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Old Habits Die Hard (Sometimes)
Can *département* heterogeneity tell us something about the French fertility decline?♣

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Abstract

Recent developments in endogenous growth theory suggest fertility decline in the context of the demographic transition was crucial for achieving long-term growth, and that it was triggered by forces eminently economic in nature. It is then somewhat puzzling that France, which was not as industrialised as other parts of Europe, lead that decline. Taking advantage of the considerable internal heterogeneity, this paper looks within France for some answers. Using département *level data for the last quarter of the nineteenth century, it studies the correlates of fertility estimating a 2SLS 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 explain part of the variation. Spatial dependence turns out as well to be significant in all specifications of the model, suggesting some sort of diffusion was indeed taking place.*

Keywords: economic history, France, demographic transition, nineteenth century, fertility decline.

JEL classification: N33, J13.

♣ This paper stems from the research I carried out for my doctoral thesis at the Department of Economics at Oxford University, while being a member of Nuffield College and a Student Research Associate of TARGET (Canada), and continued as a Research Fellow at IGIER and Centro Dondena at Università Bocconi. It has benefited greatly from discussions with my supervisor, Bob Allen, with my thesis examiners, Knick Harley and Cormac Ó Gráda, and with various colleagues at Nuffield College, specially Natàlia Mora-Sitja and Roman Studer. Jean-Pascal Bassino, Steve Bond and Timothy Guinnane provided also very useful suggestions. Earlier versions of this article were presented at the Oxford University, the University of British Columbia, London School of Economics, the VI Conference of the EHES (Istanbul), and the 2006 Annual Conference of the Economic History Society (Reading), and I want to thank their participants for helpful comments. In particular, Marina Adshade, Leah Bassel, Alberto Behar, Mauricio Drelichman, Price Fishback, Regina Grafe, David Greene, Michael Huberman, Jane Humphries, Avner Offer, Martín Rossi and Javier Silvestre. The support and advice I received from all these people has been very valuable to me, but the responsibility for all remaining errors and omissions is, of course, entirely mine.

INTRODUCTION

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. For the major part of human history income per capita seems to have remained at subsistence level, with improvements in the standards of living (if any) only marginal or temporary [e.g. Clark, 2005: 507]. Mankind became somewhat technologically more sophisticated over time, but not richer. Barely two centuries ago, this ceased to be the case, and an era of sustained growth was launched. Economic historians have looked at this phenomenon with great interest over the years, but now a substantial body of theoretical work in mainstream economics is also trying to make sense of it. What has come to be known as 'unified growth theory' takes upon the daunting task of trying to consistently explain in a single framework *both* pre-industrial stagnation and modern economic growth, *and* the transition from one to the other [Galor 2005b]. Notwithstanding a few probable raised eyebrows in the academic community, this literature has encouraged a healthy exchange of ideas between disciplines by broadening the debate beyond the familiar discussion on sources of growth to territories relatively less explored by economists such as population dynamics: common to most unified growth models, it is a Malthusian logic that sustains pre-industrial stagnation and the systematic fall in birth rates the ultimate element driving societies away from that fate. The various studies disagree on *what* drives the fall, but the endogenously-triggered decline in fertility plays a key role in the transition to the modern age. Either to corroborate the internal logic of these models or to think further on the mechanisms at work in them, knowing why fertility fell appears to be of crucial relevance to understand the path taken by Europe into economic growth. The literature on fertility decline is neither scarce nor new, but in the last few years it has gone somewhat out of favour without reaching any clear consensus [van de Kaa, 1996], and this renewed interest provides a good motivation to revise the topic, specially some specific cases.

The most iconic case is without doubt that of France. The evolution of birth rates during the nineteenth century was rather unequal in the various corners of the continent, but even to the bare eye distinct regional patterns are easily identifiable [Flinn, 1981: 30-31]. Downward trends were common, yet timing of the initial fall sometimes differed. Although following the general overall pattern, the French decline began (arguably) 50 years earlier than in other parts of Europe. As, in contrast with other places like England or the Netherlands, France was relatively less urban or industrialised [see e.g. Heywood, 1995], this timing is particularly difficult to reconcile with unified growth models where the fall in birth rates is a key, yet *intermediate* stage in an endogenous mechanism that economic forces trigger [e.g. Galor and Weil, 1999, 2000; Lucas, 2002: 109-188; Galor and Moav, 2002; Doepke, 2004]. Instead of following some structural changes, the demographic transition in France appears to have come *ahead* of them, contributing most likely to counteract the relative industrial retardation and allowing the country to achieve the high standards of living it enjoyed during the nineteenth century [O'Brien, 1996: 213-214]. These stylised facts are not entirely ignored by the unified growth literature, but they are most often than not treated as a mere anomaly [Galor and Moav, 2002: 1136; Galor, 2005b: 201], not as a case that deserves explanation. Further, along with other pieces of evidence drawn from the European Fertility Project [Coale and Watkins, 1986], the French experience has contributed to support the so-called 'Princeton view' that economic change played only a minor role in the fertility transitions of the Western world.

In the last few years, however, a growing body of research has provided reasons to believe that view was built upon shaky grounds. Although vague theorising has received part of the blame [Galloway *et al.*, 1994: 135], it is the unsuitability of empirical tools used to assess the underlying hypotheses that has been the centre of attack [Brown and Guinnane, 2007]. Recent studies exploring panel datasets on Bavaria [Brown and Guinnane, 2002] and Sweden [Dribe, 2009], along with the seminar paper on Prussia by Galloway *et al.* [1994], have all found evidence in favour of economic forces playing a role in fertility determination around the time of the transition. Following this literature, this paper looks into some of the factors that have been suggested in the economic and demographic literature as determinants of fertility and assesses whether they can explain differences *within* France. Taking advantage of the persistent heterogeneity in reproductive behaviour across the country during the nineteenth century, and using the standard Easterlin framework [Easterlin and Crimmins, 1985], I study quantitatively the correlates of fertility using *département*-level panel quinquennial data between 1876 and 1896. I assess the effect of factors such as infant mortality, urbanisation, income, financial development, female and male education, religiosity or political participation on the levels of fertility, introducing departmental and time fixed effects to control for some unobservables, and using climatologic data to instrument infant mortality to produce 2SLS estimates that account for potential endogeneity problems. Relatively novel to this literature, I also look into spatial dependence to assess the relevance of diffusion. Although good part of debate on fertility decline has been set-up in terms of diffusion versus adaptation hypotheses [Carlsson, 1966], and the study of diffusion on fertility dynamics in a sound, quantitative manner has been used already in historical perspective [e.g. Tolnay, 1995], to my knowledge this has never been integrated in any empirical study of the European fertility decline. By introducing spatial dependence along with other covariates I can assess whether the diffusion *and* adaptation hypotheses can simultaneously contribute to explain fertility.

I find evidence of wealth positively correlated with larger families, whereas extended education (both female literacy and child enrolment in primary schools) negatively correlated with it. There is also a mild (marginally insignificant) negative effect of the measure I use of financial development, (only weakly) supporting the idea that children were seen as an investment good (and financial institutions as a substitute). Once I control for other variables, there is no indication that infant mortality, urbanisation, industrialisation, or male education had any effect whatsoever. The level of religiosity (that I measured using three different proxies) is consistently relevant to explain fertility and has the expected (positive) sign. All these effects are present despite the fact that I introduced spatially lagged (time lagged) fertility, which also turns out to be strongly significant providing support for the diffusion hypothesis. These results point towards the idea that cultural factors were partly driving fertility dynamics *along* with economic incentives, and suggest that both components should be included in the theoretical models to provide a more comprehensive answer of why the decline occurred.

FRANCE IN THE FERTILITY DECLINE DEBATE

Along with timing of the decline in the European context, the evidence we have on fertility rates within the country makes the French experience particularly interesting. Figure 1 maps the widely used I_g index of marital fertility, a measure of the proportion of legitimate births with respect to the maximum biologically attainable. All throughout the period it is easy to see at least two areas of low fertility, the valley of the Seine (Bassin Parisien) and that of the Garonne (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, all suggesting the presence of some sort of diffusion. As early as 1831 one can find *départements* such as Gironde or Eure with indexes below 0.40, evidencing a clearly attempted (and quite successful) fertility limitation, while as late as 1901 places like Finistère or Côtes-du-Nord still had indexes above 0.70, showing little or no limitation at all. Again, it is difficult to find any straightforward systematic relationship with regards to known degrees of urbanisation or industrialisation. Of the five *départements* with the lowest level of marital fertility in 1831, only Gironde had a major city in 1801; not Eure, Lot-et-Garonne, Oise, nor Tarn-et-Garonne had any town of 10,000 inhabitants or more. At the same time, *départements* with a considerable population in large urban centres like Bouches-du-Rhône or Loire Inférieure still had I_g indexes above 0.60 as late as 1851. Assessing industrial development is of course more complicated. Some figures for the late eighteenth century show clusters of textile production in the Bassin Parisien, but also in Brittany and the *départements* north of Paris, whereas metallurgic activity was concentrated in the east of the country, where the fertility behaviour was close to average [Léon, 1970: 228, 234, 238]. The fact that areas leading the decline were located in major valleys is suggestive, but it is difficult to go beyond facile interpretations when thinking on the relevance of physical geography: both areas had large rural sectors, but agricultural activity was concentrated on wheat in one and vines in the other [Rémond, 1966: 55-58]; and while having large rivers, integration appears to have differed considerably between those regions [Daudin, 2008].

[Figure 1 about here]

Of course, alternative arguments are not lacking, but only to a limited extent have they been subject to careful empirical scrutiny. Most of the components that were to shape modern theories of fertility determinants [e.g. Becker, 1991], such as the role played by fluctuations in wealth, the 'remunerativeness' of children and the costs of rearing them, the rise of feminism, or the decline in religious faith, to mention a few, were already present in early discussions on the French decline more than a hundred years ago [Spengler, 1938: 168-174]. Despite this wealth of theoretical ideas, only a few have found support or rejection in sound quantitative analysis. Now we have a more or less detailed account of the evolution of past populations [Coale and Watkins, 1986], especially for France [Dupâquier, 1988], but many of the studies on the topic have remained for some time descriptive and conjectural at best [van de Walle, 1974: 6-7]. The works of people like Etienne van de Walle [1974; 1976; 1980; 1992; van de Walle and Muhsam, 1995; Lesthaeghe and van de Walle, 1976] and David Weir [1983; 1984a; 1984b; 1992; 1993a; 1993b; 1994; 1995; Mroz and Weir, 1990] brought a more systematic approach to the subject, and the quantitative approach they advocated renovated the way in which other scholars looked at the subject. Then, from the late 1970s to the early 1990s several studies refined the measurements of fertility [van de Walle, 1974; Weir, 1994; Bonneuil, 1997] and extensively explored its dynamics [e.g. van de Walle, 1974; Weir, 1984a]. To some extent they also assessed the relevance of some factors in explaining the decline [e.g. van de Walle, 1976; Weir, 1984b, 1995], but achievements in that direction were limited due to the absence of information on relevant covariates or lack of suitable methodological tools. Despite some interesting pieces devoted to other parts of Europe [e.g. Galloway et *al.*, 1994; Brown and Guinnane, 2002; Dribe, 2009], however, little work has been done to study the determinants of the fertility in France since Weir's latest contribution [Weir, 1995]. This paper tries to fill part of that void.

As it is now well understood, using a panel dataset has certain methodological advantages over cross-sectional analyses, like the possibility of introducing fixed effects to account for some unobservables, but it is not obvious that using *département*-level data is particularly desirable, as certain levels of aggregation can lead to estimation problems [Brown and Guinnane, 2007]. Individual level data would be, of course, ideal, and there is indeed an extensive number of local studies that could potentially be cross-referenced with other information. These, however, tend to concentrate only on some very particular areas of France, like Normandy or the Paris Basin [Flinn, 1980]. Some studies have used this sort of information but had to constraint themselves to relatively small areas [e.g. Weir, 1995; Hadeishi, 2003; Cummins, 2009]. The INED sample, the *enquête nominative* of 40 French parishes circa 1640-1830 done by Louis Henry and colleagues [Henry, 1972, 1978; Henry and Houdaille, 1973; Houdaille, 1976], made the natural starting point for many of them, as the study of local differences in France was one of its main motivations [Fleury and Henry, 1956, 1958], but in many respects its potential is somewhat limited. On the one hand, since the selection was done at random (which conceptually makes sense) little concern was taken about the connection of those variables with other potential sources of data. David Weir took advantage of one of those rare examples where more information was available [Weir, 1995: 2] and recently Cummins [2009] has study another three, but it is uncertain whether much can be done with others.[1] On the other hand, if the villages are to be more or less representative of the *départements* in which they are, which is not necessarily the case [Weir, 1983: 177], they seem to fall in not-so-interesting *départements* in terms of fertility behaviour. Figure 2 below shows a map of the *départements* containing a village of the INED, and the approximate location of that village. The problem of monographic research was partly overcome with this sample, but not totally. If compared with Figure 1, it is clear that the selection 'missed' key leading regions (such as Gironde or Lot-et-Garonne) but, perhaps more importantly, considered only a few villages in those *départements* lagging behind. Also, the four main studies that came out of this work aggregated together in a single common area, the 'quadrants' depicted in Figure 2, some that were rather diverse in terms of fertility: in the Northwest, for example, the *département* with the highest fertility in 1831 (Finistère, with a I_g index of 0.82) was bundled together with the one with the lowest (Eure, with 0.35).

[Figure 2 about here]

This is not to say that we cannot profit from micro-studies, but that their potential contribution to address *some issues* is probably limited. This is particularly true when it comes to study potential explanatory factors. While relatively rich on details about life events and sometimes on a few wealth or status indicators, micro-studies are often incapable of looking into other dimensions of inter-

[1] On conversations with Neil Cummins, he mentioned he selected a dozen of the most 'promising' villages in the INED sample to carry out his research, but in two-thirds of them the records to be potentially cross-referenced with the demographic data (the *Tables des Successions et Absences*, at the various departmental archives) were incomplete or simply not there.

est for the researcher. It is clear now that using information on administrative units instead of individual data to study fertility behaviour leads to inefficient estimates that might downplay the effect of some explanatory factors [Brown and Guinanne, 2007: 581], but this result only highlights the fact that there is an inevitable trade-off between the level of aggregation we choose and that for which we have a substantial amount of covariates we can study. In this paper I suggest that by looking at *département*-level data we can explore some questions micro-studies cannot illuminate, and hence become complementary to those approaches. Although van de Walle pointed out already long ago that the use of these kind of data had been largely neglected [van de Walle, 1974: 8], little has been done since then, and the handful of papers that have done so used only few covariates in a simple cross-sectional framework [e.g. McQuillan, 1984; Watkins, 1991, Chapter 7]. For this study I collected information for almost twenty different variables for all *départements* of France in five-year intervals, covering the last quarter of the nineteenth century, hence creating a panel dataset that covers the period of maximum heterogeneity among these administrative units in terms of fertility. The panel structure (which is virtually impossible to obtain for historic individual data) allows me to address one of the key criticism recently made to the European Fertility Project, namely the study of fertility transition as a *change* over time [Brown and Guinanne, 2007: 585-589] which, with only a few notable exceptions [Galloway et al., 1994; Brown and Guinnane, 2002; Dribe, 2009], have rarely been applied to historical analysis of fertility.

UNDERSTANDING FERTILITY DYNAMICS

Economists, demographers, historians and sociologist, each with their own analytical frameworks, jargon and methodological techniques, have suggested hypotheses to explain the fertility transition, making the literature itself some kind of a puzzle [see, e.g., van de Kaa, 1996]. Although it is by no means entirely uncontroversial, many participants in this debate agree that fertility transitions are perhaps not different from any other fertility change, so they can be interpreted in terms of a model of fertility determination. Of the many models that have been suggested, Easterlin's synthesis is arguably 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 depends on the interaction of a set of basic determinants: the demand and supply of children, and the regulation costs of controlling fertility. In this very simple formulation, the number of births is determined by two basic factors, level of natural fertility (*N*), and level of fertility control (*FC*), and they are occasionally affected by a random disturbance (υ):

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

Natural fertility here refers to the level of fertility associated with no active control, and it is dependent on a range of biological and cultural variables, such as duration of marriage or the nutrition of mother. The level of fertility control, on the other hand, could be thought of as affected by at least three components (plus a random component):

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

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 (RC_m), such as the cost of particular contraceptives or their actual availability, and psychological costs (RC_p), such as the displeasure of abstinence or the moral cost of going against the religious beliefs. A complete model would then look like this:

$$\text{fertility} = f\left(N, FC\right) \text{ with } FC = \begin{cases} FC^*\left(Cn - Cd, RC\right) & \text{if } FC^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

The sources of changes can be easily identified in this model if we think of the conditions required for a fertility transition to occur as stated in the classic passage by Coale [1973: 65]. In short, a fertility transition will take place if effective techniques of fertility reduction are known and available (i.e. $RC_m < \infty$), if reduced fertility is perceived as advantageous (i.e. $Cn\text{-}Cd > 0$), but also if fertility falls within the calculus of conscious choice (that can well be interpreted as $RC_m < \infty$, or $RC_p < \infty$, or both).

Means to control

An issue that regularly turns up in discussions about fertility behaviour in the past is that of the availability of means to control it; that is, whether the market costs of regulating fertility were infinite or not. There is little real evidence showing that the average couple knew how to control fertility, though there are considerable facts suggesting they did. 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. Further, in predominantly rural societies (like early modern France) the breeding of domestic animals is an essential part of the daily activities and knowledge of animal reproductive behaviour must have been widely known then. Details about the peculiarities of human fertility might have been missing, but knowledge about the general dynamics of reproduction must have been present. Looking now into anecdotal evidence, many eighteenth century writers talked about the 'art of cheating nature' [see, e.g. Ariès, 1948, 1953; Bergues et al., 1959; van de Walle and Muhsam, 1995], and it is known that the nobility and urban bourgeoisie practised some degree of family limitation [van de Walle and Muhsam, 1995: 261-265]. Little information is available, though, regarding the lower social classes and, when available, it generally refers to extra-marital relationships. Although abstinence and changes in the frequency of sexual intercourse might have played a role, what appears to have been frequently used at the time was *coitus interruptus*. Contrary to common belief, this simple tool is relatively efficient [Santow, 1995: 29-30], and most of the literature agrees that the 'sin of Onan' was fairly widespread in Europe (and France in particular) at the time and might have been the main mechanism driving the fertility decline [e.g. Le Roy Ladurie, 1965; Flandrin, 1979; van de Walle and Muhsam, 1995]. Alternative instruments associated with different ways of having intercourse like sodomy, or intercourse without ejaculation (*amplexus reservatus*) appear to have been reserved for prostitution, but were known and perhaps occasionally used among married couples. Other, rather more expensive, contraceptives like condom or sponges may have had only a minor role [McLaren, 1990: 157-158; van de Walle and Muhsam, 1995: 273], as probably did action after delivery [Bechtold, 2001: 167-168]. Abortion, on the other hand, was known and increasingly practised, especially among married women [Flandrin, 1979: 194-195].

Motivation to control

Given that evidence suggest accessibility and knowledge of contraceptive tools was more or less present at the time, explanations of the fall should be largely in terms of some sort of behavioural change, and we must look into which factors might be driving this change. The supply of children is, of course, associated with natural fertility, the components of which are rather difficult to measure, such as the extent of breastfeeding. Nevertheless, it is also affected by the mortality of children, which is observable. Even if we assume couples had some degree of control over the size their families, in the past child mortality was a factor on which they have only a marginal influence, as the ways in which to avoid morbidity were not perfectly understood. When the number of children one can have is not certain because of a high risk of death at an early age (in some places in mid-nineteenth century France one in three babies would die in the first year), couples might increase their fertility only to make up for the expected loss [Brown and Guinnane, 2002: 41] (of course, causality can go in the other direction, and I address this problem in the empirical implementation). Looking now at the demand side, as with other goods the demand for children is determined by income and tastes of the parents, as well as by the prices they face in the market [Becker, 1960]. Children can alternatively be seen as consumption goods, since they are a source of satisfaction for the parents, and parents value them for that, or –using the idea of human capital– as assets that yield some return over time, since they are as a source of future services, especially labour or social security. Something that is common to both interpretations is that children consume resources (especially time and money) that could be used in alternative ways, thus imposing some limit on the number of offspring couples want to have. Also there is a trade-off between quantity and quality; if parents are interested in the quality of their children (and they will be, 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. But parents face as well an opportunity cost of the time they need to raise children [Willis, 1973]. In rural, sometimes self-sufficient communities –for example– children can begin to contribute to family income earlier because agricultural labour usually requires less skills than industrial labour, or 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 is not as straightforward: it is probably the case that for low income levels children are normal goods, but after certain threshold parents might consider switching to invest in quality rather than quantity of children. If we consider children as investment goods, we have to think about 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, especially the mother that normally devotes more time to the raising of children. On the other hand, access to education – and the possibility of social mobility [see, e.g., Dumont, 1890; Cummins, 2009] – could encourage parents to move towards higher quality and lower quantity.

Choice to control?

The final point raised by Coale has to do with whether couples actually *consider* deciding on the size of their families. Although it is not really disputed that the transition involved the use of active contraception, it is not entirely clear whether before that time contraception was conceived as a possibility at all. For pre-transitional France there is evidence that –in a typical Malthusian fashion– the decision on *when to marry* affected fertility [Weir, 1983: chapter II], but only scarce and scattered examples of certain families or small groups actually practicing control within marriage [e.g. Livi-Bacci, 1986]. Demographers have traditionally suggested that the choice on when to marry *was* indeed the tool used to control procreation in pre-industrial times, via altering women's exposure to the risk of becoming pregnant. If that had been the case, changes in the dynamics of marriage might have generated a motivation for couples to engage in post-marriage fertility regulation. Arguably, the French Revolution brought some of them, as a few normative changes introduced shortly after 1789 facilitated marriage in several ways, and some might have even promoted unions. For example, revolutionary laws lowered the age before which parental consent was needed, authorised divorce and, by making civil contract independent of the Church, it avoided the prohibitions of marriage in certain periods such as Advent and Lent [Bergeron, 1981: 110]. Most notably, the Jourdan-Delbrel law in 1798 exempted married men from conscription, which created a clear incentive to marry, *orthogonal* to the decision of having children.

Other accounts instead point directly towards an ideational change triggered by modernisation [e.g. Lesthaeghe, 1983], yet, the nature of this modernisation and how it induced the ideational shift is rarely defined in a precise way. Lesthaeghe puts forward that the intellectuals of the Enlightenment provided the raw material that in the hands of the French revolutionaries led to the legitimisation of individual freedom of choice in different aspects of life, including fertility [Lesthaeghe, 1983: 413]. More often than not, however, it is religion that is blamed for the lack of individual self-determination in the pre-transitional period, especially on family life. Free will enjoyed a central role in Catholicism, but in matters of procreation, as in many other areas where the mechanisms of nature were not fully understood, individuals probably felt they had only limited control. 'The Lord gave, and the Lord hath taken away', the saying usually heard at the time by grieving parents that had lost a child, conveys the idea that fertility was largely dependent on the will of God (hence independent from the will of parents), and it was pervasive in medieval and early modern France [Flandrin, 1979: 179; Ariès, 1980: 646], as it is right now in many underdeveloped countries [van de Walle, 1992: 490-496]. Some authors have then ventured that for the transition to occur this preconception should disappear [van de Walle, 1992: 490]. As de-Christianisation was part of *zeitgeist* of the Revolution, arguments in this line also place that event as instrumental.

Up to the late eighteenth century Catholicism dominated social life [see e.g. Le Bras, 1955], conveyed much of the normative framework in France, and had a strong attitude regarding family behaviour and against contraception, condemning heavily the 'sin of Onan,' the main technique couples had to control fertility at the time [Flandrin, 1979: 194-196]. But already during the eighteenth century there were signs of de-Christianisation. Attendance at mass became less frequent, the number of people joining the clergy diminished, and the proportion of religious books owned by those rich enough to buy them fell considerably [Gibson, 1989: 3]. Although the early nineteenth century saw a religious revival, the Revolution had shaken the Church to its very foundations; this might have created a window of opportunity for an ideational change, as "[t]he hiatus in clerical control consequent upon the Revolution seems to have enabled at least some French men and women to break free from old constraints" [Gibson, 1989: 244-

245], allowing them to reach a new ideal normative equilibrium in terms of fertility behaviour.[2] But the National Assembly interfered in the regular functioning of the Church in a more literal way, as the latter suddenly saw many of its liberties curtailed, along with its resources, and its whole apparatus shaken by the purge of its members. It is estimated that as many as 3,000 priests were killed [Tackett, 2006: 549], more than 32,000 were forced to leave the country [Gibson, 1989: 52], and recruitment of new priests was stopped or seriously curbed. Towards the end of 1790 the revolutionaries also imposed a clerical oath of allegiance to the new Constitution that split the clergy into jurors (*constitutionnel*) or non-jurors (*réfractaire*), fuelling confrontations within the clergy and at different levels of society. The nature and consequences of the oath are rather complex [see Tackett, 1986], but some authors have ventured the idea that the relaxation of clerical discipline in 'constitutional' regions can partly explain the rapid spread of birth control in those areas [Sutherland, 2003: 345], where the Church was now lacking a considerable amount of raw material to sustain clerical authority and administer sacraments. This contributed to put an end to a quasi-universal religious practice in France [Gibson, 1989: 228] and, in particular, perhaps limited the potential ways in which local priest could have influenced on birth control practices, facilitating the rise of 'anomalies' in sexual behaviour such as contraceptive practices, illegitimacy, and bridal pregnancies [Le Roy Ladurie, 1965; van de Walle and Muhsam, 1995]. Arguments not primarily religious are consistent with this story. Given the extent of the influence of the Church it is not unlikely to think that weakly religious areas could have been more sensitive to the institutional changes brought by the Revolution and *these* changes could have had an impact on fertility. Inheritance laws provide a clear example. Although supposedly affecting the whole nation simultaneously, it has been suggested these laws were unequally enforced [Brandt, 1901], and in this the influence of the Church (by promoting or opposing its implementation) could have been instrumental.

In line with the arguments of other authors [e.g. Weir, 1983: 39], this discussion suggests the events of 1789 were connected with the fertility decline,

[2] This view can be connected with the recent developments on the role of social networks in fertility choice that suggest that fertility could well be a coordination problem [Kohler, 2001: 143-144]. For an extensive discussion on this argument, see González-Bailón and Murphy [2008].

partly channelled through their effect on self-determination, or on French Catholicism or on the organisation of the Church. Further, a recent body of literature also suggests (more as an empirical regularity than in terms of a theory) that social upheavals have a profound effect on the evolution of birth rates [Binion, 2001; Caldwell, 2004; Bailey, 2009]. In any case, there are reasons to believe factors associated with the French Revolution or the vitality of Catholicism might help to explain different levels of fertility, so we need to incorporate them, along with standard economic factors, in the empirical analysis.

ASSESSING THE FRENCH EXPERIENCE

To evaluate the hypotheses summarised above, I put together a novel *département*-level dataset spanning the last quarter of the nineteenth century, that is satisfactory in many senses. First, by using *département*-level data it allows to address the point made by some authors [e.g. van de Walle, 1974: 8] that this level of aggregation has been largely neglected. 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. It is true that by then the fertility decline was well under way, but the persistence of high fertility in some parts of France provides some confidence that whatever factor impeding its decline was still present, making the analysis meaningful. Third, as I pointed out above, instead of relying upon a standard cross-sectional dataset I especially built this set to be a panel, which lets me profit from better econometric techniques to explore the data. The period of the sample is characterised by both great heterogeneity between *départements* and a decreasing mean value of fertility level [González-Bailón and Murphy, 2008: 9], providing a unique set up for an analysis of temporal and cross-section variation. Lastly, the data cover all *départements* at the time so comprise the whole population of France at that period, and not only a few scattered villages.

Table 1 lists the variables I collected, with their definitions (see Appendix for details) and some descriptive statistics, for the whole country and for some selective groups. 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 *départements*: one consisting of the ten with the highest fertility and another of the ten with the lowest fertility, to show the main characteristics of these extreme cases. The values describing the temporal dimension for the whole country yield few surprises, as all variables evolve in the expected direction. The other columns, however, already provide some hints about what could be explaining variation. *Départements* with high fertility are net senders of immigrants, have fewer urban areas, less people working in industry, are poorer, less financially sophisticated, less educated, and – except for the first measure of religiosity – they seem to be more attached to religious activities. Nevertheless, they tend to be similar when it comes to infant mortality, and in political terms they are equally 'republican' and politically participative.

[Table 1 about here]

To study the contribution of these variables to fertility beyond simplistic correlations, we have to provide some treatable, econometric version of Easterlin's formulation. A general empirical counterpart could take the following form:

$$\text{fert}_{it} = \alpha_0 + \sum_{j=1}^{k} \beta_j n_{jit} + \sum_{j=1}^{l} \gamma_j cn_{jit} + \sum_{j=1}^{m} \eta_j cd_{jit} + \sum_{j=1}^{s} \mu_j rc_{jit} + e_{it}$$

Where, as usual, *i* indicates the individual unit (*département* in this case), *t* time and e_{it} is a random disturbance. Here, ***n***, ***cn***, ***cd*** and ***rc*** are the vector of variables explaining natural fertility, supply of children, demand for children and regulation costs. Clearly, it is sometimes difficult to determine whether a particular factor is affecting fertility through one or more of the theoretical channels. For example, women's education could be part of ***n*** (by making healthier, more fecund mothers), ***cn*** (by reducing chances of child mortality), ***cd*** (by increasing mother's opportunity costs), and ***rc*** (by affecting moral costs). Although it is plausible to conceive cases in which these effects could be disentangled, in practice we have to content ourselves with assessing the overall effect of a particular variable. Further, since many of the components of these vectors are non-observable, the model should probably be better specified as:

$$\text{fert}_{it} = \alpha_0 + \sum_{j=1}^{k-d} \beta_j n_{jit} + \sum_{j=1}^{l-f} \gamma_j cn_{jit} + \sum_{j=1}^{m-g} \eta_j cd_{jit} + \sum_{j=1}^{s-h} \mu_j rc_{jit} + u_i + e_{it}$$

Where the individual term u_i captures the effect of some unobservables, assuming that those are associated with the characteristics of each *département* and do not change much. If these are indeed constant across time, a fixed effects model will be able to provide appropriate estimates for the unknown coefficients, as coefficients are identified only by variations across periods. This method of course runs into troubles under the presence of time invariant variable,[3] but as the figures in Table 1 above illustrate, there is variability across time and across *département*, so the model is well specified in that respect.

Yet another thing to consider is the role of diffusion. Both the presence of clustering and the spatial evolution of rates points towards diffusion as a way of describing what happened in France [Bocquet-Appel and Jakobi, 1998: 190; González-Bailón and Murphy, 2008: 8-9]. Good part of the debate on fertility decline has been set up in terms of diffusion versus adaptation hypotheses [Carlson, 1966] without any systematic attempt to assess whether diffusion explains anything *once we account for other covariates*. We can address this issue in the empirical model above by introducing a spatially- and time-lagged component:

$$\text{fert}_{it} = \alpha_0 + \sum_{j=1}^{k-d} \beta_j n_{jit} + \sum_{j=1}^{l-f} \gamma_j cn_{jit} + \sum_{j=1}^{m-g} \eta_j cd_{jit} + \sum_{j=1}^{s-h} \mu_j rc_{jit} + \rho \sum_{j \neq i} w_{ij} \text{fert}_{jt-1} + u_i + e_{it}$$

This is a standard specification for a spatial regression [Upton and Fingleton, 1985; Anselin et al., 2008], and similar ones have already been used to study diffusion of fertility levels [e.g. Casterline, 2001: 18-19], inclusive in historical perspective [e.g. Tolnay, 1995]. Basically, w_{ij} are the elements of a weighting square matrix W that establishes the distances between the different individuals (in this case, *départements*), which has to be pre-specified. This is indeed arbitrary, but not more arbitrary than assuming no spatial dependence (i.e. a matrix of zeros), as it is normally done. There are different ways of establishing those distances, and in this paper I explore the two most commonly used: a neighbour-

[3] 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, as 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, in this context, fixed effects are generally preferred.

ing matrix (this is, one that assigns the value of 1 to adjacent *départements* and 0 to the rest) and distances between the centre of each *département*.

Lastly, I mentioned above that it is likely that infant mortality brings a problem of endogeneity into the model, not only because both infant mortality and fertility might be simultaneously determined, but also because unobserved factors might affect both, generating spurious correlation [Schultz, 1997: 339]. To account for this problem I used climate data (deviations of the mean temperature in Celsius in January and July over the 50-years average per *département*) to instrument infant mortality. By its very nature climate is indeed exogenous. Furthermore, temperature is likely to affect child mortality (hot summers and cold winters), but not fertility, making it a potential good instrument. F-tests of the excluded instruments in the first-stage regression (reported for each estimation in Table 2) rejected the hypothesis of them being zero and post-estimation analyses suggested the instruments were valid: in none of the estimations described in this paper the null of the Hansen's J statistic of overidentifying restrictions (the joint null that instruments are uncorrelated with the error term and that the excluded instruments are correctly excluded from the estimated equation) was rejected under the standard significance levels.

The estimates of alternative 2SLS models are shown in Table 2. All are essentially identical in terms of specification, except that models 1 to 3 use the three alternative measures of religion, and in model 4 I fixed one of those and assesses instead the use of an alternative metric when calculating the spatially lagged components (distance from centre, instead of neighbour matrix). To make results comparable to other studies I also calculated the elasticity evaluated in the overall mean. Results are consistent across specifications. Elasticities appear small, but are similar in magnitude to those obtained by Brown and Guinanne [2002: 44-45]. The first remarkable result is that, in contrast to some previous studies [e.g. van de Walle, 1976 or Dribe, 2009] but in line with quantitative analyses that control for several variables and instrument to account for potential endogeneity [Brown and Guinnane, 2002], infant mortality at this stage of the transition does not to contribute to explain fertility at all, a result that holds even when trying with alternative measures of mortality, such as child (children up to 5 years) or perinatal mortality. I also included among the covariates migration, which other works considered important to incorporate, yet none found it to be of any relevance to explain fertility [e.g. Brown and Guinnane, 2002: 43;

Dribe, 2009: 80-81]. Thanks to the detailed dataset elaborated by Bonnueil [1997], I was able to disaggregate female past migration patterns in different age groups over the whole period and, though relatively small, all effects turn out to be significant. The signs of these coefficients, however, were not all in the same direction. The net inflow of women in their mid-twenties (mean age of marriage in this period for most *départements* is in the low twenties) has a negative effect on fertility, probably by increasing the denominator of the index, whereas younger and older women have a positive effect (yet rather small), suggesting that they are affecting the numerator more than the denominator. It is very difficult to draw strong conclusions based upon these outcomes, but one way of reading them is that women –at least those migrating– were delaying births rather than spacing them, something that is certainly still debated in the literature. Although indeed quite suggestive, further research is needed to be more confident about this statement.

[Table 2 about here]

Both income and savings per capita have a similar, positive impact on births. This is an interesting result, as in Table 1 we saw that high values in these variables were associated to places with lower fertility, a correlation that has been pointed out by other authors as well [e.g. van de Walle, 1976: 286]. Nevertheless, once other factors are accounted for, and fixed effects are introduced, the relationship is clearly positive. Given the nature of the measures I use, this outcome is most likely reflecting the role of wealth on the decision to have children, in a context where they are considered to be normal goods. Other works that have looked into income-related measures have instead relied upon wage data, which arguably are closely connected to the idea of opportunity cost of time than that of wealth and, as expected, they suggest either a negative correlation with fertility [Brown and Guinnane, 2002: 44; Dribe, 2009: 85] or not correlation at all [Galloway et al., 1994: 152]. As the discussion earlier in the paper somewhat anticipated, both urbanisation and the number of people in industry are disappointingly unimportant. The proxy for financial development, on the other hand, has the right sign and it is only marginally rejected, providing some mild support to the argument that financial institutions partly substitute some of the services formerly provided by children. Brown and Guinnane [2002] using the same measure for Bavaria found the same sign but significance was even smaller, while Galloway *et al.* [1994: 251] do see that in Prussia the development insurance services in the rural sector is associated with lower fertility.

As many economic development theories suggest [see e.g. Schultz, 1997], fertility in nineteenth century France was indeed more sensitive to female than to male literacy. In fact, literacy of conscripts was not significant in any specification. This is in accordance with the idea that the opportunity cost faced by mothers matter the most at the moment of deciding the size of the family. In a similar direction, a high proportion of children in schools is a good predictor of low fertility, which highlights the importance of the trade-off between quantity and quality of children and, together with the previous one, allows us to venture the hypothesis that the efforts made by the French state during the nineteenth century to organise and enforce primary education, such as with the Guizot law of 1833, and eventually extending it to all boys and –most importantly– girls in the country probably had a reinforcing effect on fertility dynamics.

Although not all 'economic' factor appear to have had an impact on fertility, the results so far support the hypothesis that economic motives did matter to determine the level of fertility. What about cultural and social variables? If factors directly associated with the democratic values fostered by the French Revolution were ever important to explain fertility levels, they were certainly not relevant towards the end of the nineteenth century. Neither republicanism (i.e. proportion of people voting for parties that were not monarchist) nor political participation seem to be connected with fertility. All proxies of religiosity, however, suggest similar significant effects, and with the expected sign. This confirms one of the clearest results of the Princeton project [Knodel and van de Walle, 1979; Lesthaeghe and Wilson, 1986] and subsequent, more sophisticated studies [e.g. Weir, 1983; Galloway *et al.*, 1994; Brown and Guinnane, 2002]: regions (in this case, *départements*) that are more religious undoubtedly had higher fertility.

Another of the ideas suggested by the Princeton project that finds support from this study is that of the role of diffusion. It is interesting to see that all the results above hold even when controlling for spatially-, time-lagged fertility, which is also statistically significant.[4] In fact, the introduction of this component using the distant weighting matrix (instead of the neighbours one) absorbs most of the explanatory power of the time dummies without having any substantial effect on the level or significance of the other coefficients. Here then, as found by Guinnane and Brown [2002: 45] for Bavaria, date tells us nothing. In the case of France, it is a combination of economic and cultural factors that contribute to explain different levels of fertility, which to some degree appear to be mediated by a diffusion process. It is, however, hard to say from the analysis presented here much about the actual mechanisms behind this diffusion. As recent literature argues [e.g. Kohler, 2001], it is plausible to think that this had to do with the role of social networks, perhaps facilitated by an increasingly common language that might partly explain why low fertility was achieved earlier in places where French was more widespread [see e.g. Weber, 1976: 498-501], not in the distribution of information about contraception, but in the definition of fertility choice as a coordination problem among agents. This is nevertheless an area on which further research could be particularly useful [González-Bailón and Murphy, 2008].

CONCLUSION

In this paper I looked into the potential factors driving the fertility decline within France. The econometric analysis I perform using 2SLS estimation in a fixed-effects panel model finds evidence that confirms the key roles played by *both* economic *and* cultural factors in explaining fertility. Most notably, wealth is positively correlated with larger families, whereas extended education (both female literacy and child enrolment in primary schools) is negatively correlated with it. There is also a mild (only marginally insignificant) negative effect of the measure I use of financial development, (only weakly) supporting the idea that children might have been seen as an investment good (and financial institutions as a substitute). There is no clear indication that infant mortality, urbanisation, industrialisation, or male education had any effect whatsoever. Religiosity, measured in three different ways, is consistently relevant to explain fertility. All

[4] For ease of exposition, I omitted many other possible models where the spatial dependence is removed. Perhaps unsurprisingly, this makes some of the other variables slightly more significant, but coefficients and estimated elasticities remain basically the same.

these effects are present despite the fact that I introduced (in two alternative ways) spatially-, time- lagged fertility, which also turns out to be strongly significant providing support for the diffusion hypothesis. One possible way to read these results points towards the idea that cultural factors were partly driving fertility dynamics, by preventing or allowing the adjustment to economic incentives. This suggests that both components should be included in the theoretical models to provide a more comprehensive answer of why the decline occurred (and eventually induced Western Europe to achieve modern economic growth). The analysis developed here allows us to be more confident in establishing the link between some cultural traits, economics, and fertility, though it is still rough in determining the precise way in which this took place. As pointed out by many researchers, probably most emphatically by Weir [1983: 281], the connection cannot be taken lightly and more research should be put into the mechanism behind this.

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APPENDIX: VARIABLES USED AND DATA SOURCES

Table 1 in the text summarise and describe the variables used in the analysis and, though definitions are in general self-explanatory, some might need further explanations. First, since the main interest was on the behaviour of couples, I decided to use the I_g Princeton index to measure fertility. Guinnane *et al.* [1994] warn us to be cautious when drawing conclusions from this index 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. Since I am not making statements about parity dependence and looking into a period when the transition is ongoing, those caveats are not particularly relevant in this case. Second, due to the lack of data on actual income, I used direct taxes per capita as a proxy –as done by Weir [1995], and supported by the fact that those taxes were more or less equal across *départements* and did not change much over the period studied [see Willis, 1895: 46-48]– which I made more illustrative by taking the income for the whole country in the relevant years and using the proportion of national contribution to direct taxes as a weight to obtain departmental proxies for income. Third, 'children attending' is really a proxy for school attendance constructed by dividing the number of children at school over twice the population of children aged 1 to 4 years old, which is a relatively good proxy of those aged 5 to 12 (roughly school-age): the proxy is not perfect (its mean is above 1 in some cases), but it is probably a decent monotonic transformation of the true values, hence useful for the analysis. Lastly, I experimented with several measures of secularisation. One tentative possibility was to look at the size of the clergy, so I use the number of *desservants* (a class of parish priests who were named by the bishop without the sanction of the Government, but could also be removed at any time by the bishop, i.e. a part of clergy over which the Church still had substantial discretion) per thousand inhabitants, which enjoyed some variability. I also constructed another 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. Also, there is some suggestion in the literature [Gibson, 1989: 7] that rate of bastardy can be a good indicator of the declining influence of the Catholic Church as it represented that either people were listening less to the advice of the Church or they were merely less scared of saying so. This represents the third index of the declining hold of the Catholic Church.

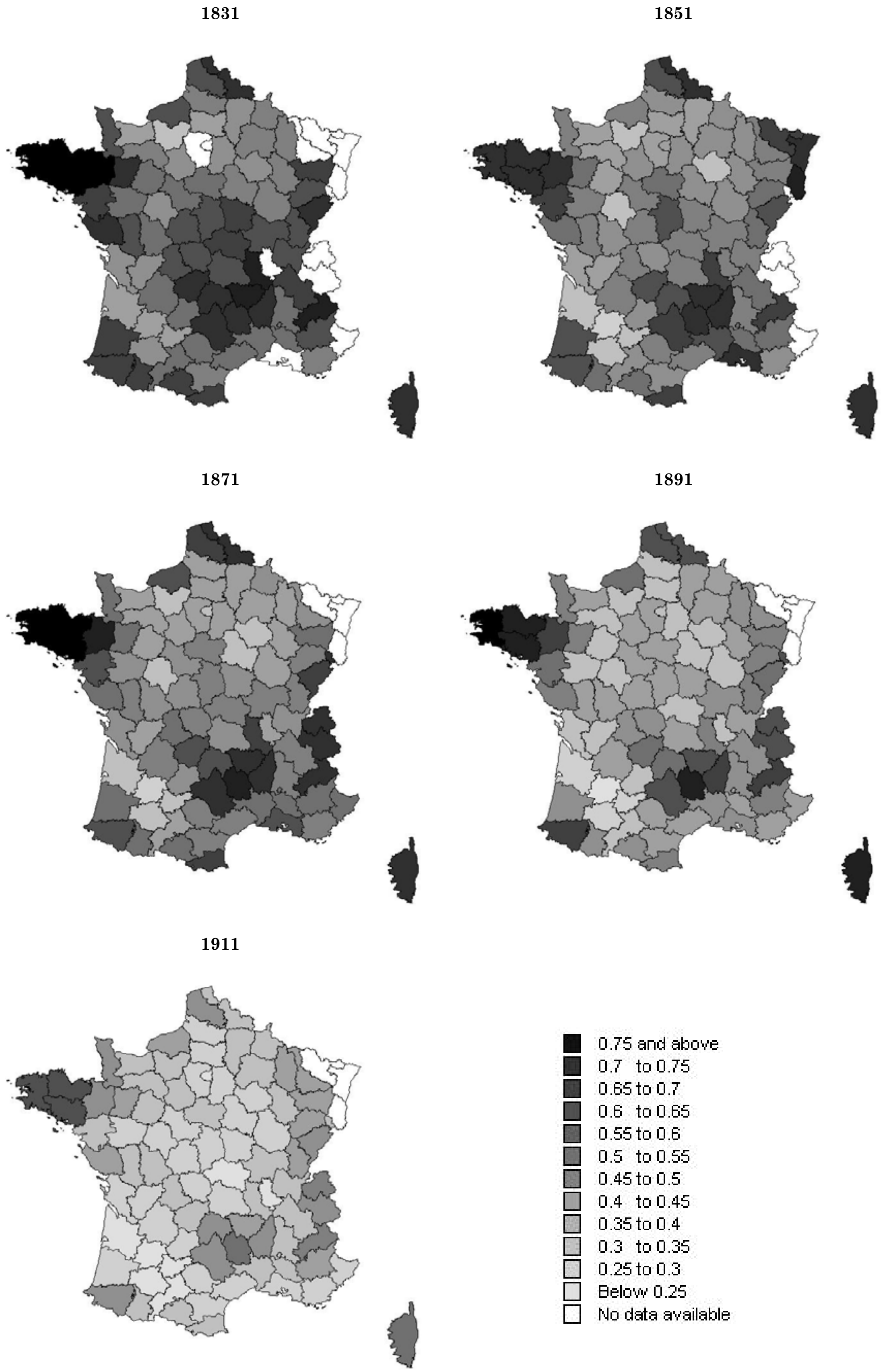
The panel dataset comprises the years 1876, 1881, 1886, 1891 and 1896, and all *départements* that were part of France during that period are represented in the sample. The major part of the dataset was constructed using official statistics by the Service de la Statistique Général de la France between 1878 and 1903 and Table A details the references for each variable collected. Data were in general available for all five years, so for only a few cases I had to rely upon an alternative reported year or estimates. To get the missing values for the people working in industry 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. 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 (I_g), was obtained from the original core publication of the project [Coale and Watkins, 1986: 94-107]. 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. Climatologic data was kindly given by a group of researchers at the University of Bern that calculated a monthly series spanning five centuries of European climatologic data [Luterbacher et al., 2004].[5] 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° × 0.5° (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° radius. About 250 of these data-points lay on French territory. To obtain estimates of the temperature in each *département*, I took the values corresponding to the points laying on that department and averaged them.

[5] I have to thank Roman Studer here for letting me know about this study and putting me in contact with the researchers in charge of it.

Following this procedure I calculated for the years of the panel the average temperature for January and July, as well as their deviations from the corresponding 1850-1900 mean.

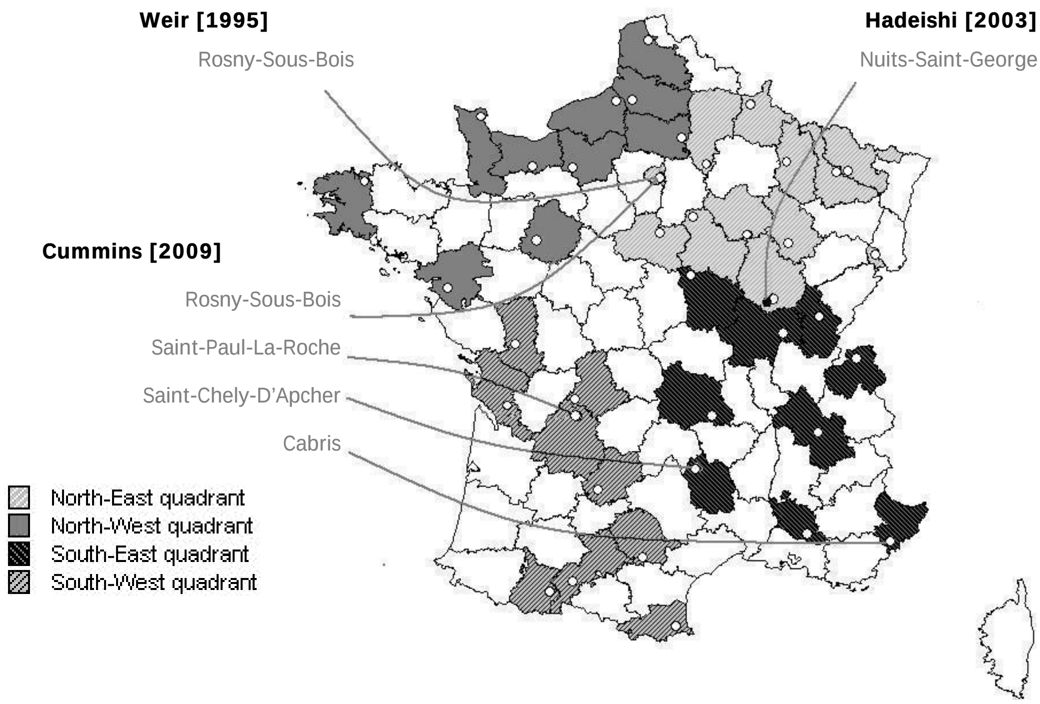
[Table A about here]

<u>Figure 1</u>. Marital fertility index (Ig) in France for each *département*, 1831-1911



<u>Sources</u>: Maps are mine, constructed using data from Coale and Watkins [1986: 94-107].

Figure 2. INED 1670-1829 sample and studies using individual data



Sources: The map indicates the *départements* where the INED sample villages [Henry, 1972, 1978; Henry and Houdaille, 1973; and Houdaille; 1976] were located. White circles indicate their approximate location, and the black circle in Côte-d'Or corresponds to the town of Nuits-Saint-George. The three main studies carried out using individual data are shown indicating on which towns they were based upon.

Table 1. **Means and standard deviations of the variables used in the panel regressions, French *départements*, 1876-1896**

Variable	Definition	All 1876	All 1896	High Fertility 1876	High Fertility 1896	Low fertility 1876	Low fertility 1896
Marital fertility	Princeton index of marital fertility (Ig)	0.491 (.132)	0.415 (.114)	0.735 (.070)	0.644 (.064)	0.320 (.022)	0.282 (.032)
Infant mortality	Deaths of children younger than 1 year old over births	0.165 (.039)	0.149 (.027)	0.179 (.032)	0.161 (.036)	0.168 (.030)	0.145 (.023)
Net immigration 15/19-20/24	Net immigration of women aged (a)/(a+4)-(a+5)/(a+9) in the last five years	-0.006 (.045)	-0.028 (.078)	-0.044 (.020)	-0.095 (.037)	0.025 (.063)	0.025 (.118)
Net immigration 20/24-25/29		-0.004 (.065)	-0.043 (.063)	-0.021 (.015)	-0.097 (.030)	0.028 (.061)	0.005 (.074)
Net immigration 25/29-30/34		0.006 (.050)	-0.040 (.045)	-0.019 (.012)	-0.073 (.025)	0.018 (.039)	-0.002 (.040)
Foreigners	Change in the amount of foreign born per population in the last five years	0.002 (.006)	-0.001 (.006)	0.001 (.002)	-0.002 (.006)	0.001 (.003)	-0.002 (.003)
Income per capita	National domestic product weighted by direct taxes, per capita, over the price of wheat	570.9 (226)	963.8 (347)	326.0 (86.5)	519.3 (146)	818.9 (303)	1377.0 (436)
Savings per capita	Money in saving accounts, per capita, over the price of wheat	20.2 (14.0)	137.5 (84.6)	8.5 (4.9)	63.3 (31.3)	25.0 (16.8)	176.0 (120)
Urban population	People living in urban areas as a % of total population	0.260 (.157)	0.300 (.169)	0.146 (.054)	0.169 (.060)	0.310 (.249)	0.343 (.246)
Population in industry	People working or depending on someone working in industry as a % of total population	0.216 (.093)	0.221 (.109)	0.118 (.060)	0.132 (.049)	0.258 (.109)	0.255 (.110)
Saving books	Number of saving books per adult	0.096 (.066)	0.229 (.134)	0.041 (.020)	0.112 (.054)	0.125 (.079)	0.282 (.164)
Literacy (female)	% of women signing the marriage contract (not drawing a cross)	0.701 (.183)	0.901 (.100)	0.596 (.199)	0.808 (.175)	0.755 (.147)	0.939 (.039)
Literacy (male)	1 minus the % of conscripts that do not know how to write or read	0.844 (.102)	0.951 (.041)	0.783 (.142)	0.913 (.070)	0.893 (.062)	0.959 (.022)
Children attending	% children in school-age attending school (proxy)	0.887 (.144)	1.076 (.124)	0.811 (.214)	1.062 (.224)	0.949 (.120)	1.095 (.087)
Religion 1 (desservants)	Number of *desservants* per 1,000 population	0.931 (.349)	0.995 (.439)	0.937 (.448)	0.959 (.504)	0.998 (.449)	1.178 (.569)
Religion 2 (religious education)	% Primary school students attending religious institutions	0.375 (.132)	0.284 (.106)	0.444 (.176)	0.353 (.169)	0.322 (.076)	0.241 (.060)
Religion 3 (natural children)	% illegitimate births over total births	0.055 (.031)	0.068 (.035)	0.036 (.017)	0.043 (.017)	0.075 (.063)	0.091 (.060)
Republican vote	% of votes received by republican parties (as opposed to monarchist parties)	0.543 (.151)	0.681 (.136)	0.510 (.147)	0.642 (.179)	0.509 (.141)	0.646 (.117)
Turnout at the polls	People turning out at the polls as a % of voters inscribed	0.808 (.045)	0.762 (.056)	0.803 (.054)	0.729 (.063)	0.827 (.046)	0.784 (.046)

Notes: Standard deviations in parenthesis. See the appendix for a detailed account of sources and of how variables were constructed. *Départements* with systematic high fertility are Finistère, Côtes-du-Nord, Morbihan, Lozère, Ille-et-Vilaine, Corsica, Hautes-Alpes, Ardèche, Savoi and Haute-Savoi; those with systematic low ferility are Lot-et-Garonne, Eure, Gironde, Tarn-et-Garonne, Gers, Seine, Aube, Indre-et-Loire, Oise and Yonne.

Table 2. **Modelling marital fertility in France (1876-1896) using *départements* data, 2SLS with fixed effects**

	Model 1			Model 2			Model 3			Model 4		
	Elast.	Coef.	(s.e.)	Elast.	Coef.	(s.e.)	Elast.	Coef.	(s.e.)	Elast.	Coef.	(s.e.)
Demographic controls												
Infant mortality	**-0.032**	-0.088	(.118)	**-0.039**	-0.110	(.121)	**-0.004**	-0.012	(.124)	**-0.044**	-0.122	(.108)
Net immigration 15/19-20/24	**-0.004**	0.119**	(.055)	**-0.004**	0.115**	(.049)	**-0.004**	0.111**	(.053)	**-0.004**	0.107**	(.052)
Net immigration 20/24-25/29	**0.012**	-0.212***	(.052)	**0.013**	-0.219***	(.053)	**0.011**	-0.190***	(.052)	**0.013**	-0.214***	(.052)
Net immigration 25/29-30/34	**-0.003**	0.084**	(.039)	**-0.003**	0.098***	(.038)	**-0.004**	0.103***	(.036)	**-0.003**	0.087**	(.039)
Foreigners (% change in pop)	**0.001**	0.255	(.247)	**0.001**	0.212	(.242)	**0.001**	0.265	(.239)	**0.001**	0.253	(.236)
Economic												
Income per capita	**0.040**	0.00002*	(.000)	**0.035**	0.00002	(.000)	**0.040**	0.00002*	(.000)	**0.033**	0.00002	(.000)
Savings per capita	**0.035**	0.00021***	(.000)	**0.031**	0.00018**	(.000)	**0.040**	0.00023***	(.000)	**0.037**	0.00021***	(.000)
Urban population	**0.019**	0.030	(.094)	**0.007**	0.011	(.099)	**0.000**	0.000	(.093)	**0.009**	0.014	(.091)
Population in industry	**0.029**	0.062	(.059)	**0.029**	0.062	(.058)	**0.023**	0.048	(.057)	**0.028**	0.060	(.058)
Saving books per capita	**-0.037**	-0.098	(.078)	**-0.028**	-0.073	(.076)	**-0.040**	-0.105	(.075)	**-0.045**	-0.118	(.079)
Education												
Literacy (female)	**-0.074**	-0.042*	(.024)	**-0.074**	-0.042*	(.025)	**-0.097**	-0.054**	(.025)	**-0.078**	-0.044*	(.024)
Literacy (male)	**0.000**	-0.0002	(.033)	**-0.001**	-0.001	(.034)	**-0.026**	-0.013	(.034)	**-0.023**	-0.012	(.033)
% children attending school	**-0.098**	-0.045***	(.016)	**-0.103**	-0.047***	(.016)	**-0.102**	-0.047***	(.016)	**-0.100**	-0.046***	(.016)
Modernisation												
Religion 1 (desservants)	**0.066**	0.032**	(.014)							**0.068**	0.033**	(.014)
Religion 2 (religious education)				**0.066**	0.095*	(.053)						
Religion 3 (natural children)							**-0.072**	-0.530**	(.227)			
% republican vote	**0.009**	0.006	(.011)	**0.009**	0.006	(.011)	**0.010**	0.007	(.011)	**0.008**	0.005	(.010)
Turnout at the polls	**-0.024**	-0.014	(.021)	**-0.028**	-0.017	(.023)	**-0.004**	-0.003	(.021)	**-0.030**	-0.018	(.022)
Spatial dependence												
ρ (neighbour)	**0.279**	0.280**	(.135)	**0.284**	0.285**	(.139)	**0.278**	0.278**	(.140)			
ρ (distance)										**0.852**	0.839*	(.452)
Time dummies												
Dummy – 1881	**-0.005**	-0.011**	(.005)	**-0.004**	-0.009*	(.005)	**-0.003**	-0.007	(.006)	**-0.004**	-0.008	(.005)
Dummy – 1886	**-0.013**	-0.029***	(.009)	**-0.009**	-0.022**	(.009)	**-0.010**	-0.023*	(.009)	**-0.008**	-0.018*	(.010)
Dummy – 1891	**-0.025**	-0.057***	(.013)	**-0.019**	-0.045***	(.013)	**-0.019**	-0.044***	(.013)	**-0.014**	-0.032	(.020)
Dummy – 1896	**-0.031**	-0.070***	(.015)	**-0.025**	-0.057***	(.016)	**-0.024**	-0.054***	(.016)	**-0.014**	-0.031	(.031)
R^2:		0.8004			0.7999			0.8049			0.7980	
F(2,86) – Test excl. instruments		21.31			20.80			18.62			23.14	

Notes: See appendix for a complete description of sources. All estimations included 435 observations (5 per each of the 87 *départements*). Estimates are heteroskedasticity robust, and clustered by *département* as suggested by Bertrand *et al.* [2004: 270-272] to correct the potential risks of serial correlation. Asterisks indicate significance levels: * 10%, ** 5%, and *** 1%.

Table A. Variables obtained from official French statistics

Variable	Reported year PUBLICATION [publication year: pages]				
Population					
Total	1876 ASF [1879: 14-17]	1881 ASF [1884: 12-15]	1886 ASF [1888: 4-5]	1891 ASF [1903: 8-11]	1896 ASF [1903: 8-11]
Women	1876 ASF [1879: 34-37]	1881 ASF [1883: 20-23]	1886 DEN [1888: 84-85]	1891 ASF [1892/4: 24-25]	1896 ASF [1899: 2-5]
By age (< 5 years old)	1876 DEN [1878: 96-99, 120-123]	1881 DEN [1883: 136-139, 160-163]	1886 DEN [1888: 152-155]	1891 DEN [1894: 605-607]	1896 DEN [1899: 356-359]
Births, stillbirths, and number of natural children born	1876 ASF [1879: 44-47]	1881 ASF [1884: 26-29]	1886 ASF [1889: 14-17]	1891 ASF [1899: 2-5]	1896 ASF [1902: 16-19]
Deaths (male < 5 years old)	1876 ASF 1879: 54-57]	1881 ASF [1884: 36-39]	1886 SGF [1889: 64-67]	1891 SGF [1892, 56-59]	1896 SGF [1898, 80-83]
Deaths (female < 5 years old)	1876 ASF [1879: 58-61]	1881 ASF [1884: 40-43]	1886 SGF [1889: 68-71]	1891 SGF [1892, 60-63]	1896 SGF [1898, 84-87]
Foreigners (a)	1876 DEN [1878: 88-91]	1881 DEN [1883: 116-119]	1886 DEN [1888: 96-97]	1891 DEN [1894: 506-509]	1896 DEN [1899: 258-261]
Urban	1876 ASF [1879: 14-17]	1881 ASF [1884: 12-15]	1886 ASF [1888: 4-5]	1891 ASF [1892/4: 12]	1896 ASF [1903: 24-27]
In industry	1876 DEN [1878: 212-215]	1881 DEN [1883: 272-275]	1886 DEN [1888: 222-223]	1891 ASF [1892/4: 28-29]	[extrapolated]
Literacy and education					
Women being able to sign	1876 ASF [1879: 18-21]	1881 ASF [1884: 31, 33]	1886 ASF [1889: 18-19]	1892 ASF [1892/4: 50-51]	[extrapolated]
Number of conscripts and their literacy level (b)	1876 ASF [1879: 474-477]	1881 ASF [1884: 524-527]	1887 ASF [1888: 414-417]	1893 ASF [1892/4: 684-5]	1897 ASF [1898: 628-629]
Students in lay and congregational primary schools (c)	1875-1876 ASF [1878: 240-243]	1880-1881 ASF [1883: 246-249]	1885-1886 ASF [1888: 184-187]	1892-1893 ASF [1892/4: 282-5]	1895-1896 ASF [1897: 442-446]
Others					
Taxes: direct contributions (in francs) (d)	1876 ASF [1881: 520-523]	1880 ASF [1885: 546-549]	1886 ASF [1889: 384-387]	1892 ASF [1892/4: 572-75]	1896 ASF [1897: 485]
Number of saving books and amount of francs in them (e)	1876 ASF [1879: 218-221]	1881 ASF [1884: 232-235]	1886 ASF [1886: 158-159]	1892 ASF [1892/4: 200]	1896 ASF [1898: 68-71]
Wheat prices	1876 ASF [1879: 14-17]	1881 ASF [1884: 314-316]	1886 ASF [1888: 216-218]	1893 ASF [1892/4: 308-310]	1896 ASF [1898: 94-97]
Number of Desservants	1876 ASF [1879: 68-71]	1881 ASF [1884: 60-63]	1886 ASF [1889: 26-29]	1991 ASF [1891: 34-35]	1996 ASF [1897: 485]
Electors and voters (f)	1877 ASF [1879: 458-459]	1881 ASF [1882: 460-461]	1885 ASF [1887: 554-557]	1893 ASF [1892/4: 668-9]	1898 ASF [1898: 521-522]

Sources: All these figures came from publications of the Service de la Statistique Général de la France [1878-1903], either the Annuaire Statistique de la France (ASF), the Statistique Générale de la France - Statistique Annuelle (SGF) or the Résultats Statistiques du Dénombrement (DEN)

Notes: (a) Residents that are not French nationals. Change from 1871 estimated using data for 1872 [DEN, 1873: 44-47], as the former was not available; (b) Information corresponding to the original list of conscript, not to those admitted to the army. Cases where the level of education was not known were extracted from the total to get literacy rates; (c) Includes all primary schools, free and public; (d) Includes mainly taxes on land (*foncière*), personal property (*personnel et mobilière*), houses (*des portes et fenètres*), and licenses (*des patentes*). Income estimates built applying the proportions implied by these taxes to the domestic product in Toutain [1987], deflated by the price of wheat; (e) Accounts hold in national *Caisses d'epargne*; (f) Corresponding to legislative elections for the reported years.