
								(0.051)		(0.083)		(0.083)		
Educational attainment									-0.08***	-0.03***			-0.07***	-0.03***
									(0.007)	(0.013)			(0.008)	(0.013)
Constant	4.05***	4.22***	3.97***	3.94***	4.03***	3.98***	3.94***	3.96***	2.54***	4.47***	4.24***	4.49***	2.77***	4.47***
	(0.162)	(0.168)	(0.159)	(0.155)	(0.162)	(0.240)	(0.191)	(0.191)	(0.165)	(0.303)	(0.168)	(0.302)	(0.174)	(0.303)
Observations	27,601	27,601	22,480	25,775	27,601	10,485	17,647	17,647	23,776	7,258	22,480	7,258	18,655	7,258
R-squared	0.182	0.183	0.206	0.191	0.182	0.183	0.204	0.203	0.124	0.203	0.208	0.202	0.133	0.203
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table J.1: OLS estimates. Dependent variable: children ever born in vertical families.
Results from an OLS regression of different measures of fertility on household's headship, income and age. Unit of observation: married woman (various ages) living in vertical families (with employed husband). CEB indicates how many children a woman had throughout her life at the moment of the Census interview. Head or head's wife, dummy variables equal to 1 whenever the woman or her husband were "head of the family". Family income, sum of the occupational income score of each family member. Income of the young, sum of the occupational income score of the woman and her husband. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Head or head's wife	0.91***	0.91***	0.99***	0.97***	0.89***	0.78***	0.93***	0.95***	0.80***	0.73***	0.97***	0.75***	0.84***	0.73***
	(0.013)	(0.013)	(0.015)	(0.015)	(0.013)	(0.023)	(0.015)	(0.015)	(0.019)	(0.037)	(0.016)	(0.026)	(0.025)	(0.037)
Family income	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Income of the young	-0.03***	-0.03***	-0.03***	-0.03***	-0.02***	-0.02***	-0.03***	-0.03***	-0.02***	-0.01***	-0.02***	-0.01***	-0.01***	-0.01***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.03***	0.03***	0.03***	0.02***	0.02***	0.03***	0.03***	0.03***	0.00***	0.02***	0.02***	0.03***	0.01***	0.02***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
White		-0.14***								-0.21***	-0.20***	-0.18***	-0.27***	-0.21***
		(0.021)								(0.061)	(0.024)	(0.047)	(0.032)	(0.061)
Urban			-0.26***							-0.24***	-0.28***	-0.28***	-0.20***	-0.24***
			(0.014)							(0.034)	(0.015)	(0.024)	(0.024)	(0.034)
Owner				0.06***						0.03	0.03**	-0.00	0.06**	0.03
				(0.014)						(0.035)	(0.015)	(0.024)	(0.026)	(0.035)
Active					-0.31***					-0.49***	-0.37***	-0.48***	-0.41***	-0.49***
					(0.013)					(0.027)	(0.015)	(0.023)	(0.018)	(0.027)
Age at first marriage						-0.07***				-0.06***		-0.08***		
						(0.002)				(0.003)		(0.002)		
Foreign born							0.36***			0.23***		0.39***		
							(0.023)			(0.070)		(0.046)		
Foreign parent								-0.04**		0.06*		0.09***		
								(0.015)		(0.034)		(0.025)		
Educational attainment									-0.05***	-0.03***			-0.05***	-0.03***
									(0.003)	(0.006)			(0.004)	(0.006)
Constant	1.71***	1.80***	1.40***	1.13***	1.52***	2.21***	1.31***	1.33***	1.39***	2.29***	1.19***	2.36***	1.43***	2.29***
	(0.075)	(0.077)	(0.078)	(0.058)	(0.067)	(0.088)	(0.065)	(0.065)	(0.075)	(0.145)	(0.064)	(0.106)	(0.097)	(0.145)
Observations	118,152	118,152	100,561	100,041	116,842	46,513	94,413	94,413	59,503	20,094	89,981	36,623	41,912	20,094
R-squared	0.146	0.147	0.161	0.135	0.147	0.158	0.150	0.147	0.111	0.173	0.150	0.187	0.131	0.173
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table J.2: OLS estimates. Dependent variable: number of own children in vertical families.
Results from an OLS regression of different measures of fertility on household's headship, income and age. Unit of observation: married woman aged 20-49 living in vertical families (with employed husband). Number of own children indicates how many coresiding children a woman had at the moment of the Census interview. Head or head's wife, dummy variables equal to 1 whenever the woman or her husband were "head of the family". Family income, sum of the occupational income score of each family member. Income of the young, sum of the occupational income score of the woman and her husband. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Head or head's wife	0.22***	0.22***	0.25***	0.22***	0.21***	0.19***	0.23***	0.23***	0.15***	0.14***	0.22***	0.17***	0.13***	0.14***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.012)	(0.008)	(0.008)	(0.010)	(0.019)	(0.008)	(0.014)	(0.013)	(0.019)
Family income	-0.00	-0.00	-0.00	-0.00*	-0.00**	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income of the young	-0.01***	-0.01***	-0.00***	-0.00***	-0.00***	-0.01***	-0.01***	-0.01***	-0.00***	0.00*	-0.00***	-0.00	0.00***	0.00*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Age	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
White		-0.04***								-0.16***	-0.08***	-0.12***	-0.14***	-0.16***
		(0.010)								(0.031)	(0.012)	(0.023)	(0.016)	(0.031)
Urban			-0.05***							-0.07***	-0.07***	-0.07***	-0.05***	-0.07***
			(0.007)							(0.016)	(0.007)	(0.012)	(0.011)	(0.016)
Owner				-0.01**						-0.04***	-0.02***	-0.04***	-0.04***	-0.04***
				(0.007)						(0.016)	(0.007)	(0.011)	(0.012)	(0.016)
Active					-0.26***					-0.34***	-0.28***	-0.33***	-0.29***	-0.34***
					(0.006)					(0.014)	(0.007)	(0.011)	(0.009)	(0.014)
Age at first marriage						0.00***				0.00***		0.00		
						(0.001)				(0.001)		(0.001)		
Foreign born							0.14***			0.06**		0.10***		
							(0.010)			(0.031)		(0.021)		
Foreign parent								0.00		0.02		0.02*		
								(0.007)		(0.017)		(0.013)		
Educational attainment									-0.00	-0.01**			-0.00**	-0.01**
									(0.002)	(0.003)			(0.002)	(0.003)
Constant	2.05***	2.07***	1.99***	1.88***	2.09***	1.73***	2.00***	2.01***	1.76***	1.78***	1.89***	1.81***	1.80***	1.78***
	(0.034)	(0.035)	(0.035)	(0.027)	(0.031)	(0.043)	(0.030)	(0.030)	(0.037)	(0.073)	(0.030)	(0.051)	(0.049)	(0.073)
Observations	118,152	118,152	100,561	100,041	116,842	46,513	94,413	94,413	59,503	20,094	89,981	36,623	41,912	20,094
R-squared	0.161	0.162	0.157	0.154	0.175	0.164	0.157	0.155	0.180	0.208	0.166	0.183	0.209	0.208
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table J.3: OLS estimates. Dependent variable: number of own children aged 5 or less in vertical families.

Results from an OLS regression of different measures of fertility on household's headship, income and age. Unit of observation: married woman aged 20-49 living in vertical families (with employed husband). Number of own children indicates how many coresiding children aged 5 or less a woman had at the moment of the Census interview. Head or head's wife, dummy variables equal to 1 whenever the woman or her husband were "head of the family". Family income, sum of the occupational income score of each family member. Income of the young, sum of the occupational income score of the woman and her husband. Column (1), no controls; Columns (2)-(10) controls added one by one; Column (11), all controls; Column (12)-(14), subsets of controls. Families are defined as in Section 2.2. Controls are defined as in Section 2.4. Source: our calculations from IPUMS. The sample size changes according to the availability of the different controls.

K Heterogenous siblings: back-of-the-envelope calculations

In the model we assume that siblings are homogeneous. When it comes to κ^y, this is tantamount to assuming that genetics and education fully determine the taste for coresidence. We here speculate on the potential impact of removing this assumption and consider the possibility that siblings are heterogenous in terms of preferences for coresidence. The idea is to infer to what extent having more children could mechanically increase the likelihood that at least one of them has a taste for coresidence that exceeds the one from Proposition 1.

For the sake of the argument we shall make the extreme assumption that the probability of liking coresidence is an independent random event for each child, i.e. genetics and education don't matter at all. This is akin to a Bernoulli process in which: the probability of success k is the probability of having $\kappa^y > \Phi^c$ for a given ι, where Φ_c is the coresidence frontier from Proposition 1; the number of trials n is the number of children. Hence the probability of having k successes is distributed as a binomial and reads as:

$$P = \binom{n}{k} p^n (1-p)^{n-k}, \tag{35}$$

where p is the probability of success in any trial. Hence, the probability of having *at least k* success is:

$$\pi_k = 1 - \sum_{j=0}^{k-1} \binom{n}{j} p^n (1-p)^{n-j}. \tag{36}$$

Since we assume that only one child coresides, we are interested in the probability of having *at least* 1 success, which is:

$$\pi_1 = 1 - (1-p)^n. \tag{37}$$

The probability of success p in any trial (i.e. the probability that κ^y is such that coresidence is chosen) can be retrieved as $1 - F(\Phi_c)$, where F is the cumulative distribution function for $N(\mu, \sigma^2)$ truncated at zero. Hence, given μ, σ, and ζ, one can compute π_1 for any value of ι and n. We set $\zeta = 0.56$ and $\sigma = 0.26$ as in Section 4. We fix μ so that π_1 is equal to the coresidence rate in 1850, assuming $\iota = 1$ and fixing $n = 6$, which is the proxied average fertility of the 1833 cohort.

In Table K.1, we then compute the value of π_1 for $n \in [1, 10]$ and $\iota \in [0.5, 2]$. The Tables allows us to disentangle the effect on π_1 of: i) exogenous changes in n for a given ι (a given row); ii) exogenous changes in ι for a given n (a given column). The numbers reveal that the elasticity of π_1 with respect to n is increasing in ι and decreasing in n. This back-of-the-envelope calculation suggests that a degree of approximation introduced by our assumption of homogeneous siblings is less sizeable for the context characterized by high fertility and low relative income of the young.

ι	$n=1$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$	$n=7$	$n=8$	$n=9$	$n=10$
0.5	0.37	0.61	0.75	0.85	0.90	0.94	0.96	0.98	0.99	0.99
1	0.19	0.34	0.46	0.57	0.65	0.71	0.77	0.81	0.85	0.88
1.5	0.11	0.21	0.30	0.38	0.45	0.51	0.56	0.61	0.66	0.70
2	0.08	0.14	0.21	0.27	0.32	0.37	0.42	0.46	0.50	0.54

Table K.1: π_1 as a function of ι e n

L The inverted Caldwell hypothesis

L.1 Model with exogenous coresidence

The simplest way to model the inverted Caldwell hypothesis under the assumption of exogenous coresidence is to introduce a cost/benefit from coresidence with the old in an otherwise standard model of endogenous fertility.

The economy is populated by three overlapping generations of individuals; the young, denoted by a superscript y; the old, denoted by a superscript o; and the children. Both the old and the children do not take any decision in this model. The old may live with the young in vertical families, but this is taken as given. The children accumulate human capital as chosen by the young.

There are two possible living arrangements, coresidence – the extended vertical family, denoted by a subscript c – or living alone – the nuclear family, denoted by a subscript a.

We assume preferences are independent of the family structure. The young care for consumption c, the number of children n, and their human capital h:

$$U(c_t, n_t, h_{t+1}) = (1-\gamma)\ln c_t + \gamma \ln(n_t h_{t+1}). \tag{38}$$

Young parents pay a time cost $\phi \in (0,1)$ for raising each child, and a good cost e for educating him. Education builds up the child's human capital according to the following production function:

$$h_{t+1} = (1+e_t)^{\beta}. \tag{39}$$

There is time cost-benefit $\chi \in (-1,1)$ of having coresiding elderly, o.

The budget constraint differs along the family dimension. With no coresidence (nuclear family),

$$w_t(1-\phi n_t)h_t = c_t + e_t n_t. \tag{40}$$

With coresidence (extended vertical family),

$$w_t(1-\phi n_t - \chi o_t)h_t = c_t + e_t n_t. \tag{41}$$

Hence, the optimal fertility and education choices for nuclear families are:

$$e_{a,t} = \begin{cases} 0 & \text{if } w_t \leq \frac{1}{\beta\phi h_t} \\ \frac{\beta\phi h_t w_t - 1}{1-\beta} & \text{if } w_t > \frac{1}{\beta\phi h_t} \end{cases}, \tag{42}$$

$$n_{a,t} = \begin{cases} \frac{\gamma}{\phi} & \text{if } w_t \leq \frac{1}{\beta\phi h_t} \\ \frac{\gamma(1-\beta)h_t w_t}{\phi h_t w_t - 1} & \text{if } w_t > \frac{1}{\beta\phi h_t} \end{cases}. \tag{43}$$

By the same token, the optimal education and fertility choices for extended vertical families are:

$$e_{c,t} = \begin{cases} 0 & \text{if } w_t \leq \frac{1}{\beta\phi h_t} \\ \frac{\beta\phi h_t w_t - 1}{1-\beta} & \text{if } w_t > \frac{1}{\beta\phi h_t} \end{cases}, \tag{44}$$

$$n_{c,t} = \begin{cases} \frac{\gamma(1-\chi o_t)}{\phi} & \text{if } w_t \leq \frac{1}{\beta\phi h_t} \\ \frac{\gamma(1-\beta)h_t w_t(1-\chi o_t)}{\phi h_t w_t - 1} & \text{if } w_t > \frac{1}{\beta\phi h_t} \end{cases}. \tag{45}$$

We assume $h_t w_t > \frac{1}{\phi}$.

So, the model features both the Post-Malthusian and the Modern regimes as defined in the main text.

Using Equations (43) and (45), one gets

$$n_{c,t} = (1 - \chi o_t) n_{a,t}. \tag{46}$$

Hence, in the model, $n_a > n_c$ if $\chi o_t < 1$. This implies that if the old are a liability (*i.e.*, if $\chi \in (0,1)$), the model conforms to Fact I: fertility differs by family type, with intergenerational coresidence systematically associated with lower fertility than nuclear families.

Furthermore, it is straightforward to verify that in this model fertility is always non increasing both in the wage per unit of efficiency and in the human capital of the young, or:

$$\frac{\partial n_a}{\partial w_t} \leq 0, \text{ always;} \tag{47}$$

$$\frac{\partial n_a}{\partial h_t} \leq 0, \text{ always;} \tag{48}$$

$$\frac{\partial n_c}{\partial w_t} \leq 0, \text{ if } \chi o_t < 1; \tag{49}$$

$$\frac{\partial n_c}{\partial h_t} \leq 0, \text{ if } \chi o_t < 1. \tag{50}$$

The conformity of the model to Fact I and the income-fertility relationship are illustrated in Figure L.1.

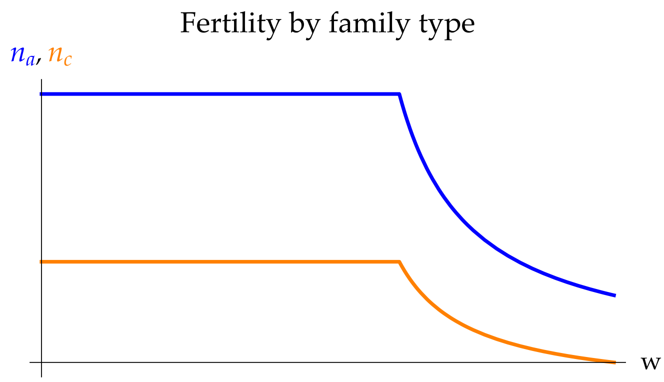


Figure L.1: The income-fertility relationship by family type and the cross-family differential fertility under the inverted Caldwell hypothesis (exogenous coresidence, elderly are a liability).

While the static nature of the model does not allow to tackle Fact II and III head on, one can say something under the assumption that wages increase over time. In this case, since both n_a and n_c are non-increasing in w, they will both decline when the latter increase sufficiently. Furthermore, it follows from Equation 46 that the ratio n_c/n_a is constant. Since both are decreasing in w in the modern regime, it must be true that their difference shrinks. In more formal terms, defining $\Delta_{n,t} \equiv n_{a,t} - n_{c,t}$, one has

$$\Delta_{n,t} = \begin{cases} \frac{\gamma \chi o_t}{\phi} & \text{if } w_t \leq \frac{1}{\beta \phi h_t} \\ \frac{\gamma \chi (1-\beta) h_t w_t o_t}{\phi h_t w_t - 1} & \text{if } w_t > \frac{1}{\beta \phi h_t} \end{cases}. \tag{51}$$

Hence,

$$\frac{\partial \Delta_{n,t}}{\partial w_t} \leq 0 \text{ for } w_t > 0,$$

$$\lim_{w_t \to \infty} \Delta_{n,t} = \frac{\gamma \chi (1-\beta) o_t}{\phi}.$$

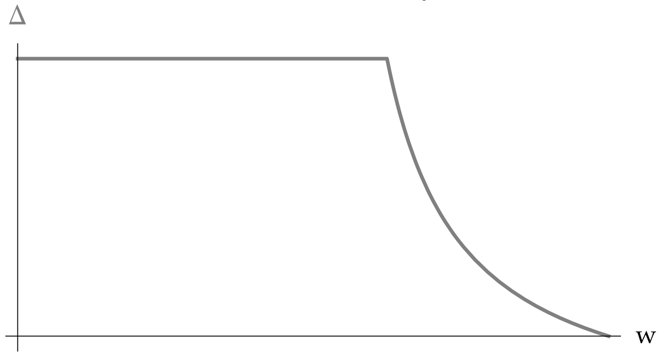


Figure L.2: Differential fertility and income.

The shrinking Δ_n (with no reversal in the differential fertility) is showed in Figure L.2.

Notice that this simple model can arrange a reversal in differential fertility through variations in χ. In fact, when $\chi \in (0,1)$, the coresiding elderly are a liability, a time cost. This is the case considered so far. But when $\chi \in (-1,0)$, the coresiding elderly are an asset, a time gain. This corresponds to the widespread view that having coresiding grandparents, or at least grandparents living nearby, frees some parental time from childcare. In this case, we observe a complete reversal of the fertility differential, with nuclear families now having less children than vertical families. This case is depicted in Figure L.3.

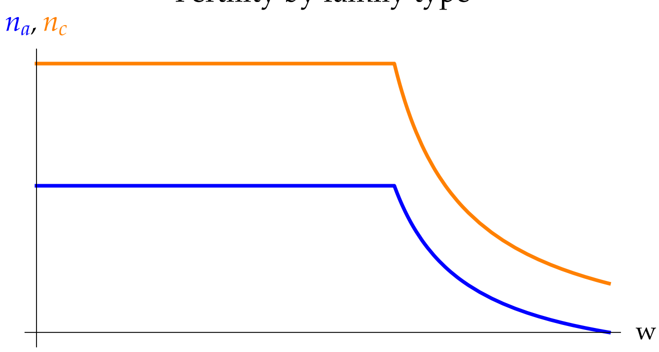


Figure L.3: The income-fertility relationship by family type and the cross-family differential fertility under the inverted Caldwell hypothesis (exogenous coresidence, elderly are an asset).

L.2 Model with endogenous coresidence

The model is the same as the one in Section 3, with two modifications. First, as in the previous Section, we assume that there is time cost-benefit $\chi \in (-1,1)$ of having coresiding elderly. Second, we assume that the elderly work only a fraction $\tau > 0$ of their last period of life. We further assume that it is only during the period in which they do not work that the elderly may be a liability or an asset to the young. Like in Section 3, and in accordance with the empirical evidence, we assume that coresidence only happens between one young and one old agent (couple).[32] With these assumptions, the budget constraint of the elderly when living alone, Equation (6), becomes

$$\tau w_t h_t^o = c_t^o + p_t^x x_t^o. \tag{52}$$

[32]Hence, $o = 1$ always.

By the same token, the budget constraint of the household under coresidence, Equation (11), becomes

$$w_t\{h_t^o\tau + h_t^y[1-\phi n_t - \chi(1-\tau)]\} = c_t^o + c_t^y + e_t n_t + p_t^x x_t. \tag{53}$$

Using the same procedure as in Section 3, the optimal choices for education and fertility reads:

$$e_{a,t}^* = e_{c,t}^* = \begin{cases} 0 & \text{if } w_t h_t^y \le \frac{1}{\beta\phi} \\ \frac{\beta h_t^y w_t \phi - 1}{1-\beta} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}; \tag{54}$$

$$n_{a,t}^* = \begin{cases} \frac{\gamma}{\phi} & \text{if } w_t h_t^y \le \frac{1}{\beta\phi} \\ \frac{\gamma(1-\beta)h_t^y w_t}{\phi h_t^y w_t - 1} & \text{if } w_t h_t^y > \frac{1}{\beta\phi} \end{cases}; \tag{55}$$

$$n_{c,t}^* = n_{a,t}^* \theta \frac{h_t^y[1-(1-\tau)\chi] + h_t^o\tau}{h_t^y}. \tag{56}$$

By equating the indirect utility functions in case of coresidence and non-coresidence for both the young and the old, and remembering $\iota \equiv h^y/h^o$, one gets:

$$\theta_{min} = \left(\frac{1}{\kappa^y}\frac{\iota_t}{\tau + \iota_t(1-(1-\tau)\chi)}\right)^{\frac{1}{1-\zeta}}; \tag{57}$$

$$\theta_{max} = 1 - \left(\frac{\tau}{\tau + \iota_t(1-(1-\tau)\chi)}\right)^{\frac{1}{1-\zeta}}. \tag{58}$$

As before, coresidence turns out to be Pareto improving if $\Delta_\theta \equiv \theta_{max} - \theta_{min} > 0$.

Notice that for $\tau = 1$, we retrieve Equations (19) and (20). As the old always work and never affect the time endowment of the young, the model reduces in effect to that of Section 3.

For $\tau \in (0,1)$, instead, both the coresidence choice and the cross-family differential fertility are affected by χ and τ. Proceeding as in Section 3, we can characterise the coresidence and differential fertility frontiers.

Proposition 3 *Given the coresidence frontier*

$$\Phi_c \equiv \frac{\iota_t\left(1-\left(\frac{\tau}{\iota_t(1-(1-\tau)\chi)+\tau}\right)^{\frac{1}{1-\zeta}}\right)^{\zeta-1}}{\iota_t(1-(1-\tau)\chi)+\tau}, \tag{59}$$

if $\kappa^y > \Phi_c$, then $\Delta_\theta > 0$: coresidence is Pareto efficient.

Proof
Upon request. ■

Proposition 4 *Given the differential fertility frontier*

$$\Phi_n \equiv \frac{\iota_t\lambda^{1-\zeta}\left(\left(\frac{\tau}{\iota_t(1-(1-\tau)\chi)+\tau}\right)^{\frac{1}{1-\zeta}} + \frac{\iota_t}{\iota_t(1-(1-\tau)\chi)+\tau} - 1 - \lambda\left(\left(\frac{\tau}{\iota_t(1-(1-\tau)\chi)+\tau}\right)^{\frac{1}{1-\zeta}} - 1\right)\right)^{\zeta}}{(1-\lambda)\tau\left(\left(\frac{\tau}{\iota_t(1-(1-\tau)\chi)+\tau}\right)^{\frac{\zeta}{1-\zeta}} - 1\right) + \iota_t((1-\lambda)(1-\tau)\chi + \lambda)}. \tag{60}$$

If $\kappa^y > \Phi_n$, then $n_a > n_c$: nuclear families have more children than extended vertical families.

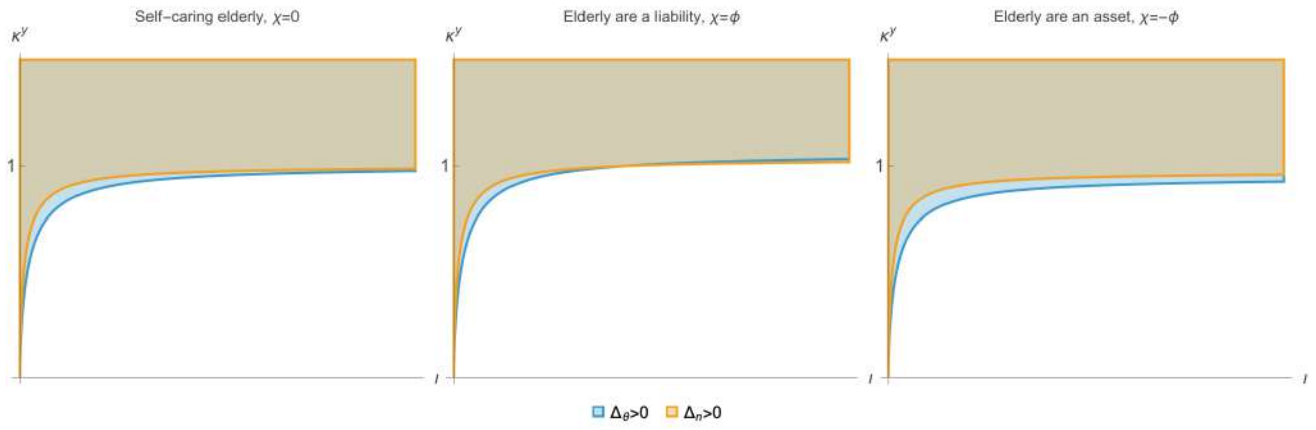


Figure L.4: The inverted Caldwell hypothesis as a special case of the relative income hypothesis. When the two areas overlaps, coresidence is Pareto improving and $n_a > n_c$.

Proof
Upon request. ■

The logic of the model is the now familiar logic of the relative income hypothesis. For a given relative human capital of the young, a higher taste for coresidence makes coresidence more likely. *Vice versa*, given the taste for coresidence, higher relative human capital makes coresidence less likely. As to the differential fertility, in this model, $n_a > n_c$ if $\theta < \frac{h^y}{h^y(1-(1-\tau)\chi)+h^o\tau}$. As before, there is an income effect at work. If the young reap less (more) resources from coresidence than they would have reaped by leaving alone, then they will have less (more) children under coresidence. The prevalence and strength of this income effect depends on the relative human capital of the young, and the parameters λ, κ^y and ζ. What the inclusion of the inverted Caldwell hypothesis does is basically to affect the relative income of the young, by making it dependent also on the parameters τ, and χ. To witness it, in Figure L.4 we represent Proposition 3 and 4 in the (k^y, ι) plane. We fix λ and ζ equal to the calibrated values in Section 4, and we assume $\tau = 1/2$ for the purpose of illustration. We then plot the two frontiers for different values of χ, so as to assess how biting is the inverted Caldwell hypothesis. We first fix $\chi = 0$, meaning that the elderly are neither an asset nor a liability. This allows a comparison with our benchmark model of Section 3. Then, we explore the case $\chi = \phi$ meaning that the elderly cost to the young an amount of time equivalent to that necessary to raise one child. We see this as a reasonable upper bound. Finally, we explore the case $\chi = -\phi$, meaning that the elderly allow the young to save an amount of time equivalent to that necessary to raise one child. In all three cases, the picture is remarkably similar to that from the benchmark model (Figure 11). This suggests that the inverted Caldwell hypothesisis is not necessary to explain the cross-family differential fertility.[33]

[33]This does not exclude the possibility that it helps to bring a quantitative model closer to the data. We leave the evaluation of this possibility to further research.

M Fertility and family structure in an alternative model of the demographic transition

In the model discussed in the main text, the cost of education is normalised to one and thus constant, while the wage rate in efficiency units is assumed to increase over time. Accordingly, the demographic transition turns out to be driven by a decrease in the relative price of education with respect to the number of children. There is some discussion in the literature as to whether this is the best way to model the demographic transition. Doepke et al. (2023), for instance, argue that since teachers are the primary input in education – and hence their wage the primary cost – it is not unreasonable to assume that wages and the price of education must have co-moved along the growth pattern, leaving unaffected the relative price of education with respect to the number of children. They suggest an increase in return to education as an alternative mechanism for the demographic transition and the take-off from stagnation to growth. Accordingly, in this Section, we propose a version of our model, in which the demographic transition is triggered by an increase in the return to the parental investment in human capital: we will conclude that our results on differential fertility and family structure are independent of the way in which we model the demographic transition.

Agents' choices are described by the same model discussed in Section 3, but for the human capital production function and the price of education. The human capital production function is:

$$h_{t+1}^{y} = (1 + \eta_t e_t)^{\beta} h_t^{y}. \tag{61}$$

where $\eta_t > 0$ is a time-varying parameter that will be used to model changes in the return to education.[34]

The price of education is denoted by p_e. Accordingly, the budget constraint of the young when living alone is given by:

$$w_t h_t^{y} = c_t^{y} + \phi w_t h_t^{y} n_t + p_t^{e} e_t n_t + p_t^{x} x_t^{y}. \tag{62}$$

and the budget constraint of a vertical family reads as:

$$w_t (h_t^{o} + h_t^{y}) = c_t^{o} + c_t^{y} + \phi w_t h_t^{y} n_t + p_t^{e} e_t n_t + p_t^{x} x_t. \tag{63}$$

As in Section 4 the taste for coresidence κ^{y} represents the only source of intragenerational heterogeneity. Accordingly, heterogeneity is represented by the distribution $f_t(\kappa^{y})$, which is assumed to be constant over time, i.e. $f_t(\kappa^{y}) = f(\kappa^{y}) \quad \forall t$. Population dynamics is described by equations (32) and (33).

Differently from Section 4, we here assume that there is a separate sector for the production of education. We assume perfect competition in all markets as well as perfect labor mobility. The latter assumption implies that the wage is the same regardless of the sector in which labor supply is utilized.

Education is produced using only the labor supply of young agents; the production function is $E_t = \psi L_t^{ye}$, where E_t is the aggregate output of the education sector, L_t^{ye} denotes aggregate hours of work used in this sector and $\psi \geq 1$ is a productivity parameter. This means that 1 hour of work produces ψ units of education or, equivalently, that to produce 1 unit of education, $\frac{1}{\psi}$ hours of work are needed. Accordingly,

$$p_t^{e} = \frac{w_t h_t^{y}}{\psi} \tag{64}$$

[34]More generally, the human capital production function can be written as $h_{t+1}^{y} = (1 + \eta_t e_t)^{\beta} (h_t^{y})^{\epsilon}$. In the main text we have assumed $\epsilon = 0$ (as well as $\eta_t = 1$). In equation (61), we assume $\epsilon = 1$: thus the production function has constant returns in parents' human capital and the model features endogenous growth. We have also developed an exogenous growth version of the model, i.e. $\epsilon < 1$: the calibration of such a model delivers results (available upon request) that are similar to those presented in this Section.

The final good is produced using the following production function:

$$Y_t = A\left[h_t^y N_t^y\left(1 - \phi\bar{n}_t - \frac{L_t^{y,e}}{N_t^y}\right) + h_t^o N_t^o\right]. \tag{65}$$

where, differently from equation (27), we take into account that a fraction $L^{y,e}/N^y$ of working hours is devoted to the production of education. The price of the final good is chosen as the *numeraire* and, accordingly, perfect competition implies $w_t = A$. Also the modelling of the production of the housing services is identical to that of Section 4.

Agents' choices, once we consider the human capital production function (61) and we replace p_e by equation (64), can be written as:

$$e_t = \begin{cases} 0 & \text{if } \beta \leq \frac{1}{\eta_t\psi\phi} \\ \frac{\beta\phi - \frac{1}{\eta_t\psi}}{(1-\beta)\frac{1}{\psi}} & \text{otherwise} \end{cases} \tag{66}$$

$$n_{a,t} = \begin{cases} \frac{\gamma}{\phi} & \text{if } \beta \leq \frac{1}{\eta_t\psi\phi} \\ \frac{\gamma(1-\beta)}{\phi - \frac{1}{\eta_t\psi}} & \text{otherwise} \end{cases} \tag{67}$$

$$n_{c,t} = n_t^a \theta \frac{1+\iota_t}{\iota_t} \tag{68}$$

with:

$$\iota_t \equiv \frac{h_t^y}{h_t^o}; \tag{69}$$

$$\theta_t = \lambda\theta_{min,t} + (1-\lambda)\theta_{max,t}; \tag{70}$$

$$\theta_{min,t} = \left(\frac{\iota_t}{1+\iota_t}\frac{1}{\kappa^y}\right)^{\frac{1}{1-\zeta}}; \tag{71}$$

$$\theta_{max,t} = 1 - \left(\frac{1}{1+\iota_t}\right)^{\frac{1}{1-\zeta}}. \tag{72}$$

$$\iota_{t+1} = \begin{cases} 1 & \text{if } \beta \leq \frac{1}{\eta_t\psi\phi} \\ \left(1 + \eta_t \frac{\beta\phi - \frac{1}{\eta_t\psi}1}{(1-\beta)\frac{1}{\psi}}\right)^{\beta} & \text{otherwise} \end{cases} \tag{73}$$

Notice that when η is constant, fertility, education and relative income are also constant. The same holds for the stationarized value of the final output, defined as the ratio between Y and the aggregate working hours in efficiency units of the young. Indeed:

$$\hat{y}_t = \frac{Y_t}{h_t^y N_t^y} = A\left[1 - \bar{n}_t\left(\phi + \frac{e_t}{\psi}\right) + \frac{1}{\bar{n}_{t-1}}\frac{1}{\iota_t}\right]; \tag{74}$$

which is clearly constant when n, e and ι do not change over time. Thus, when η does not change over time, the economy is on a balanced growth path in which the growth rate of output is equal to the growth rate of $h_t^y N_t^y$, i.e. $\iota n - 1$.

In our computational exercise, we consider an economy that is initially on a balanced growth path characterized by an education level equal to zero. Then we change the parameter η_t to affect the education decision and look at the impact on fertility as well as on coresidence. We now discuss how η_t and all the other parameters are set.

To calibrate the model, in addition to the data on fertility and coresidence already used in the main text, we use data on education, namely we rely on data on the average years of

Cohort	Schooling$_{(year)}$	Coresidence$_{(year)}$
1803	$0.97_{(1840)}$	$70.49_{(1850)}$
1823	$2.04_{(1860)}$	$66.84_{(1870)}$
1843	$3.64_{(1880)}$	$62.42_{(1890)}$
1863	$4.94_{(1900)}$	$61.66_{(1910)}$
1883	$6.28_{(1920)}$	$55.19_{(1930)}$
1903	$8.41_{(1940)}$	$42.76_{(1950)}$
1923	$10.20_{(1960)}$	$23.97_{(1970)}$
1943	$12.00_{(1980)}$	$16.51_{(1990)}$

Table M.1: Average years of schooling, source: Turner et al. (2006). Coresidence rate of old people from Figure (5).

schooling in the workforce provided by Turner et al. (2006). These data are available every 20 years for the period 1840 - 2000. We stress that, as to education and coresidence, we use aggregate data that mix up several generations. Accordingly, the mapping between fertility data, on the one hand, and education and coresidence data, on the other hand, is not trivial. We think of education in a year as reflecting the parental choices of a generation born 40 years before; for instance, the first data on education we have, i.e. data 1840, is attributed to the choices of parents born in 1801-1805. That's why the latter is the first cohort we consider in our simulation. Unfortunately, for such a cohort, we don't have a measure of fertility; we thus assume that fertility for this cohort (and more generally for all the cohorts born before 1831) is equal to the fertility of the first cohort for which data are available, i.e. the cohort 1831-1835. As to coresidence, we attribute coresidence in a year to the cohort born 50 years before: e.g. the coresidence rate in 1850 is assumed to refer to the cohort born in 1801-1805 and their parents. The relationship between education, coresidence and the different cohorts is summarized in Table M.1 A model period is set equal to 20 years and we simulate the model for 8 cohorts.

As in Section 4, we assume that the distribution $f(\kappa^y)$ is a normal distribution, with mean μ and standard deviation σ, truncated at zero. The procedure described in Section 4 is used to set μ and σ, as well as ϕ, γ, ζ, β and λ.

The parameter η is set so that e_t matches data on education for the years 1840-2000. Since years of schooling in 1840 are not too different from zero (i.e. 0.97), we approximate this value of education with 0 since we want the initial balanced growth path to be a post-Malthusian economy. Accordingly, the parameter η in the first period of the simulation is such that $\eta_1 \leq \frac{1}{\beta\psi\phi}$. The implied values of η_t from simulation period 2 to simulation period 8 are $1.65, 1.77, 1.87, 1.97, 2.08, 2.28, 2.48, 2.72$. As to the production side, A is a scale parameter normalized to 1. The productivity parameter of the education sector, i.e. ψ, is set equal to 9, in order to have a ratio between expenditure on education and GDP consistent with the data for the last cohort we simulate - that is cohort 1943 whose parental investment in education is measured using 1980 data.[35]

Table M.2 summarizes the calibration procedure. Results are reported in Figure M.1.

The model has the right qualitative behaviour: an increase in the productivity of education - captured by η - generates a reduction in coresidence and fertility as well as a shrinkage of the gap between the fertility of nuclear and vertical families. In other terms, we get results that are qualitatively similar to those derived in Section 4, where the demographic transition is triggered by an increase in total factor productivity and not by a rise in the productivity of

[35]The value of education expenditure on GDP in 1980 is 6.2% (see `https://nces.ed.gov/programs/digest/2022menu_tables.asp`). However, GDP in the model abstracts from capital income: it is only represented by labor income. Accordingly to compare the ratio between education expenditure and GDP generated by the model and that in the data we multiply the value produced by the model by labor income share of GDP, which we set equal to 70%.

Parameter	Value	Target
ϕ	0.11	de la Croix and Doepke (2003)
γ	0.30	Average fertility of nuclear families in pre-modern regime
β	0.6	Elasticity of earnings with respect to education
λ	0.99	Average fertility of vertical families in pre-modern regime
ζ	0.56	Share of public to private consumption in the family in 1929
μ	0.69	Coresidence rate of the old in 1850
σ	0.26	Coresidence pattern
ψ	9	Ratio between expenditure on education and GDP in 2000
η_t	Several values	Years of education from 1840 to 2000.

Table M.2: Numerical values of the parameters

education. Thus, we conclude that results on differential fertility and family structure seem to be independent of the way in which we model the demographic transition.

From a quantitative perspective, the model accounts for 27% (44%) of the observed drop in the intergenerational coresidence rate from 1850 to 1990 (1930) and for 52% of the observed reduction in the differential fertility from the 1803 cohort to the 1843 cohort.

When we calibrate μ_t , given σ, so as to perfectly match the coresidence rate in each period (Figure M.2), the fitness of the model improves: the model accounts for 98% of the drop in the fertility differential between the 1833 and the 1943 cohorts.

In Figure M.3, we still calibrate μ as in the second panel, but we shut down economic factors by assuming that the return to education are constant over time. As in the main text, a change in cultural factors only deliver a counterfactual prediction on fertility levels, that is cultural factors alone are not able to reproduce the fertility transition.

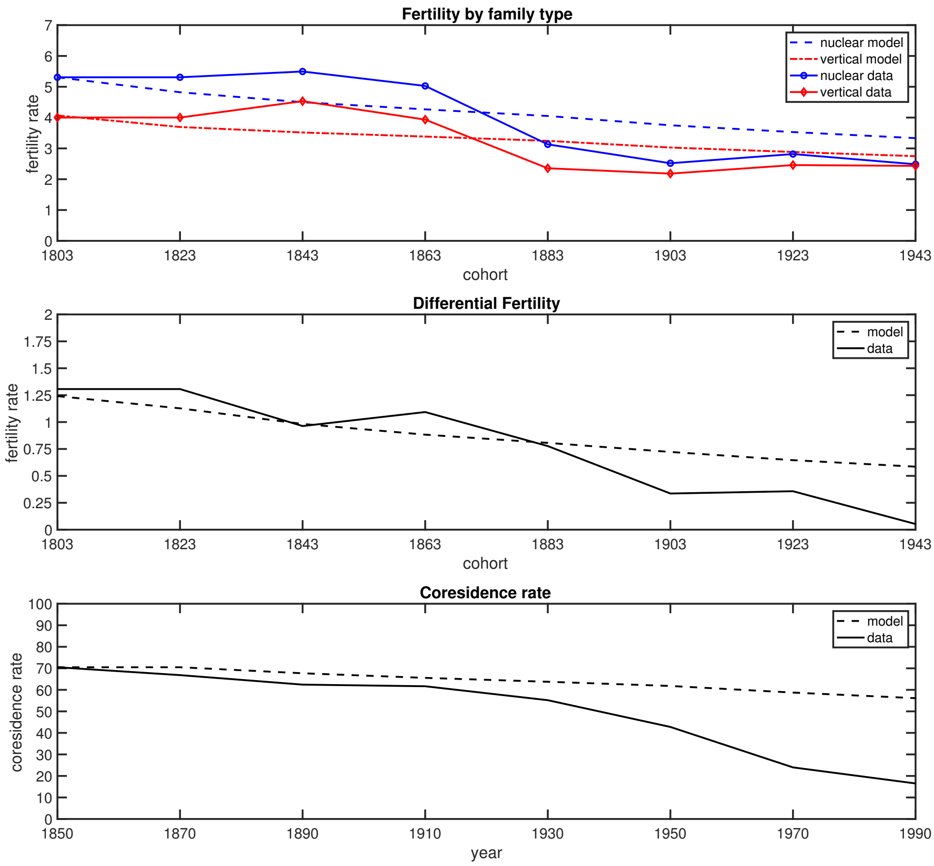


Figure M.1: Simulation results. Benchmark: changing economic factors and given cultural factors.

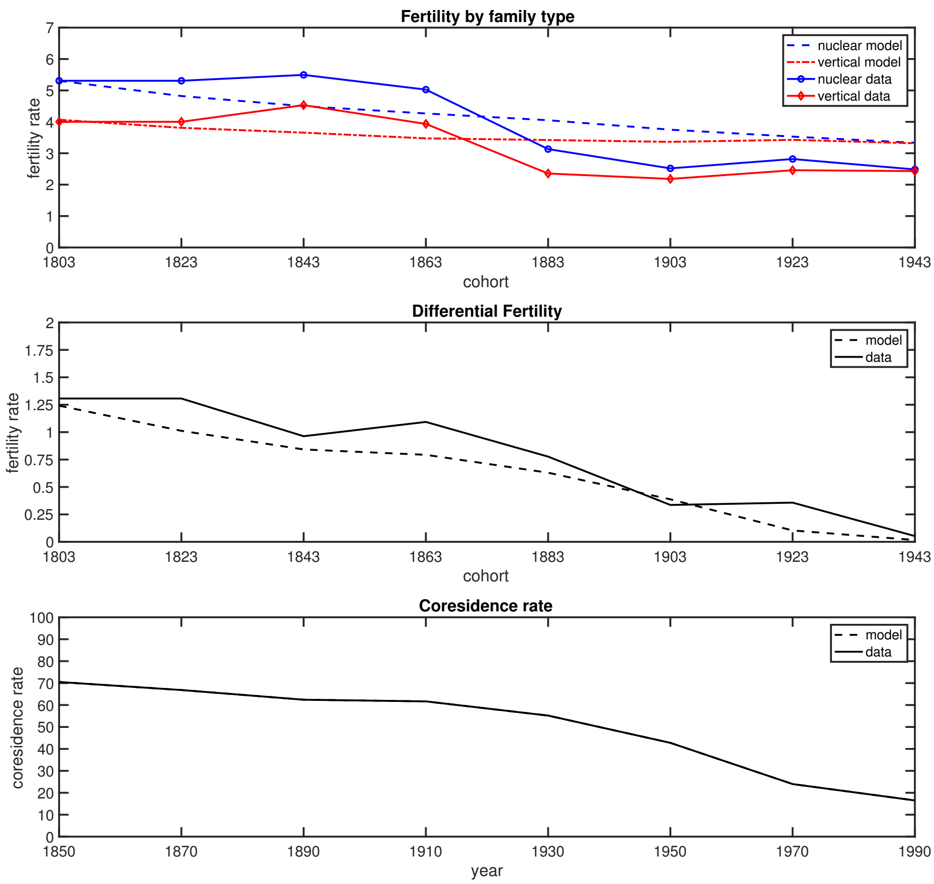


Figure M.2: Simulation results. Variant 1: changing economic and cultural factors.

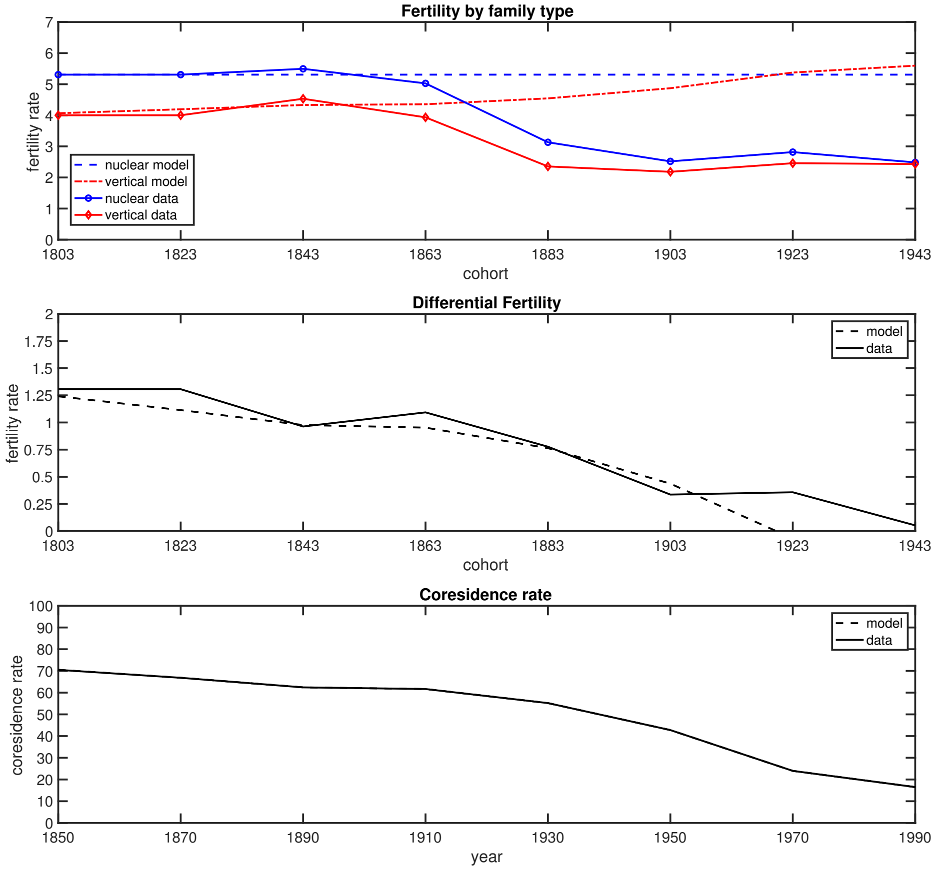


Figure M.3: Simulation results. Variant 2: given economic factors and changing cultural factors.