OLD HABITS DIE HARD (SOMETIMES)
WHAT CAN DÉPARTEMENT HETEROGENEITY TELL US ABOUT
THE FRENCH FERTILITY DECLINE?

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Abstract: Recent developments in endogenous growth theory suggest that fertility decline in
the context of demographic transition matters for achieving long term economic growth and
vice versa. Yet France, the first clear case of fertility decline in Europe, seems to have escaped
this fate. The long-term evolution of birth rates places the onset of the French decline some-
where around 1800, more than 50 years before other regions and when France was still far
from becoming industrialised. This fall was not homogenous throughout the country and
some regions maintained high rates until quite late in the nineteenth century. Variation in
the average levels of fertility among départements reached its peak in the last third of that
century. I take advantage of this diversity within France to explore which local characteristics
explain the different levels of fertility in each region. From various sources, I construct a
panel of département level data for the last quarter of the nineteenth century and study the
correlates of fertility using a fixed-effects model. Results confirm the importance of some of
the forces suggested by standard fertility choice models. Nevertheless, certain non-economic
factors (such as secularisation) for which I provide new measurements also appear to play a
considerable role in explaining the variation across départements.

Keywords: economic history, demographic history (Europe pre-1913), France,
demographic economics, fertility.


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Economists have always considered the study of economic growth important, yet only recently have they given attention to how that growth became more the rule than the exception. Sustained growth has existed in several regions of the world for at least two centuries, but before then improvements in standards of living were marginal or temporary at best. Economic historians have looked at this phenomenon with great interest over the years. Now, many mainstream economists seem to be eager to take the challenge of building models to explain it.¹ One of the main strands of this new literature, stemming from the seminal contribution of Galor and Weil [1999, 2000], gives particular emphasis to the demographic transition as one of the key elements in driving societies away from stagnation [Galor, 2005a: 494].² These models emphasise how important the synergy between technology and population is to explain growth. Either to corroborate the internal logic of these models or to think further on the mechanisms playing a role in them, knowing why fertility fell is of crucial relevance to understand the path taken by Europe away from long term stagnation into modern economic growth.

There is therefore a renewed interest in the discussion on European fertility decline. During the course of the nineteenth century Europe experienced a decline in birth rates across regions to a common low level, but we are still not sure why, as little consensus has been reached on the actual causes of this fall.³ In economics, the classical story of Becker [1960] on the demand for children has parents dealing with a budget constraint and having to decide whether to invest in quantity or quality of children. Galor and Weil’s account incorporates this idea and has increases in skill

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¹ This falls into what is now known as ‘unified growth theory’: models capable of consistently explaining both stagnation and modern growth and the transition from one to the other. See, for example, Jones [2001], Lucas [2002: 109-188], Hansen and Prescott [2002], Galor and Weil [1999, 2000], Galor and Moav [2002], Doepke [2004] and Galor [2005a, 2005b].

² In Galor and Weil’s model, for example, the transition from stagnation to modern economic growth is driven by the interaction of technological change, population dynamics and income growth. In their account, skilled biased technological change widens the skill premia, increases the demand for human capital and motivates parents to switch to smaller but better educated families, which in turn creates a downward pressure on population that leads to higher per capita income.

³ For general overviews, see –for example- Coale and Watkins [1986], Alter [1992], or Pollak and Watkins [1993].
premia triggering the decline. Other authors in similar frameworks, for example, also point out to the role of child mortality [Weisdorf, 2004; Doepke, 2005] or government policy [Doepke, 2004] in contributing to the fall. Although the timing implied by these models does not seem to fit the evidence fully, predictions in general correspond to what actually happened in many regions of Western Europe. This is probably not the case for France, the first country to experience a fertility decline. France clearly led the transition and a long time passed before any other region followed. At the same time, it was probably one of the least industrialised regions in Europe and child mortality had not noticeably decreased as in other places like England. In this way, France appears as an interesting case to study the factors driving fertility decline where the standard economic factors do not seem to play a straightforward role.

Quite distinct from other European experiences, France maintained a considerable diversity in terms of birth rates throughout the 19th century. Therefore, the behaviour of the whole country is likely to hide local heterogeneities that could allow us to make sense of the apparent French puzzle. With that motivation in mind, this paper looks into what factors have been suggested in the economic and demographic literature as determinants of fertility and assesses how much they can explain differences within France. I take advantage of the heterogeneity and assess quantitatively the correlates of fertility using département level data, an approach not yet exploited elsewhere, but already suggested as one promising line of research [Brown and Guinnane, 2005]. Taking variables collected mainly from the Annuaire Statistique de la France [Service de la Statistique Général de France, 1878-1903], as well as from other sources, I put together a panel data set comprising a period of 25 years (quinquennial data between 1876 and 1896) that I use to evaluate various hypotheses. In particular, I look at the potential effect of variables such as infant mortality, urbanisation, income, financial development, female and male education, religiosity and political participation on the levels of fertility, controlling by the internal migration of women. Since the panel structure allows me to introduce departmental and time fixed effects, I can also control for unobservable data to better recognise the relevance of the variables I assess. I find evidence that confirms that infant mortality indeed played the expected role in explaining local differences, as well as female literacy.

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4 See, for example, Clark [2005: 511-512].
Income, nevertheless, appears to have a positive impact on the size of families, suggesting that children might be considered as a normal good. My results are also consistent with arguments that suggest the French Revolution contributed to the decline, as secularisation (for which I propose a new proxy) might well have been relevant in explaining the early onset of the decline in fertility in that part of Europe. This latter finding highlights the influence cultural factors could have in driving these dynamics and suggests they should probably be introduced in future theoretical modelling.

A LOOK AT THE FERTILITY DECLINE IN FRANCE

That Europe experienced a decline in fertility (the rate at which women bear children\(^5\)) that led rates across regions to a common, low level is widely known. Families consisting of a couple with one or two children have become the norm and countries that not long ago looked very different in this respect such as Italy and Germany, or Spain and Belgium are now quite similar. This contrasts with what happened two and a half centuries ago, when the average household across the region had six or more children. As with many other variables, historic data on births is scarce, but family reconstitution figures suggest that before 1750 all European regions behaved somewhat alike in terms of fertility [Flinn, 1981: 30-31]. Between the mid-eighteenth and late twentieth centuries, however, those trajectories diverged.

The peculiarity of France in the European context

A sense of the different experiences can be grasped by looking at some carefully selected cases. Here I begin by paying attention to the crude birth rate (that is, the number of births per 1,000 population). The crude birth rate is considered a coarse measure of fertility, at least as opposed to more sophisticated ones like the total fertility rate or the gross reproduction rate, but remains the most readily and widely available measure for cross-country comparison. Figure 1 depicts (smoothed) series of this variable for England and Wales, France and Sweden since the middle eighteenth till the late twentieth century. The pattern of Sweden is representative of what went on in most other regions of Europe. Pre-industrial fertility is characterised by

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\(^5\) Not to be confused with fecundity, the biological capacity of becoming pregnant.
some fluctuation around a relatively high (to modern standards) mean, followed by a
decline that begins at some point after the middle of the nineteenth century and that
goes all the way up to the interwar period. For Sweden that initial mean was about
33 births and the fall became evident after 1865. Other countries started at a higher
rate like Finland (around 40) or at a lower rate like Denmark (around 31), and had
different timings for their respective turning points, but their story is essentially the
same. England and Wales could be included in that description, but its fertility rate
had the particularity of showing an increasing trend well into the nineteenth century.
That trend reaches a halt around 1820, when a deep fall leads births to a level of 35.7,
which is maintained in a 50 years plateau until the definitive (and steep) decline in
the last quarter of the century. These patterns contrast with that of France, where the
initial level is quite high (40 births), the fall comes early (around 1800), and fertility
remains below that of the rest of Europe until the First World War.

Figure 1. Crude birth rates in France, England and Wales, and Sweden, 1745-1985

and Mitchell [1998: 93-116]; and, for Sweden, Statistiska Centralbyran (Statistics Sweden,
http://www.scb.se/indexeng.asp). Values are 11-year averages, centred in the year.

The early arrival of the French fertility decline is, to some degree, quite puzzling.
There is an ongoing debate on the actual forces driving this whole process in Europe,
but there is some consensus on the fact that modern, industrialised, urban economies
tend to have low fertility rates (see, for example, Dasgupta [1995] or Schultz [1997]).
At the same time, many studies agree on noting that France was –at least compared
to Britain—relatively traditional and rural (for example, O’Brien [1996]). Even in this context, the assertion that the fertility decline in Western Europe began in the wrong place might sound like an overstatement, but it is still the case that on the eve of the nineteenth century two of the largest economies in Europe were about to take two very different and divergent trajectories. It is also the case that one of them entered a process of rapid technological change, industrialisation and urbanisation while the other remained for the most part rural and agricultural-based. And it is the case that one of them experienced—from the very onset of this period—a secular decline in the number of births while in the other that process had to wait quite a few decades. Any moderately informed individual will assert nowadays with little hesitation that the early fall in fertility rates took place in the economy going through this impressive modernisation. And they will be wrong. In this convergence story France was clearly the forerunner.

This issue has attracted many researchers, and as early as 1902 more than 200 works on French ‘depopulation’ could be counted [van de Walle, 1974: 6]. Although many of these studies, and those that followed in the twentieth century, worked with substantial datasets, analyses remained mainly descriptive and conjectural at best. Only recently have there been some attempts to bring a more systematic quantitative approach to the subject (as can be seen in Weir [1983, 1984a, 1995] or Bonneuil [1997]), but there is still some way to go in exploiting already available data and, with the help of rigorous quantitative techniques, unveil a part of France’s particular story and shed light on the larger questions on the demographic transition. I bring a new approach to the problem by exploiting the heterogeneity among départements to explore the determinants of fertility within France. As Schultz [1997] does to understand the different levels of fertility in developed and developing countries, I perform a panel analysis of the covariates of fertility to account for potential fixed effects. This way of studying fertility has become increasingly popular in the last few years but it has rarely been applied to historical analysis,6 basically due to scarcity of data or lack of variation in the variable to be explained. To deal with the first of these problems, I put together a rich dataset containing information for all French départements in five year intervals, covering the last quarter of the nineteenth century. Regarding the second, as it will be shown in the following sections, it turns out that

there was considerable variation across districts, making the quantitative analysis meaningful.

Measuring fertility

For current populations there are a considerable number of refined alternatives to measure fertility, but when dealing with historical data the choice is very much restricted to coarse measures [Ewbank, 1993]. I referred above to the crude birth rate as one of them. It only describes the contribution of newborns to population and hides many relevant facts about the actual behaviour of couples like ages of conception, spacing between pregnancies, or illegitimate births, that might be of particular interest for the researcher. Due to lack of appropriate details about cohort birth rates, information about an interesting and very intuitive measure such as total fertility rate (that is, the estimated number of children per woman) is scarce and scattered at best for the nineteenth century. An educated guess would say that for France in that period a crude birth rate of 40 in the pre-transition stage represented a total fertility rate of about 6 (that is, a woman on average has around 6 children) whereas a birth rate of 15 in the post-transition stage can be associated with a total fertility rate of about 2, but measures do not fully overlap. When trying to understand a process as dramatic in terms of behavioural change as the fertility decline more descriptive terms could become useful.

For this study I rely on an index of marital fertility, normally called ‘Ig’, developed in the context of the European Fertility Project [Coale and Watkins, 1986]. For the sake of evaluating differences among countries a comparable measure was sought. The unit of reference chosen was the biologically maximum fertility attainable. This index of marital fertility is then defined as:

\[
I_g = \frac{B^m}{\sum_{a=15-19} N_{a,t} m_{a,t} h_a}
\]

Where \( B^m \) is number of legitimate births in year \( t \), \( N_{a,t} \) is the number of women of age \( a \) in year \( t \), \( m_{a,t} \) is the proportion of women of age \( a \) actually married in year \( t \) and \( h_a \) is
the rate of childbearing of married Hutterites at age $a$. Considering that Hutterite fertility establishes a proxy for the ceiling of what is biologically possible, Ig represents the proportion of births with respect to the maximum biologically attainable given the age structure of married women. For the sake of comparison, I depicted in Figure 2 the evolution of the crude birth rate and the Ig estimates for France [Weir, 1994].

**Figure 2. Crude birth rate and marital fertility (Ig) in France, 1745-1906**

![Crude birth rate and marital fertility (Ig) in France, 1745-1906](image)


Marital fertility in the initial part of the period was around 0.8. This roughly means that married women were having as many children as 80% of what was biologically possible given the age and marriage structure. Such a level suggests little or no control over fertility in the eighteenth century, especially if one bears in mind that cultural differences such as longer breast-feeding periods or biological disparities such as nutritional deficiencies prolonging post-partum amenorrhoea could explain by themselves the divergence from the Hutterites rates. With respect to the crude birth rate, the picture is not substantially altered but some distinctions can be pointed out. Most notably, marital fertility does not immediately follow the crude birth rate down

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7 The Hutterites are an Anabaptist sect that adheres scrupulously to precepts forbidding the practice of contraception or abortion, and their mothers do not nurse their infants more than a few months. They have the highest fertility rates recorded to date and are representative of the maximum biologically attainable.
in the middle of the eighteenth century, and likewise in the first half of the nine-
teenth century.

In those two periods France experienced sharp decreases in the marriage rate that, by reducing the population at risk of having children, produced a decrease in births per population. Increases in population that followed the notable decreases in mortality of the period further reduced that variable. To some degree, this index is indeed an improvement from the alternative measure we have. Also, as the data requirements to generate it are quite modest, estimates of marital fertility are available for France at département level for the census years from 1831 onwards [Coale and Watkins, 1986: 94-107], making it an appealing candidate for any study of fertility. The Princeton group produced similar indices to describe non-marital fertility (Ih) and total –of the whole population- fertility (If) using this principle (see Coale and Treadway in Coale and Watkins [1986: 153-162]), but I will concentrate my analysis on marital fertility. On one hand, there are good reasons to think that information on births out of wedlock is less reliable than information on married couples. On the other, and probably more importantly, given the scale of the phenomenon in France, a radical change must have happened within the family and -in particular- in the mind of the married couples. The index is, of course, not without drawbacks. Guinnane et al. [1994] have highlighted some of them, most notably the difficulty of inferring the timing of fertility transitions from it. Also, the correlation between this index and the total fertility rate -a more intuitive concept- is not straight-forward. Still, I will argue later that many of these problems do not pose a serious impediment in drawing cautious conclusions from the analysis I perform here.

The blessing of diversity

To explore whether there was any degree of heterogeneity in terms of fertility in France, I begin by plotting in a series of maps the levels of marital fertility for selected years. The story conveyed by the maps in Figure 3 is quite telling. All throughout the period it is easy to see –quite distinctively- at least two zones of low fertility, in the valley of the Seine (the Bassin Parisien) and the region of Aquitaine (the Bassin Aquitaine), spreading while the two ‘islands’ of high fertility, the region of Bretagne in the north-west and the Massif Central in the centre-south-east, keep
shrinking. As early as in 1831 one can find départements with indexes below 0.40 (evidencing clearly attempted and sometimes successful fertility limitation), such as Gironde, Lot-et-Garonne or Eure. As late as 1901 places like Finistère or Côtes-du-Nord were resisting change and still had indexes above 0.70 (showing little or no limitation at all).

The maps suggest a (slow) process of diffusion from the Parisian and Aquitaine basins towards these ‘islands’ of high fertility. As in other diffusion processes, from a fairly homogenous population a particular region begins with a new ‘status’ and it transfers it to the surrounding areas which, in turn, will transfer it to their surrounding areas, and so on, spreading like a disease. It is quite unfortunate that there are no data available for earlier periods, as it would be interesting to spot the early focuses of this new behaviour, but the picture we already have is revealing. The thing that is still quite puzzling –if we are to assume that there was indeed diffusion- is its speed. The diffusion of knowledge or new technologies is expected to be fast, and the picture just depicted describes a process that takes more than a century. If there was diffusion of this new behaviour, what was actually being diffused?

Setting this question aside for a moment, as I will try to answer it later, the distinctiveness of France can be illustrated by taking a look at other European regions. Here the comparison with England, the new industrial economy across the channel, seems inevitable (although it should be taken cautiously, as the size of the region is only half of the French one in terms of population). Regional comparable data is available only after 1851 but, then again, England arrived quite late in the fertility transition. Figure 4 below shows a clear contrast with the French case.
Figure 3. Marital fertility index (Ig) in France for each département, 1831-1921

Sources: Maps are mine, constructed using data from Coale and Watkins [1986: 94-107].
Figure 3 (cont.). Marital fertility index (Ig) in France for each département, 1831-1921

1881

1891

1901

1911

1921

Sources: Maps are mine, constructed using data from Coale and Watkins [1986: 94-107].
Throughout the eight decades displayed it is quite difficult to say whether a particular region behaved as a leader and other as a follower. Changes in fertility seem to be pretty homogeneous across the country and at best it is pretty hard to say at any time that there is a clear heterogeneity among counties.\textsuperscript{8} If there was a process of diffusion taking place in England, it was indeed much faster.

\textbf{Figure 4. Marital fertility index (Ig) in England for each county, 1851-1921}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\end{figure}

\textbf{Sources:} Maps are mine, constructed using data from Coale and Watkins [1986: 88-93].

\textsuperscript{8} If English counties were larger (as a percentage of England) than the French \textit{d\textsuperscript{e}partement} they might be hiding some heterogeneity and look more homogeneous. Nevertheless, they are not. In the early 1870s, if we take out London (as it is a clear outlier), both France and England had two large administrative areas (Seine and Nord, and Lancashire and West Riding in Yorkshire) and the rest were distributed in pretty similar way. If anything, French \textit{d\textsuperscript{e}partement} were larger in size (an average of 387 thousand individuals -s.d. 150.3-, versus 304 in England -s.d. 173.7-), so they might be hiding more heterogeneity [English data comes from Mitchell, 1988: 30-31].
Figure B (cont.). Marital fertility index ($I_g$) in England for each county, 1851-1921

Sources: Maps are mine, constructed using data from Coale and Watkins [1986: 88-93].
In terms of the questions we wish to answer in this paper, the actual experience of France provides an invaluable resource for research. One of the implications of the observed slow diffusion, which can also be perceived from the maps, is that heterogeneity must be first increasing and then decreasing (as is standard in diffusion processes). While the average fertility for the country as a whole is decreasing, the variance between départements is expected to increase to then decrease. Figure 5 illustrates this point.

**Figure 5.** Mean and variance of marital fertility (Ig) within departments (1831-1921)


This period of both great heterogeneity between départements and decreasing mean value of fertility level provides a unique set up for an analysis of temporal and cross-section variation. Ideally, one would use individual or family level information but, for this period, that is –at best- hard to find. Fortunately, in 1878 the government of France began to publish systematically some statistical series (that appeared yearly since then) under the name *Annuaire Statistique de la France* that, though not having individual level disaggregation, counts with diverse information for 87 départements.

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9 There is, indeed, some micro- disaggregated information for some places in France and many case studies of some villages have been done. See, for example, Weir [1995].
in the period when the heterogeneity among them in terms of fertility is maximised, providing a good second best alternative for this study.

THE MODERNISATION OF THE WESTERN FAMILY

Economists, demographers, historians and sociologist have all tried to provide answers to the puzzles in this debate, bringing their own analytical frameworks, jargon and methodological techniques, making the literature itself some kind of a puzzle. I will not attempt to convey here all the details of that debate, as it has been done extensively elsewhere, but I will introduce some of its concepts and ideas that will be useful to understand the logic behind the alternative hypotheses I evaluate below.

The Malthusian story

Despite its limitations, the Malthusian model remains the main way to understand population dynamics in past societies. Two factors have decisively contributed to the persistence of this model in the academic literature: its relative simplicity and the fact that it seems to work fairly well (see, for example, Wrigley and Schofield [1981], Weir [1984]). This could come as a surprise to anyone raised in the modern economic approach to family behaviour. Gary Becker [1991] taught us that couples make choices about the size of their families. But, at the core of the Malthusian argument fertility is controlled by external factors, cultural norms that act by delaying (or even discouraging) marriage, for it was not in the parents to choose the number of children they would have. This story seems far-fetched now but, reframed in terms of bounded rationality or social/moral costs the success of the Malthusian story in explaining pre-industrial population behaviour is not necessarily bad news for the microeconomic approach [Murphy, 2006]. Individuals (in this case, couples) have limited resources to make decisions and, sometimes, choosing not to choose could be

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10 There are many articles that look into this. See, for example, Tilly [1976], Weir [1983], Coale and Watkins [1986],Alter [1992], or Pollak and Watkins [1993].

11 As a reverend, a man of God and the church, Malthus could not possibly think that, though 'neither theory nor experience will justify us in believing either that the passion between the sexes, or the natural prolificness of women, diminishes in the progress of society' [Malthus, 1817 Appendix: 483], couples could intervene in between this dynamic and the actual procreation.
indeed an optimal decision. Alternatively, there might be some unobservable social costs (born out of moral rules set up in the past, probably to provide solutions to other problems) associated with that decision. Maintaining the *status quo*, keeping old habits, is a way of avoiding dealing with complex information or new ways of sorting out problems. In this sense the *passive* attitude in the Malthusian framework is consistent with the modern interpretation of fertility choice.

The big change in historic terms is from passive to active control of fertility. Birth control is compatible with passive fertility control and can be expected, if it exists, to ease the movement toward active control. Malthusian preventive checks (that is, the steep positive slope in the curve of births) involve, in one way, passive controls; biological limitations and customs more than actual decisions. Social arrangements that increase the age of marriage, extend the period of breastfeeding or discourage sexual intercourse for some time after the delivery of a child are some of them. Even *coitus interruptus* seems to have been present in early modern European societies in a form of social norm or tradition [Santow, 1995]. In this set-up, families have fewer children than the maximum attainable not exactly because they choose to but because that is the maximum they can attain given the social institutions. In the words of Easterlin and Crimmins:

> “Fertility in preindustrialized societies seems to be strongly determined if not controlled in the sense we give to the word today. It is determined by a network of sociological and biological factors and when the network is known, the result can be predicted. Freedom of choice by couples is almost absent. The couples have the number of children that biology and society decide to give them.” [Easterlin and Crimmins, 1985: 5]

The *active* control of fertility, on the other hand, presupposes not only knowledge about and access to contraceptive techniques and the concept of being able to control the actual size of the family, but also the couple’s assessment of control as a *possibility* and the actual motivation to control. This was succinctly put by Coale [1973: 65], when he identified three conditions for a fertility transition: effective techniques of fertility reduction must be known and available, fertility must be within the calculus of conscious choice, and reduced fertility must be perceived as advantageous. As the following discussion elucidates, it is hard to argue that in eighteenth century France neither ignorance nor lack of contraceptives could be claimed as limiting factors for
birth control, leaving room only for change in motivation or attitude to family control on the side of parents as the trigger of the transition.

**Understanding fertility dynamics**

There could be, of course, unaccountable variables affecting fertility. Many models have been suggested analysing this problem, but the Easterlin model (or Easterlin synthesis as it is referred to sometimes) is the one that unites most of them and provides a suitable environment to assess alternative hypotheses [Easterlin and Crimmins, 1985]. The model states that the number of children born is a consequence of the interaction of a set of basic determinants, namely, the demand and supply of children, as well as the regulation costs of controlling fertility. In this very simple model, the number of births is determined by two basic factors, level of natural fertility ($N$) and level fertility control ($FC$), and affected by a random disturbance ($\nu$):

$$\text{births} = N + \theta FC + \nu$$

Natural fertility refers to the level of fertility associated with no active control, and it is dependant on a range of biological and cultural variables, such as duration of marriage, birth intervals, nutrition of mother, etc. The level of fertility control, on the other hand, could be thought of as affected by at least three components:

$$FC = \phi + \varphi (Cn - Cd) + \eta RC + \mu$$

That is, it depends on the motivation for fertility control, represented here by the difference between supply of children ($Cn$) and the demand for children ($Cd$), and the regulation costs ($RC$), including both market costs (such as the cost of particular contraceptives) and psychological costs (such as the displeasure of abstinence, the moral cost of going against the religious beliefs, etc). A complete model would then look more or less like this:

$$\text{fertility} = f(N, FC) \text{ with } FC = \begin{cases} FC*(Cn - Cd, RC) & \text{if } FC^*>0 \\ 0 & \text{otherwise} \end{cases}$$
In the next few sections I will look into the different components of this relationship, assessing their potential influence on fertility, to set up an empirical model that I can use to evaluate the determinants of fertility.

*Motivation to control fertility*

The supply of children is, of course, associated with natural fertility, the components of which are rather difficult to measure; nevertheless, it is also affected by the mortality of children, which is observable. Even if we assume that couples had some degree of control over the size their families, child mortality is a factor on which couples have only a marginal influence and, in historic perspective, its role is not trivial. When the number of children one can have is not certain because of a high risk of death at early age (in some places in mid-nineteenth century France the risk of dying in the first year of age was as high as 1/3), couples might increase their fertility only to make up for the expected loss.\(^\text{12}\) So, when assessing the influence of the supply of children on fertility, though we might not be able to say much about several determinants of natural fertility, we do have an expectation on the role of child mortality, namely that it should be affecting fertility in a positive way.\(^\text{13}\)

Looking now at the demand side, as with other goods the demand for children is expected to be determined by income and tastes of the parents, as well as the prices they face in the market. Within the context of socially determined economic goals and within bounds largely set by biological and psychological factors, one can think of fertility behaviour as economically rational. If fertility decisions are (or become) economically rational, they could be incorporated in the traditional neoclassical framework and the literature on micro-foundations of family behaviour tries to do precisely that. Neglected by modern economist until the 1950s, since the 1960s the debate on fertility has gained momentum. Gary Becker promoted the current domi-

\(^\text{12}\) In some cases the survival of the children depends on the attitude of parents and child mortality could be a substitute for contraception to control family size [Brown and Guinnane, 2002: 41]. However, some models suggest that the decrease in mortality is more modest than the consequent declines in fertility [Doepke, 2005], motivating the idea that other factors should be accounted for.

\(^\text{13}\) Of course, fertility might also be causing some child mortality and one has to be aware of this potential endogeneity problem.
nant framework that suggests that families indeed decide their size. The general approach he pursued was to assume that couples maximise, subject to a budget constraint, a utility function consisting of the number of children and all other goods, from which one obtains a demand for siblings. From this basic set-up, the literature has spread in different theoretical directions, allowing for numerous specifications: incorporating alternative characteristics of the utility function, modifying the structure of the budget constraint or including life-cycle dynamics. In essence, however, they all suggest that fertility depends on a number of factors affecting (unsurprisingly) the cost and benefits of having children.

In the simplest of the frameworks, children can be seen as consumption good. They are a source of satisfaction for the parents, and parents value them for that. This interpretation goes along with the idea that people are genetically predetermined to like their own children, and it is consistent with the Darwinian notion that any living creature attempts to maximise its representation in the next generation. Alternatively, using the idea of human capital, families could be viewed as productive units, and children as assets that are costly to produce and that yield some return over time. Under this reading, one can see children as a source of future services, especially labour or social security. Something that is common to both the consumption good and the capital good interpretation is that children consume resources (specifically time and money) that could be used in alternative ways, thus imposing some limit in the number of offspring couples want to have. The relevance of this constraint became more apparent after two important theoretical breakthroughs in the debate on fertility choice. The first is associated with the trade-off between quantity and quality (that is, how healthy or educated children are), and was suggest originally by Becker [1960]. If parents are interested in the quality of their children (and they will, either because they care for them or because they want them to generate a higher return in the future), and that quality does not come for free, one expects that at some point a substitution might come into play between quality and quantity. In this context, for example, the sudden possibility of social mobility could have stimulated a change from quantity to quality, motivating birth control. The second idea has to do with the opportunity cost of the parents and was initially proposed by

---

With Willis [1973]. The logic goes back to the idea that raising a family costs money and time. Although higher wages mean that parents could devote more resources to raise infants, they also imply a higher opportunity cost of the time devoted to them.

These insights provide some clues on where explanations for the change in attitude towards fertility could be found. Needless to say there might be many factors affecting the demand for children, but we can begin by assessing those that are more readily available in historical data. In rural, sometimes self-sufficient, communities for example, children can begin to contribute to family income earlier because agricultural labour requires usually less skills than industrial labour. Also, the direct access to food supplies decreases the costs of having additional children. So urbanisation should discourage fertility and in a similar way the size of the agricultural sector could encourage it. The effect of income, on the other hand, appears to be slightly ambiguous. It is probably the case that children are normal goods, suggesting that an increase in income will contribute positively to their demand and at low levels of income this might be the case. After a threshold, nevertheless, parents might consider switching to invest in quality rather than quantity of children, so the direction of the effect could be reversed. We can also look at children as investment goods and this leads us to the role played by financial institutions, as the introduction of alternative ways of investing could reduce the demand for children. Lastly, education might play a dual reinforcing negative role on fertility. On the one hand, more educated parents are likely to have higher wages and hence higher opportunity cost of time. This is of particular relevance for women, who normally devote more time than men to the raising of children. On the other hand, access to education—and the possibility of social mobility—could encourage parents to move towards higher quality and lower quantity.

Means to control

It is probably too often assumed that people out of reach of clinics, condoms and pills are helplessly generating uncontrollable numbers of offspring. Becker [1991: 138-139] has suggested that societies have, in fact, maintained high levels of fertility even when they have the means to reduce it significantly. Most cultures across space and time have had some method to control the size of their families. Abstinence, coitus...
interruptus, abortion, and infanticide –for example- were generally known. It can be argued then that families have always planned their size and that the number of children couples had in the past was not the consequence of ignorance, but of rational choice. Still, most family planning schemes developed in the twentieth century for the third world were based on the idea that couples had many children not because they wanted to, but because they lacked the knowledge and means to control their fertility. This and the fact that even nowadays in developed economies the percentage of unwanted pregnancies is high casts some doubt on the idea of rational fertility choice and easy access (more to knowledge than to means) of contraceptive techniques. It seems to be the case that in the modern world there is some degree of ignorance regarding reproductive matters that explains a proportion of births. But, is it obvious that past societies shared that ignorance? There is at least one argument against that presumption since –unlike modern, urban societies- predominantly rural communities (as was the case for the greater part of France in the late eighteenth century) had to deal with reproductive matters on a regular basis. The breeding of domestic animals was an essential part of the daily activities and knowledge of animal reproductive behaviour must have been widely known. Details about the peculiarities of human fertility might have been missing, but knowledge about the general dynamics of reproduction must have been present.

Anecdotal evidence provides further reasons to believe that in early modern France means of contraception were known and accessible. Many eighteenth century writers talked about the ‘art of cheating nature’ (see van de Walle [1980], or van de Walle and Muhsam [1995]). It is known that nobility and urban bourgeoisie practised some degree of family limitation [van de Walle and Muhsam, 1995: 261]. Little information is available regarding the lower social classes and, when available, it generally refers to extra-marital relationships. Still, there is some evidence that since the late eighteenth century the practice of wet-nursing was becoming less popular and, consequently, breastfeeding was common [McLaren, 1990: 163]. Also, the idea that semen might affect the baby’s milk seems to have been pervasive, generating a reinforcing mechanism with extended breastfeeding [Santow, 1995: 30]. Although abstinence and changes in the frequency of coition might have been related to that, what appears to have been frequently used at the time was coitus interruptus. Contrary to common belief, this simple tool to control fertility is highly efficient: only 14% first-
time users are expected to conceive accidentally during the first year of use against, for example, the 18\% that are expected if using the rhythm rule [Santow, 1995: 29-30]. Most of the literature agree that ‘sin of Onan’ was fairly widespread in France at the time and might have been the main mechanism driving the fertility decline (see Flandrin [1979], van de Walle [1980], McLaren [1990], Santow [1995], van de Walle and Muhsam [1995]). Alternative instruments associated with different ways of having intercourse like sodomy, or intercourse without ejaculation (*amplexus reservatus*) were normally reserved for prostitution. Other, rather more expensive, contraceptives may have had only a minor role. Both condoms and sponges were available in eighteenth century France but they were quite expensive and used more to avoid contagion of venereal diseases than to control births [McLaren, 1990: 157-158]. One could assume that prostitutes had some knowledge also about the rhythm rule, but outside those circles such a knowledge seems to be relatively limited or misunderstood [McLaren, 1978: 467-468]. Action after conception seems to have played a major role. Infanticide, widely used in Asia, was never popular in Europe, but abortion was known and increasingly practiced. Whereas in the early modern period it seems to have been reserved for young unmarried women or prostitutes, throughout the nineteenth century it became more and more common among married women [McLaren, 1978].

Overall, it seems that instead of a diffusion of new contraceptive techniques, nineteenth century France experienced the spread of already known and available means to control fertility. In the late eighteenth century France a new model of family began to prevail in which the number of children were consciously planned by the parents, by means of sexual continence, *coitus interruptus* [Santow, 1995] or, if everything else failed, abortion [McLaren, 1978].

*Choice to control?*

The question is whether or not families in France were actually deciding the size of their families. At first sight this might seem rather obvious, since the decrease in fertility experienced in France is difficult to explain unless there is an active role of couples in deciding how many children they would have. But there was in early modern Europe a traditional belief that man had few ways of influencing nature,
technologically (he simply could not affect nature) or morally (he should not affect nature), and procreation did not escape this principle. The shift came when couples changed their attitude toward family to actually decide the number of children they would have.\textsuperscript{15}

Here I suggest, in the line of Weir [1983, 1984b], that the French revolution had an important effect. The simultaneity of the French revolution with the onset of the fertility decline is suggestive but, could the revolution have had anything to do with it? I will argue that it did, and that it did so by breaking a bond with the Catholic Church and with the unquestionable power of authority, hence encouraging self-determination in many aspects of life, including family planning.\textsuperscript{16} My argument about the rise of choice in family size mirrors in spirit the reasoning used by Hicks [1969: 9-24] to explain the rise of the market.\textsuperscript{17} Regarding children as goods, historical accounts suggest pre-eighteenth century French fertility behaviour was dominated by a certain mix of custom and command (see van de Walle [1992], and McLaren [1990]), represented by the Catholic dogma/church and reflected in the fact that “being a gift of God, the child was taken back by God when it pleased Him, and parents should accept both events with the same piety” [Flandrin, 1979: 178]. Predestination in family structure was the rule rather than the exception. And this was expected to continue until economic forces made this logic a burden too heavy to carry or, in other words, until the cost of not taking the decision would have become too high.

But in France something else happened. The French Revolution broke with the legitimating institution of this body of traditions that sustained the passive role in fam-

\textsuperscript{15} Simply put, in terms of Easterlin’s model described above, this happens when RC becomes substantially smaller than infinite.

\textsuperscript{16} Weir [1983] makes a similar point but also suggests that the revolution influenced land redistribution, putting further incentives toward family reduction.

\textsuperscript{17} Hicks talked about the existence in past times of two ways of producing and distributing products not related to market mechanisms: custom and command. In times of peace a certain body of customs provide the basic guidelines on how the exchange of goods should be done. When a crisis (war, famine, etc) came, this set of traditions would lack the flexibility needed to adjust to the circumstance and someone would eventually take the role of leader to command over the scarce resources of the economy. In this context, early history is seen as a movement from one combination of custom-command to another until certain conditions stimulate the emergence of a third way to deal with production and distribution: the market economy.
ily planning before economic factors generated the break. The country remained, of course, Catholic all throughout the nineteenth century. Further, the church enjoyed considerable financial and practical support from the State. But this was at the cost of concessions in respect of the appointment of bishops and limitations on its freedom. In few areas of interest for the church was this felt more than in the educational arena. And, with education, the church lost a key tool to maintain the status quo of the dogma. Needless to say, some regions in France were more receptive than others to this, and the map in Figure 6 shows how religious primary school education was unevenly distributed across the territory.

Figure 6. Religious Education (% primary school students in religious institutions) in France for each département, 1876

Sources: Author’s calculations, constructed using data from Service de la Statistique Général de France [1878: 240-243].

If we have in mind the two ‘islands’ of high fertility we saw in the previous maps, the correspondence is striking. Both in the region of Bretagne and the Massif Central there is, on average, a higher proportion of student attending religious schools. Interestingly enough, those same regions are identified by Jones [1988: 219] as the heart-lands of the counter-revolution after 1789. The Revolution opened the door for an alternative mindset, affecting the costs of making some decisions. In some sense, political self-determination could have influenced individual self-determination en-
encouraging, among other things, possibility of choice in family size. A similar argument is elaborated by Binion [2001] when comparing American and French experiences of fertility decline. North America was also an early starter in the transition and, interestingly enough, also experienced a democratic revolution which led Binion to think that this attitude of self-determination encouraged by the events in each country can provide some explanation:

“The French and American peoples were unique in the eighteenth century in accomplishing unprecedented demographic transitions and, concomitantly with these, two great political revolutions that were also unprecedented […] The same spirit of the age that rejected the ancestral patriarchal authority in the political sphere also rejected it in the domestic sphere” [Binion, 2001: 172-174]

A new attitude towards family takes the form of conscious choice in family planning and it is associated with what van de Walle [1992] labelled ‘numeracy about children’. This refers to a “clear notion of what family size ought to be and individuals awareness of where they stand with respect to the norm” [van de Walle, 1992: 490]. In his study, van de Walle provides both contemporary interviews with mothers in Africa and anecdotal references to French experience suggesting this might be a relevant factor in explaining the transition. In some sense, numeracy is to be understood as new technology that (like any technology) spreads unevenly through population.

This corresponds with the diffusion pattern of fertility we saw in the maps of France. Pollak and Watkins [1993: 471-472] mention that in a process like this, different things could be actually diffusing. On the one hand, it could be technology, either its novel availability (a new contraceptive technique is discovered) or the change in preference for a particular –probably more effective- kind of technology (people could move from using the rhythm rule to coitus interruptus). On the other hand, they mention more subtle things that could be spreading. One is the thought of the possibility of fertility control, which is the one I mentioned above as numeracy about children. The other is preference for a different family size. These last two are expected to spread more slowly than technology, as people tend to be conservative and avoid change for several reasons (see, for example, Edwards [1968]). A corollary of this is that, even without the appearance of a new contraceptive technique, we may still find some kind of diffusion. What is important, however, is that once this attitude towards family planning becomes widespread, economic factors can (and will)
play a role in the level of fertility directly and that can be tested. This latter part of my argument insinuates that in the empirical analysis, together with economic factors, we must include some measure of secularisation of education and political self-determination in order to take into account their potential influence on individual self-determination and family planning. And that is what I assess in the remainder of the paper, trying to explain the variation between départements in the late nineteenth century.

ASSESSING THE FRENCH EXPERIENCE

The data

In order to evaluate the hypotheses summarised above (as done, for example, by Schultz [1997: 393-394] for the developing world) I put together a dataset satisfactory in many senses. First, much of the data I extracted from the Annuaire Statistique and other sources have not been used –to my knowledge- before to do this kind of analysis, hence it is novel. Second, it comprises five years in five-year intervals between 1876 and 1896, covering the period when the divergence in fertility among départements was greatest. Third, as I pointed out in the introduction, instead of relying upon a standard cross-sectional dataset I specially built this set to be a panel, which let me make use of better econometric techniques to explore the data. Lastly, the data cover all départements at the time so it comprises the whole population of France at that period. Table 1 lists these variables, their definitions, and some descriptive statistics. The definitions of the variables are in general self-explanatory, but some need further explanations.

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18 Full detail of variables, their construction and their sources can be found in the Appendix.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>All</th>
<th>High Fertility</th>
<th>Low fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>1876</td>
</tr>
<tr>
<td>Marital fertility</td>
<td>Ig Princeton index</td>
<td>0.490</td>
<td>0.415</td>
<td>0.743</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.311</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>Deaths of children younger than 1 year old as a proportion of children in that age</td>
<td>0.251</td>
<td>0.197</td>
<td>0.345</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.177</td>
</tr>
<tr>
<td>Urban population</td>
<td>People living in urban areas as a % of total population</td>
<td>0.260</td>
<td>0.300</td>
<td>0.176</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.237</td>
</tr>
<tr>
<td>Population in agriculture</td>
<td>People working in agriculture as a % of total population</td>
<td>0.575</td>
<td>0.510</td>
<td>0.670</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.577</td>
</tr>
<tr>
<td>Income per capita</td>
<td>National domestic product weighted by direct taxes, per capita, divided by the price of wheat</td>
<td>570.8</td>
<td>963.8</td>
<td>399.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>719.4</td>
</tr>
<tr>
<td>Saving books</td>
<td>Number of saving books per capita</td>
<td>0.065</td>
<td>0.163</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.074</td>
</tr>
<tr>
<td>Literacy (female)</td>
<td>% of women that sign the marriage certificate (not drawing a cross)</td>
<td>0.701</td>
<td>0.901</td>
<td>0.581</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.717</td>
</tr>
<tr>
<td>Literacy (male)</td>
<td>1 minus the % of conscripts that do not know how to write or read</td>
<td>0.844</td>
<td>0.951</td>
<td>0.749</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.885</td>
</tr>
<tr>
<td>Literacy (female/male)</td>
<td>Female literacy over male literacy</td>
<td>0.856</td>
<td>0.961</td>
<td>0.817</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.865</td>
</tr>
<tr>
<td>Religious education</td>
<td>% Primary school students attending religious institutions</td>
<td>0.375</td>
<td>0.284</td>
<td>0.492</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.329</td>
</tr>
<tr>
<td>Republican vote</td>
<td>% of votes received by republican parties (as opposed to monarchist parties)</td>
<td>0.543</td>
<td>0.681</td>
<td>0.501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.500</td>
</tr>
<tr>
<td>Turnout at the polls</td>
<td>People turning out at the polls as a % of voters inscribed</td>
<td>0.807</td>
<td>0.762</td>
<td>0.811</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1876</td>
<td>1896</td>
<td>0.829</td>
</tr>
</tbody>
</table>

Guinnane et al. [1994] warn us to be cautious when drawing conclusions from the Coale index of marital fertility arguing that it does not describe perfectly parity dependence/independence, especially when there is substantial cultural heterogeneity or in the early stages of the transition. Those caveats are not particularly relevant in this case, but I take note of the limitations of the index and will use any conclusion I draw from them with the appropriate care. Due to the lack of data on income, I explored the possibility of using direct taxes per capita as a proxy (a similar approach has been taken by Weir [1995] when studying fertility and mortality in a French village during the Ancien Régime). Direct taxes per capita can be a good proxy of in-
come only if those taxes are equal across départements and if they did not change much over the period studied. A brief revision of French fiscal system in Willis [1895: 46-48] suggests that such an assumption could be reasonable. To make the proxy more illustrative, I took the income for the whole country in the relevant years and used the proportion of national contribution to direct taxes as a weight to obtain departmental proxies for income.

One option to measure secularisation could be the size of the clergy. Some studies suggest, however, that anticlericalism in the aftermath of the revolution was not followed by a substantial decrease in the size of the clergy [Gargan and Hanneman, 1978]. I hence decided to construct an alternative variable using the proportion of students in religious schools, on the premise that in a more anticlerical region fewer parents would have sent their children to religious schools. Alternatively, but in the same vein, a community with fewer religious schools had less chance of inculcating the Catholic dogma and was at an increased risk of becoming more secular.

The table also lists selective means. The first two columns give the mean for all départements for the years at the beginning and the end of the sample. The other four simply average the values at the two ends of the period for a selection of 16 départements: one group of 8 with consistent high fertility and one of 8 with consistent low fertility, to show the main characteristics of these extreme cases. Figure 7 shows these départements.

The values describing the temporal dimension for the whole country yield few surprises. The other columns, however, already provide some hints about what could be explaining variation. Departments with high fertility have more than twice the infant mortality, have fewer urban areas, are poorer and less educated, and the proportion of students going to religious schools is considerably larger. Nevertheless, they tend to be pretty similar in political terms as they are equally ‘republican’ and politically participative.
The econometric model

The evolution of these variables suggests that they might have played some role in the decrease of fertility, and I will test that econometrically. The sample consists of 12 variables (included the explained variable) for five years (1876, 1881, 1886, 1891 and 1896) that belong to 87 départements. I made a particular effort to build a panel that includes at least some temporal dimension to be able to exploit the benefits of panel data analysis. Of the many variables affecting fertility some can be identified in the historical data I have, and those that are not could be interpreted as fixed effects. From the simple model I described above we could establish an empirical counterpart:

\[
\text{fertility}_{it} = \alpha_0 + \sum_{j=1}^{k} \beta_j n_{jit} + \sum_{j=1}^{l} \gamma_j cn_{jit} + \sum_{j=1}^{m} \eta_j cd_{jit} + \sum_{j=1}^{s} \mu_j rc_{jit} + e_{it}
\]
Here, \( n, cn, cd \) and \( rc \) are the vector of variables explaining natural fertility, supply of children, demand for children and regulation costs. Since many of the components of these vectors are non-observable, the model should probably be better specified as:

\[
\text{fertility}_{it} = \alpha_0 + \sum_{j=1}^{k-l} \beta_j n_{jlt} + \sum_{j=1}^{l-f} \gamma_j cn_{jlt} + \sum_{j=1}^{w-g} \eta_j cd_{jlt} + \sum_{j=1}^{z-h} \mu_j rc_{jlt} + u_i + e_{it}
\]

Where the individual effect term \( u_i \) captures the effect of unobservable variables associated with the characteristics of each department. If these are constant across time for départements, a fixed effects model will be able to provide appropriate estimates for the unknown coefficients. In the fixed effects model the coefficients are identified only by variations across periods, so it is simply not feasible to estimate the effect of any time invariant variable, and results can be unsound if nearly-invariant variables are included. Also, the standard deviation tends to be relatively large and estimates are thus less efficient. The random effects approach does not have these problems, but it assumes that individual effects are uncorrelated with the other regressors, which is quite a strong assumption for our model (some of the variables we are unable to observe are likely to be correlated with those we do observe). This can generate inconsistent estimates due to omitted variable bias. So, fixed effects are generally preferred in this context.

What do the data suggest?

The results are shown in Table 2. The first set of coefficients corresponds to the estimation with pooled OLS; that is, ignoring the fact that the observations were taken from the same place at different periods of time. Most coefficients in that specification appear as significant, but many of them do not have the expected sign, notably the proportion of population in agriculture, the female literacy and the literacy gap. These problems are sorted out when we impose the panel structure. In the column labelled ‘fixed effect I’ some coefficients lose significance but the others gain the right sign. Both urbanisation and size of the agriculture sector do not seem to matter any more, but infant mortality has a strong positive effect and income a negative one. As the theory suggests, fertility seems to be more sensitive to female literacy than to
male literacy, and gender gap in literacy does not show significant coefficients. The proxy of religiosity effectively increases fertility, whereas the proportion of republican vote decreases it.

Table 2. Modelling marital fertility in France (1876-1896) using départements data

<table>
<thead>
<tr>
<th></th>
<th>Pooled OLS</th>
<th>Fixed effect I</th>
<th>Fixed effect II</th>
<th>Fixed effect III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef. (s.e.)</td>
<td>Coef. (s.e.)</td>
<td>Coef. (s.e.)</td>
<td>Coef. (s.e.)</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>1.067*** (0.124)</td>
<td>0.292*** (0.081)</td>
<td>0.151* (0.080)</td>
<td>0.132* (0.077)</td>
</tr>
<tr>
<td>Urban population</td>
<td>-0.258*** (0.078)</td>
<td>-0.137 (0.153)</td>
<td>0.073 (0.111)</td>
<td>0.043 (0.113)</td>
</tr>
<tr>
<td>Population in agriculture</td>
<td>-0.225*** (0.087)</td>
<td>0.040 (0.049)</td>
<td>-0.004 (0.048)</td>
<td>0.007 (0.049)</td>
</tr>
<tr>
<td>Income per capita</td>
<td>0.0001*** (0.000)</td>
<td>-0.00002* (0.000)</td>
<td>0.000003* (0.000)</td>
<td>0.000002 (0.000)</td>
</tr>
<tr>
<td>Saving per capita</td>
<td>-0.083 (0.105)</td>
<td>0.003 (0.058)</td>
<td>0.124* (0.064)</td>
<td>-0.055 (0.097)</td>
</tr>
<tr>
<td>Saving books per capita</td>
<td>-0.083 (0.105)</td>
<td>0.003 (0.058)</td>
<td>0.124* (0.064)</td>
<td>-0.055 (0.097)</td>
</tr>
<tr>
<td>Literacy (female)</td>
<td>-0.139*** (0.036)</td>
<td>0.093** (0.035)</td>
<td>0.007 (0.012)</td>
<td>0.006 (0.012)</td>
</tr>
<tr>
<td>Literacy (male)</td>
<td>0.123*** (0.036)</td>
<td>0.093** (0.035)</td>
<td>0.007 (0.012)</td>
<td>0.006 (0.012)</td>
</tr>
<tr>
<td>Religious education</td>
<td>0.188*** (0.071)</td>
<td>0.123*** (0.048)</td>
<td>0.115** (0.052)</td>
<td>0.093* (0.055)</td>
</tr>
<tr>
<td>% republican vote</td>
<td>-0.035 (0.036)</td>
<td>-0.015* (0.009)</td>
<td>0.007 (0.012)</td>
<td>0.006 (0.012)</td>
</tr>
<tr>
<td>Turnout at the polls</td>
<td>-0.068 (0.088)</td>
<td>-0.035 (0.024)</td>
<td>-0.007 (0.023)</td>
<td>-0.009 (0.023)</td>
</tr>
<tr>
<td>Net immigr. 15/19-20/24</td>
<td>0.057 (0.047)</td>
<td>0.079 (0.049)</td>
<td>0.057 (0.047)</td>
<td>0.079 (0.049)</td>
</tr>
<tr>
<td>Net immigr. 20/24-25/29</td>
<td>-0.172*** (0.053)</td>
<td>-0.176*** (0.050)</td>
<td>-0.172*** (0.053)</td>
<td>-0.176*** (0.050)</td>
</tr>
<tr>
<td>Net immigr. 25/29-30/34</td>
<td>0.087* (0.045)</td>
<td>0.083** (0.042)</td>
<td>0.087* (0.045)</td>
<td>0.083** (0.042)</td>
</tr>
<tr>
<td>Dummy - 1881</td>
<td>-0.015*** (0.005)</td>
<td>-0.011*** (0.005)</td>
<td>-0.015*** (0.005)</td>
<td>-0.011*** (0.005)</td>
</tr>
<tr>
<td>Dummy - 1886</td>
<td>-0.029*** (0.008)</td>
<td>-0.029*** (0.008)</td>
<td>-0.029*** (0.008)</td>
<td>-0.029*** (0.008)</td>
</tr>
<tr>
<td>Dummy - 1891</td>
<td>-0.056*** (0.011)</td>
<td>-0.037*** (0.011)</td>
<td>-0.056*** (0.011)</td>
<td>-0.037*** (0.011)</td>
</tr>
<tr>
<td>Dummy - 1896</td>
<td>-0.069*** (0.014)</td>
<td>-0.071*** (0.015)</td>
<td>-0.069*** (0.014)</td>
<td>-0.071*** (0.015)</td>
</tr>
</tbody>
</table>

In none of the above specifications does the measure I am using for financial development show any effect on fertility. This seems to change in the following regression. Under the label ‘fixed effects II’ I do two things: I control for migration flows using the net immigration of women in three particular age ranges in the previous five years, and I introduce year dummies to perceive time fixed effects in the same way. Not surprisingly in a context of continuing modernisation, the time fixed effects are strongly significant and negative. This takes out some explanatory power from other variables, but infant mortality, female education and religious education remain explanatory for fertility —although more weakly— with their respective signs unchanged. Interestingly enough, the effect of income now turns out to be positive.
(which is not entirely unreasonable), but the number of saving books is also significant but with the wrong sign. This, however, is probably not indicating a positive influence of financial development on fertility, but picking up an income or wealth effect that is not fully perceived by my rather imperfect proxy for income.

In light of this result, I included the amount of francs per capita in those accounts (deflated by the price of wheat to account for inflation) as an alternative measure of income, or perhaps wealth, shown in the last column. As can be seen, the introduction of this variable picks up all the power of the financial development proxy and the income proxy, maintaining the significance and approximate values of all the other coefficients. The positive sign suggests that départements that are relatively richer, once the other variables are accounted for, would have higher fertility, an expected outcome if children were a normal good.

The coefficients associated with past migration also tell an interesting story. The mean age of marriage in this period for most départements is in the low twenties, so it is not surprising to find that there is no significant effect of post-adolescent female migration (as it does not contribute to the marital fertility index in any way). What the other two coefficients tell us, nevertheless, is quite revealing. The net inflow of women in their late twenties has a negative effect on fertility, probably by increasing the denominator of the index, whereas older women have a positive effect, suggesting that they are affecting the numerator more than the denominator. It is, of course, very difficult to draw conclusions for the whole population based upon the behaviour of migrants, but this result is suggesting that women— at least those that were migrating— were delaying birth rather than spacing it, a result that is certainly debated in the literature.

Before moving into other results it is worth noting another technical matter. I mentioned above that it is likely that infant mortality brings a problem of endogeneity into the model, not only because both child mortality and fertility might be simultaneously determined, but also because unobserved factors might affect both, generating spurious correlation [Schultz, 1997: 339]. To control for it, I instrumented for
child mortality using climatologic data. By its very nature climate is indeed exogenous. Furthermore, temperature is likely to affect child mortality, but not fertility, making it a suitable instrument. In order to evaluate which of these values could be used as instrument, I looked into the correlation with both fertility and child mortality. I found that the deviation from the winter and summer temperature (i.e. winters too cold and summers too hot) was highly correlated with infant mortality, but not correlated with fertility and the instrumental equation F-test showed significance of coefficients, supporting the use of temperature as an instrument. Post-regression analysis, nevertheless, rejected the relevance of the instrument, so I decided keep the original fixed effects regressions as the preferred model.

One of the limitations of using fixed effects, of course, is that it constrains the analysis to variables that change through time, and some of those that do not change, or some for which we only have information at one point in time could be relevant. A way around this problem could be to see how much of the predicted fixed effects can be explained by these time-invariant factors. The coefficients themselves in this respect would probably not really be informative, but their sign and significance could give us some hints on their relevance. In this case I obtained information about the labour market, the infrastructure of the church and some institutional variables. Regarding the labour market, I have real wages estimated for all departments in 1874 by Bassino and Dormois [2006], and the labour force participation in industry and agriculture in 1896, both measures trying to perceive the effect on parents’ opportunity costs and the importance of the formal labour market in imposing a more rigid time demand on them. Although I introduced a measure of religiosity in the original equation, by bringing in the size of the clergy I want to assess whether the infrastructure of the church could contribute additional explanatory power. Lastly, I included

The problem, of course, is obtaining temperature data at département level. Luckily, a group of researchers at the University of Bern have obtained recently a monthly series spanning five centuries of European climatologic data [Luterbacher et al., 2004]. They reconstructed the climatic history of Europe using a large number of homogenised instrumental data series, as well as additional information coming from sea-ice, tree rings and documentary records [Luterbacher et al., 2004: 1500], obtaining a grid with a resolution of $0.5\degree \times 0.5\degree$ (which in the case of France is equivalent to having a measure each 38 km in the east-west spectrum, and around 55 km in north-south direction) where the value at each point represents the monthly average temperature in the $0.5\degree$ radius. 250 of these data-points lay on French territory and I use them to estimate the temperature in each department. To obtain estimates of the temperature in each département, I simply took the values corresponding to the points laying on that department and averaged them. Following this procedure I calculated for the years of the panel I am analysing the average temperature for the year, the winter (first quarter of calendar year) and January, as well as their deviations from the corresponding 1850-1900 mean.
a dummy capturing some institutional factors. Inheritance systems refer loosely to the set of legal and customary norms that establish the way in which property is transferred from one generation to the next, and it was probably amongst the first culprits to be blamed for the fertility decline in France. The actual way in which inheritance systems affected fertility is, however, not clear. There seems to be two basic ‘model’ systems: one of partible (where property is distributed among all children) and one of impartible (where one –normally the eldest son- would take it all). But depending on whether any of these systems is assumed to influence nuptiality or marital fertility, it will give a different answer (see Berkner and Mendels in Tilly [1976: 209-223]). The variable that appears in the regression is simply a dummy describing whether the system is partible or impartible (and the option left out corresponds to a mixed system) coded following Brandt [1901]. Table 3 shows the contribution of the variables just described to the fixed effects of the results of trying to explain the fixed effect estimated by our final model in Table 2.

**Table 3. Explaining the fixed effects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coef. (s.e.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real wages (1874)</td>
<td>-0.265** (0.116)</td>
</tr>
<tr>
<td>% male labour force in Industry</td>
<td>-0.029 (0.408)</td>
</tr>
<tr>
<td>% female labour force in Industry</td>
<td>0.207 (0.304)</td>
</tr>
<tr>
<td>% male labour force in agriculture</td>
<td>-0.152 (0.290)</td>
</tr>
<tr>
<td>% female labour force in agriculture</td>
<td>0.314 (0.244)</td>
</tr>
<tr>
<td>Priests per 1000 population</td>
<td>-0.050 (0.571)</td>
</tr>
<tr>
<td>Employees of the church per 1000 pop.</td>
<td>-0.054 (0.048)</td>
</tr>
<tr>
<td>Partible inheritance</td>
<td>-0.087* (0.046)</td>
</tr>
<tr>
<td>Impartible inheritance</td>
<td>-0.011 (0.035)</td>
</tr>
<tr>
<td>_constant</td>
<td>0.161 (0.210)</td>
</tr>
</tbody>
</table>

$R^2$: 0.327

**Sources:** See Appendix for a complete description of the sources. Asterisks indicate significance levels: * 10%, ** 5%, and *** 1%.

As the table shows, it is not clear that the structure of the labour market as described by the participation rates had anything to do with the differences among départements, but real wages do. The coefficient on that variable is not only significant, but also has the expected sign, as places with higher real wages (higher opportunity cost for the parents) are expected to have a negative influence on the fixed effects (then suggesting a negative influence on fertility). The infrastructure of the church, on the other hand, does not provide any further explanation, but the prevalence of a part-
ible inheritance system does, meaning that in places where the inheritance was distributed among all children there was less motivation to have larger families.

CONCLUSIONS

One of the greatest challenges faced by economists is to understand what drove societies away from Malthusian stagnation into modern economic growth, and population dynamics seem to be at the core of many potential explanations. Malthus already suggested this when he asserted that the original sin was condemning the future of society. ‘[T]he power of population is indefinitely greater than the power in the earth to produce subsistence for man’ [Malthus, 1985: 71]. This key statement followed from two self-evident ‘truths’: that we live in a world with limited resources, and that population growth is impossible to restrain. That population could not be restrained was obvious to Malthus because ‘the passion between the sexes is necessary and will remain nearly in its present state’ [Malthus, 1985: 70, my emphasis], and only by delaying or avoiding marriage would population be checked. Yet, fertility rates have dropped well below replacement level in Europe and other parts of the world. Recent developments in endogenous growth theory suggest that part of the explanation for this fall (and its consequent effect on growth) lies in a synergistic relationship between technological change, population dynamics and income growth. Nevertheless, the first region in Europe to experience a fertility decline seems to have escaped this logic, casting some doubts on the relevance of those models.

In this paper I look into the potential factors driving the fertility decline within France and show that a considerable diversity within the region hides a rather complex behaviour. The econometric analysis I perform finds evidence that confirms the key roles played by infant mortality and female literacy in explaining fertility decline. Income, or probably more accurately wealth, has a positive impact on the size of families once we control for other variables. Part of the change is therefore explained by different economic forces, but here I also suggest in line with other studies that the break with religious authority could have also played a role. The evidence I show is incapable of proving that this was indeed the case, but it is consistent
with that story. In particular, the fact that religious education is able to explain part of the divergences within France is suggestive. A different mind-set is hard to build and it takes time to spread, so it is not surprising that in some regions of France this tradition of maintaining large families took some time to fade away. This result points to the fact that cultural factors could have been partly driving these dynamics, by preventing or allowing the adjustment to economic incentives, and suggest that they should probably be included in the theoretical models to provide a more comprehensive answer of why Western Europe achieved modern economic growth.
REFERENCES


Avenel, Henri [1894]; Comment vote la France: Dix-Huit ans de suffrage universel -1876-1893- (Paris)


Bonneuil, Noël [1997]; Transformation of the French Demographic Landscape, 1806-1906 (Clarendon Press, Oxford)

Brandt, Alexandre von [1901]; Droit et coutumes des populations rurales de la France en matière successorale -translated from the German to French by Eugène Régnier- (Paris, Larose)


Chesnais, Jean-Claude [1992]; The Demographic Transition: Stages, Patterns, and Economic Implications (Clarendon Press, Oxford)


Flinn, Michael W. [1981]; The European Demographic System, 1500-1820 (The Johns Hopkins University Press, Baltimore, Maryland)


Greene, William H. [1997]; *Econometric Analysis* (Prentice Hall, New Jersey)

Guinnane, Timothy W., Barbara S. Okun and James Trussell [1994]; “What Do We Know about the Timing of Fertility Transitions?,” *Demography*, Vol. 31, No. 1, February, pp. 1-20


Hicks, John [1969]; *A Theory of Economic History* (Oxford University Press, Oxford)


Ministère du Commerce, de L’Industrie et des Colonies [1889]; Statistique Générale de la France –Tome XVI, Année 1886- (Nancy, Imprimerie Berger-Levrault et Cie.)


Price, Roger [1987]; A Social History of Nineteenth-Century France (Hutchinson, London)


Van de Walle, Etienne [1980]; “Motivations and technology in the French fertility decline,” in Wheaton and Hareven (Eds.) [1980]; Family and Sexuality in French History (University of Pennsylvania Press, Philadelphia)


Wheaton, Robert and Tamara K. Hareven (Eds.) [1980]; Family and Sexuality in French History (University of Pennsylvania Press, Philadelphia)


Wooldridge, Jeffrey M. [2001]; Econometric Analysis of Cross Section and Panel Data (MIT Press, Cambridge Mass.)

APPENDIX: DATA SOURCES

For this study I put together a panel dataset comprising the years 1876, 1881, 1886, 1891 and 1896. All départements are represented in the sample. The major part of the dataset was constructed using information published in the Annuaire Statistique de la France between 1878 and 1903 and Table A1 details the references for each variable collected. As can be seen there, data were in general available for all five years. Only for some cases I had to rely upon an alternative reported year or estimates. To obtain the number of women in 1886, I interpolated the values of 1881 and 1891, and to get the missing values for the people working in agriculture I calculated the implicit annual rate between 1876 and 1891, and applied it to the known values. To get the 1896 number of women capable of sign their marriage certificate I extrapolated using the average rate of growth of the previous periods. In the remaining variables there were no missing values. I decided to use information from the original list of conscript, not to those admitted to the army, to avoid any kind of selection bias. For a certain number of conscripts the level of education was not known, so I simply assumed those missing cases did not provide extra information and extracted them from the total to get literacy rates. Regarding the student’s data for lay (laïques) and congregational (congréganistes) schools, that includes all primary schools, free and public. Direct contributions includes land tax (foncière), personal property tax (personnel et mobilière), house tax (des portes et fenêtres), taxes upon licences (des patentes), and others. To make these last values comparable across time, I deflated them by price of wheat. The number of saving books correspond to those of national Caisses d’epargne. Lastly, electoral data correspond to legislative elections for the years reported.

In 1899 and 1900, the Annuaire Statistique published a detailed survey of the structure of the labour market in France in 1896, from where I got the number of men and women in formal employment in industry and agriculture[Service de la Statistique Général de France, 1899: 208, 1900: 16-21].
Table A1. Variables obtained from the *Annuaire Statistique de la France*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reported year [publication year: pages]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td></td>
</tr>
<tr>
<td>– Total</td>
<td>1876 [1879: 14-17], 1881 [1884: 12-15], 1886 [1888: 4-5], 1891 [1903: 8-11], 1896 [1903: 8-11]</td>
</tr>
<tr>
<td>– Women</td>
<td>1876 [1879: 34-37], 1881 [1883: 20-23] [interpolated], 1886 [1888: 4-5], 1891 [1892/4: 24-25], 1896 [1899: 2-5]</td>
</tr>
<tr>
<td>– Urban</td>
<td>1876 [1879: 14-17], 1881 [1884: 12-15], 1886 [1888: 4-5], 1891 [1892/4: 12], 1896 [1903: 24-27]</td>
</tr>
<tr>
<td>– Working in agriculture</td>
<td>1876 [1879: 34-37] [1892/4: 28-29]</td>
</tr>
<tr>
<td><strong>Agriculture</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Female literacy</strong></td>
<td></td>
</tr>
<tr>
<td>– Women being able to sign</td>
<td>1876 [1879: 18-21], 1881 [1884: 31, 33], 1886 [1889: 18-19], 1892 [1892/4: 50-51] [extrapolated]</td>
</tr>
<tr>
<td><strong>Conscripts</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Students in primary schools</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Taxes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Saving books</strong></td>
<td></td>
</tr>
<tr>
<td>– Number of saving books</td>
<td>1876 [1879: 218-221], 1881 [1884: 232-235], 1886 [1888: 159-159], 1892 [1892/4: 200], 1896 [1898: 58-71]</td>
</tr>
<tr>
<td><strong>Legislative elections</strong></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Service de la Statistique Général de France [1878-1903].

The rest of the variables were obtained from diverse publications. Fertility data were available from studies part of the European Fertility Project. In particular, marital fertility (Ig), was obtained from the original core publication of the project [Coale and Watkins, 1986: 94-107]. Infant mortality and migration came from Bonneuil [1997]. The proportion of votes received by the republican parties (as opposed to monarchist parties) in the legislative elections between 1877 and 1893 is from Avenel [1894: 65] and the value for 1896 was estimated as the average of the four previous periods. Lastly, from the annexe in Brandt [1901] I obtained the inheritance systems that I codified into dummies for impartible, partible and mixed systems (where the later is the base reference).