Marital Fertility and Wealth in Transition-Era France, 1750-1850

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Abstract

It has been long established that the demographic transition began in 18th century France, yet there is no consensus on exactly why fertility declined. This analysis links fertility life histories to wealth at death data for four villages in transition-era France, 1750-1850. For the first time, the individual-level economic correlates of the French fertility decline can be reported. Where fertility is declining, wealth is a powerful predictor of smaller family size. This paper argues that fertility decline in France was a result of changing levels of economic inequality, associated with the 1789 Revolution. In cross-section, the data support this hypothesis: Where fertility is declining, economic inequality is lower than were fertility is high.

JEL Classification: N33 J13 D31
Keywords: economic history; fertility decline; France; family economics; wealth; inequality; social mobility

1 Introduction

Two key events in the emergence of the modern World are the Industrial Revolution and the demographic transition. Britain was the pioneer of industrialization; France was the pioneer of conscious fertility control. Is there a connection between these two revolutions? The economic reasons for the fertility transition are poorly understood. We still cannot explain why fertility fell in eighteenth century France; just as we cannot explain why it fell over a century later in the rest of Europe. Economic explanations for the European fertility transition, such as demographic transition theory (Notestein, 1945), micro economic theory (Becker, 1960, 1991) and more recently unified growth theory (Galor, 2004) have treated the early French fertility decline as noise, the extreme tail end of a normal distribution. This is the intellectual equivalent of treating Britain as the exception in explaining the Industrial Revolution[1]. At the time fertility fell (apx. 1800); France was by far the largest country in Europe, excluding Russia, with a population of almost 30 million people representing 27.7% of the total population of Western Europe (calculated from Maddison (2003)). France should therefore be considered as the exemplar of the transition to low fertility.

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[1]Comparison borrowed from (van de Walle, 1974, p.5).

Empirically there are no obvious aggregate level socio-economic triggers for the European fertility transition. This has led some (e.g. Cleland and Wilson (1987)) to argue that the fertility transition was fundamentally a non-economic event. But there have been remarkably few studies of the individual-level economic correlates of the fertility decline. If the fertility decline was stratified along economic lines at the individual-level but not at the aggregate level, this has important implications for our understanding of the causes of the demographic transition. This analysis links detailed individual-level fertility life histories to wealth at death data for four villages in transition-era France, 1750-1850. The study presented here is the first to analyze the wealth-fertility relationship *during* the onset of the French fertility decline. In addition to reporting the empirical patterns, I forward an new explanation for why fertility declined in France. Decreases in the level of economic inequality, associated with the 1789 Revolution, suggest that the environment for social mobility changed to incentivize lower fertility in France.

1.1 Background

Over the past two centuries, fertility in most of the World has undergone a sustained and seemingly irreversible transition. In France, this revolutionary new behavior became widespread towards the end of the 18th century. Before this, the evidence suggests that human fertility was uncontrolled within marriage (Cleland and Wilson, 1987, p.12). Today, a low fertility regime is the norm in the developed world, with some regions experiencing fertility below that necessary to maintain a stable population. This fertility transition enabled the productivity advances of the Industrial Revolution to be transformed into higher living standards and sustained economic growth. Without a fertility revolution, exponential population growth would have returned the World to a Malthusian equilibrium (Clark (2007); Galor and Weil (2000). Understanding this change between the pre-industrial and the modern growth eras is a central research question for economics and social science. As of 2010, there is no consensus for the causal mechanisms behind the fertility transition.

Demographic transition theory, developed soon after the second World War, categorized Europe's demographic transition into a set of stages (Thompson (1929); Landry (1934); Notestein (1945)). Essentially, it was modernization, broadly defined, which lowered child mortality and therefore temporarily increased *net* family sizes. The lag between the initial decline in mortality and the fertility response fitted the big picture: Europe's population boomed before parent's adjusted their fertility behavior to take account of the new mortality schedule. The European Fertility Project (hereafter referred to as the EFP) led by Ansley Coale at Princeton University during the 1970s and '80s set out to provide an empirical basis for demographic transition theory. However, the EFP eventually concluded that the decline of marital fertility during the late 19th century was almost completely unrelated to infant mortality decline and other socio-economic changes (Watkins, 1986, p.448). *Time* was the best indicator for the onset of sustained fertility decline: Excluding France, 59% of the provinces of Europe began their fertility transition during the decades of 1890-1920 (Watkins, 1986, p.431-43). Therefore, the transition was an 'ideational change' and not an 'economic adaptation'. Recent criticisms have somewhat diluted the authority of the Princeton view. Brown and Guinnane (2003) argue that the EFP's conclusions were biased by the level of aggregation; The sub-national districts used (departments, counties, cantons etc.) were too large and internally heterogeneous to be useful as distinct fertility regimes. Further, the socio-economic data collected was not the most relevant to parent's fertility decisions.

To go beyond the EFP two issues must be addressed. Firstly, the level of aggregation, and secondly, the relevance of the socio-economic data. The study presented here directly addresses these two concerns via an individual-level analysis of fertility behavior with real wealth information.

The exceptional fertility decline of France is a central feature of the European demographic transition. The reasons for this spectacular break from the past has never been satisfactorily explained. Weir (1994) reports annual estimates of fertility levels for France, 1740-1911. He estimates the index of marital fertility (I_g): fertility relative to an observed maximum (that of an early twentieth century religious group, the Hutterites, who married early and prohibited contraception). From the late 18th century on, fertility appears to begin a steady and consistent decline from very high levels (80-90% of the Hutterites) to very low levels (apx. 31% of the Hutterites) by 1911. Econometric testing for structural breaks in this series places the transition at 1776. This is nearly a century before anywhere else in Europe (Belgium (1874)), and 101 years before England and Wales (1877) (see (Cummins, 2009, p.77) for details).

There have been two previous studies of the relationship between economic status and family size at the individual-level for France at this period. Weir, using the Henry demographic data, examined the relationship between income and fertility in Rosny-sous-Bois, a village close to Paris, using *rôles des tailles* (high quality tax records) for 1747. Fertility was high and varied little between his three income stratifications, although the evidence does suggest a slight reproductive advantage for his highest group relative to his lowest (7.3 to 6.2 births per family respectively) (Weir, 1995, p.15). Weir's sample size was small however: his total sample consisted of 47 families. Hadeishi, with a larger sample, and also using tax records, studied the town of Nuits in Burgundy from 1744-1792, and found a positive relationship between marital fertility and income (2003, p.489).

This analysis adds to this literature by linking pre-existing historical demographic data to new wealth data collected from various *Archives Départementales* in France. The geographic and socio-economic scope, along with the sample size, is far greater than previous studies. This will allow the identification of differential fertility patterns between socio-economic strata with greater power than before. Further, there has been no previous study which has examined the relationship between wealth and fertility *during* the period of the demographic transition in France.

The rest of this paper is comprised of five sections. Section 2 details the data and its summary characteristics. Section 3 is an examination of the wealth-fertility associations. Section 4 analyses the mechanics behind the fertility patterns, while Section 5 evaluates explanations for the French fertility transition. Section 6 Concludes.

2 Data

The demographic data to be analyzed is a subsample of the Louis Henry led INED[2] demographic survey, hereafter referred to as the Enquête Henry[3]. The 41 villages of the non-anonymous part of the sample were selected by random draw to cover the period 1670-1829, but this window was extended beyond 1829 for many villages (Weir, 1995, p.2, Séguy et al., 2001, p.41). The techniques of family reconstitution, invented by Louis Henry, were applied to generate the demographic data. Family reconstitution is a simple idea. As Wrigley puts it:

> Life consists only of birth, marriage and death. If the dates...of each member of a family are known, the reconstitution of that family is complete.

(Wrigley et al., 1997, p.13). The result of the Enquête Henry is a goldmine of individual-level information on the demographic characteristics of pre-industrial France.

[2]Institut National Etudes Démographiques, www.ined.fr.

[3]The summary papers of the Enquête Henry are:Henry (1972), Henry and Houdaille (1973), Houdaille (1976), and Henry (1978). A summary of all studies using the Henry data (before 1997) is listed in Renard (1997), and detailed discussion of the database can be found in Séguy and Méric (1997); Séguy (1999); Séguy and Colençon (1999); Séguy and la Sager (1999); Séguy et al. (2001).

Family reconstitution is not without its weaknesses. In order to maintain feasibility, recorded observations are limited to those who were married and who died in the sample parish. In practice, this 'migration censoring' omits transient members of the village and the resulting demographic data solely reflects the life histories of non-migrants. Therefore any calculated rates suffer from a selection bias and in the presence of large scale post-marriage migration, may not be representative of the village as a whole. However, this does not mean that the data is unusable. The potential bias which the selection criteria introduces (i.e. richer 'stayers' are more likely to appear than poorer migrants[4]) can be mitigated by comparing demographic rates between fixed wealth groupings.

Socio-economic status, as deduced from occupation, does not consistently pick up fertility differentials in the Enquête Henry data. On this, van de Walle has stated; "unfortunately, the population of the parishes usually is not clearly stratified and most attempts in finding lags in the dates of fertility decline by socio-economic groups have failed" (1978, p.264). To understand the relationship between wealth and fertility in France at this period, the Henry dataset must be augmented with more detailed economic data.

This paper links villagers from the Enquête Henry to their recorded wealth at death. The source for this wealth data are the *Tables des Successions et Absences* (hereafter, the 'TSAs'; in English: Tables of Bequests and Absent Persons), which are kept in various *Archives Départementales* in France. The TSAs were originally constructed for tax purposes and recorded all deaths in a locality, along with detailed information on the date of death, residence, profession, age at death and marital status. The value of an individual's estate at death was recorded, with estimates for both cash and property holdings. The TSAs recorded everybody, even those with no taxable assets at death, typically recorded as "rien". Almost one-quarter of the individuals in the linked Enquête Henry-TSA sample fall into this category.

Due to the fact that the property valuation recorded in the TSAs only covered property held in the locality, it is possible that the values calculated here are underestimates of the true property wealth of individuals. However, this bias only affects a small minority of the sample. According to Bourdieu et al, 85% of individuals in the "TRA" sample (also based on the TSAs) had one property record, leaving 15% with two or more (2004, p.7). Attempts to assess the accuracy of the wealth information in the TSAs are limited by the fact that"very few alternative sources exist" (Bourdieu et al., 2004, p.25). However, Bourdieu et al. test the validity of the TSAs against other published data and find the them to yield consistent results (2004, p.26).

Starting from the 41 Enquête Henry communes, the goal was to link as many individuals to the TSAs as possible. However, due to the limited overlap of the Enquête Henry (after 1829, many communes have little or no data) and the TSAs (which only starts post 1810), there were only twelve 'candidate' communes to attempt linkage. Following a tour of the corresponding *Archives Départementales*, and the ruling out of possible linkages due to lost or destroyed TSAs, four communes were left. The linked[5] Enquête Henry-TSA communes are Cabris (in the Alpes-Maritime department, 25 km inland from the coast, near Cannes), Saint-Paul-la-Roche (in the Dordogne, halfway between Limoges and Périgueux), Saint-Chély-d'Apcher (in Lozère, 45 km from Mende) and Rosny-sous-Bois (about 10km outside Paris[6]).

The Enquête Henry communes of Saint-Paul-la-Roche, Saint-Chély-d'Apcher and Rosny-sous-Bois corresponded to villages of the same name. The "ancient parish" of Cabris not only includes the village of the same name but also the smaller villages of Peymeinade, Speracèdes and Le Tignet

[4] On wealth and mobility, see Kesztenbaum 2008, p.174.

[5] The links were based upon name, profession, sex, age at death and date of death. These criteria, coupled with the small size of the villages, serve to place 100% certainty on the accuracy of the links.

[6] This is the same village studied previously by Weir(1995). All of these communes, apart from Rosny-sous-Bois, had a population of apx. 1,700 in 1821. Rosny-sous-Bois had a population of 822 (Houdaille, 1984, p.88).

(Henry, 1978, p.856). How representative are these villages? Table 1 reports the top 25 recorded occupations for the Enquête Henry and the sample villages. Extracting the true occupational structure from parish registers is difficult as occupation was recorded only 38% of the time (post 1749). The extent to which the recording of occupations varied with the status of occupations is unknown, but it is reasonable to assume that it did.

Table 1: Top 25 Occupations for the Sample villages, 1750-1819. Percentages in Parentheses

Rank	Enquête Henry	Cabris	Saint-Paul-la-Roche	Saint-Chély-d'Apcher	Rosny-sous-Bois
1	Farmer (21)	Farmer (53)	Farmer (66)	Weaver (25)	Farmer (65)
2	Vine Grower (12)	General Worker (18)	Weaver (5)	Working Proprietor (8)	Vine Grower (8)
3	Agricultural Laborer (9)	Land Owner (16)	Agricultural Laborer (5)	Land Owner (7)	Land Owner (6)
4	Laborer (7)	Weaver (2)	Land Owner (4)	Day Laborer (7)	Bricklayer/Stonemason (2)
5	Land Owner (5)	Baker (1)	Working Proprietor (3)	Farmer (6)	Gardener (2)
6	Day Laborer (4)	Stonemason (1)	Blacksmith (3)	Agricultural Laborer (4)	Working Proprietor (2)
7	Weaver (4)	Construction Joiner (1)	Carpenter (2)	Stonemason (3)	Day Laborer (2)
8	Stonemason (2)	Surgeon (1)	Day Laborer (1)	Carpenter (3)	Construction Worker (2)
9	General Worker (1)	Notary (1)	Miller (1)	Butcher (3)	Butcher (1)
10	Weaver (1)	Shoemaker (<1)	Domestic Servant (1)	Lord (3)	Baker (1)
11	Carpenter (1)	Potter (<1)	Cartwright (<1)	Inn Keeper (2)	Broker (1)
12	Miller (1)	Cooper (<1)	Wood Worker (<1)	Miller (1)	Carpenter (1)
13	Shoemaker (1)	Potter (<1)	Tailor (<1)	Shoemaker (1)	Agricultural Laborer (1)
14	Journeyman (1)	Shoemaker (<1)	Butcher (<1)	Baker (1)	Shoemaker (1)
15	Domestic Servant (1)	Day Laborer (<1)	Beggar (<1)	Wagoner (1)	Locksmith (1)
16	Working Proprietor (1)	Carpenter (<1)	Notary (<1)	Saddler (1)	Surgeon (1)
17	Gardener (1)	Shepherd (<1)	Lord (<1)	Jurist (<1)	Saddler (1)
18	Fiber Comber (<1)	"Bourgeois" (<1)	Officer (<1)	Doctor (<1)	Cartwright (1)
19	Construction Joiner (<1)	Teacher (<1)	Paper Maker (<1)	Wood Worker (<1)	Rentier (1)
20	Shepherd (<1)	Brick maker (<1)	Rope maker (<1)	Tailor (<1)	Village Policeman (1)
21	Cooper (<1)	Mayor (<1)	Forest Supervisor (<1)	Roofer (<1)	Pork Butcher (<1)
22	Cartwright (<1)	Soldier (<1)	Blacksmith (<1)	Legal clerk (<1)	Officer (<1)
23	Logger (<1)	Oil Presser (<1)	Working Proprietor (<1)	Locksmith(<1)	Stonemason (<1)
24	Wood Worker (<1)	Customs Officer (<1)	Iron Worker (<1)	Surgeon (<1)	Wall Paperer (<1)
25	Inn Keeper (<1)	Postman (<1)	Wool Comber (<1)	Lawyer (<1)	Weaver (<1)
Other Occupations (%)	27	6	9	24	0
Proportion Occupations Recorded (%)	38	46	20	32	42

As the extent of under-reporting of occupations was so large, table 1 can only give us a rough clue on the likely occupational distribution of these villages (the extent of differential ommision between villages makes comparison with the averages difficult too). Rosny-sous-Bois had a mixed economy of grain-farming and viticulture ((Weir, 1995, p.2)). Both Cabris and Saint-Paul-la-Roche are typical rural agricultural villages (farmers and laborers account for 70% of recorded occupations). Saint-Chély-d'Apcher is undoubtedly more urban than the other villages (Weavers, at 25%, is the most frequently reported occupation). By the 1880s, Saint-Chély-d'Apcher was the center of the French wool trade (Malte-Brun, 1881, p.24) [7].

Using the Coale-Demeny model life tables, it is possible to categorize the sample villages based upon their infant and child mortality rates. There is a clear division in the sample. For two of the villages, Cabris and Rosny-sous-Bois, mortality is relatively low. In these villages, the best fitting model life table was the 'North' model with an implied e_0 of 52.6 for Cabris and 50.2 for Rosny-sous-Bois. For Saint-Paul-la-Roche and Saint-Chély-d'Apcher, mortality was far higher. The 'North' model fitted the St.Paul data best with an implied e_0 of 31.6. For Saint-Chély-d'Apcher, the 'West' model was the best fit with an associated e_0 of 33.2.

The sample covers the fertility experience of individuals who died between 1810 and 1870 and who were born between the 1720 and 1820. The relevant 'fertile period' covered is roughly 1750-1850. At this time approximately 80% of the French population lived in villages of a similar size to those in the sample (Sharlin, 1986, p.235). Fertility decline in France cannot be understood without understanding what was happening in these villages. However, the sample villages are only four out of perhaps 40,000 villages in France as a whole.

Figure 1[8] reports the changes in the index of marital fertility in 37 Enquête Henry villages and for France, over the 1750-1810 period. The variety of patterns in the Enquête Henry villages is neatly captured by the linked sample villages. Contrasting individual villages with that of France, we can see that Rosny-sous-Bois and Cabris have a relatively large drop in marital fertility, where as in Saint-Paul-la-Roche and Saint-Chély-d'Apcher, fertility decline is far more modest. Fertility actually *rises* in Saint-Chély-d'Apcher. The high degree of heterogeneity in French fertility is also reflected at the department level [9].

The diverging pattern of the linked Enquête Henry-TSA sample villages is striking. The following analysis will apply a crude division of the four sample villages into two types of demographic regime. The first regime is the *non-decline* regime, consisting of Saint-Paul-la-Roche and Saint-Chély-d'Apcher. In these villages, fertility decline is either ambiguous or entirely absent. The second type of village are the *decline* villages, Rosny-sous-Bois and Cabris, where significant fertility decline has certainly occurred in the sample period. The categorization was motivated, and is justified by, the similar trends and levels of marital fertility and infant mortality[10].

2.1 Fertility, Income and Wealth

The principal research question in this paper is: What was the relationship between wealth and fertility in transition-era France? Usually, economists relate fertility choices to income, not wealth.

[7] Religiosity is one factor not analyzed here. This feature seems to be unusually strong in Saint-Chély-d'Apcher: Jones reports that after the Revolutionary authorities threatened death for anyone who gave shelter to priests, they freely roamed Saint-Chély-d'Apcher "in full habit" (Jones, 2003, p.215).

[8] I_g was calculated from the Enquête Henry for the decades 1740-60, and 1800-1820, the figure reports the differences. There was not enough observations to calculate this for four of the Enquête Henry villages. Source for France: (Weir, 1994, p.330-1).

[9] See p.170-189 in van de Walle (1974).

[10] To be specific the *decline*/*non-decline* division is motivated by the fertility trends reported in figure 1 and the pattern of the infant mortality rates in Appendix D.

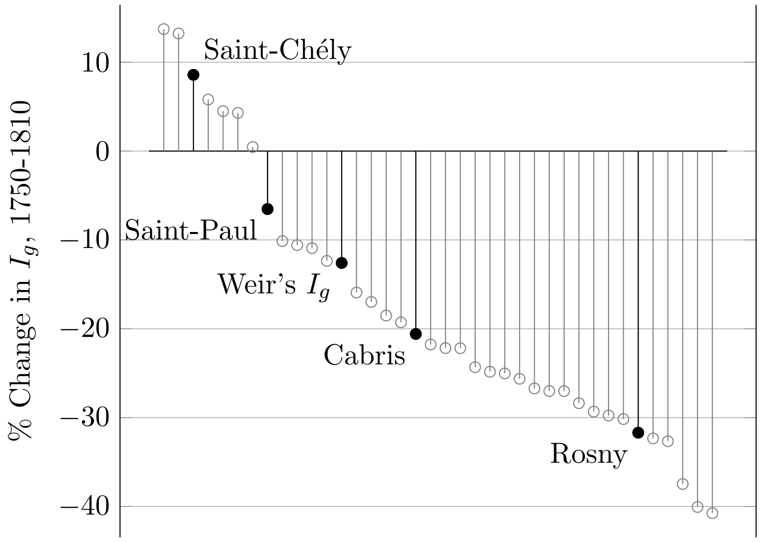

Figure 1: Fertility Decline in 37 Henry Villages, 1750-1810

For instance, Becker (1991, p.145) developed a simple family budget constraint, written as:

$$p_q qn + \pi_z Z = I \tag{1}$$

Where p_q is the cost of a unit of child quality, q is the total quality of each child, n is the number of children, π_z is the cost of other goods and Z represents an aggregate of all other goods. Parents will face a trade off between quality and quantity of children, and the amount of alternative consumption. The constraint is full income, I.

Narrow definitions of these terms are of limited use. For instance, the true cost of children will necessarily include opportunity cost. Rising relative wages for women will depress fertility by increasing the opportunity cost of women's time. In this vein, we can expand the definition of I, full income.

Milton Friedman proposed that current consumption depended not upon current income, but upon permanent income, the *Permanent Income Hypothesis* (1957). Income, I is made up of two components:

$$I = I_p + I_t \tag{2}$$

Where $_p$ and $_t$ denote permanent and transitory components of income. Friedman states: "The permanent component is to be interpreted as reflecting the effect of those factors that the unit regards as determining its capital value or wealth" (1957, p. 21). The transitory component, I_t can be attributed to cyclical fluctuations in economic activity, and other accidental or chance occurrences. The mean transitory component of income will be zero, over the life course, and in aggregated groups (Friedman, 1957, p.22).

Parents will make decisions on investment goods such as children based upon their permanent income. This proposition is formulated by combining equations 1 and 2, in equation 3.

$$p_q qn + \pi_z Z = I_p \tag{3}$$

The demand for children, n, and the quality of children, q, will depend not upon current income but upon parents' *permanent* income. The TSA wealth data, estimated at death, and reflecting inheritance and life time wealth accumulation, can be used as a proxy for this permanent income.

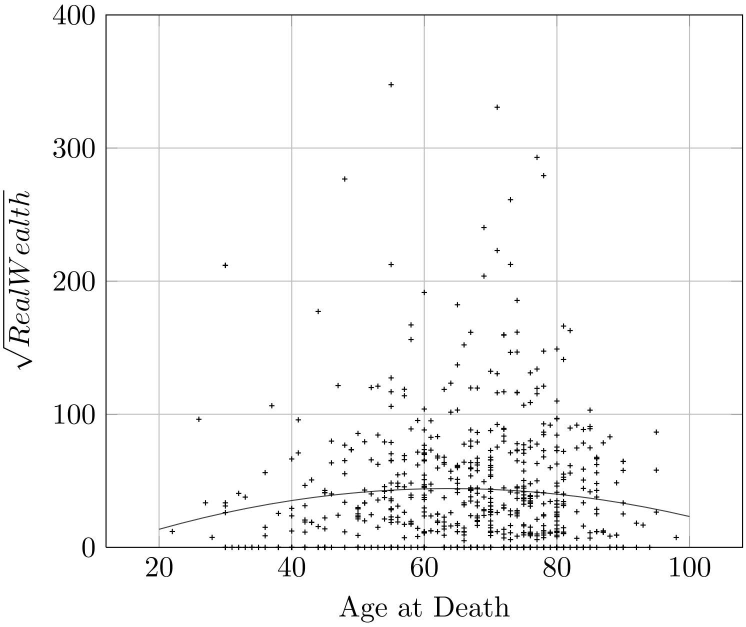

Figure 2: Life Course Effects

2.2 Wealth and the Life Cycle

The TSA wealth data is a snapshot of an individual's wealth at the time of their death. As people die at different ages, we may be picking up fathers at different points in their life course. The *Life Cycle Hypothesis* predicts that an individual's net wealth (W) should increase steadily as age increases before dissaving in retirement reduces wealth. Additionally, we can speculate that wealth itself could be a function of family size. Where children are a net cost (at young ages), wealth will be a decreasing function of the number of children:

$$Wf\frac{1}{n}, s.t.A_c \leq A_c^* \tag{4}$$

Where W is wealth, A_c is the age of the child and A_c^* is a threshold child age below which children are a net cost, and above which children are not. Wealth is influenced by the number of children because consumption varies over the life course. It is to be expected that younger men should have a lower wealth than older men, as they are more likely to be supporting dependents. This effect introduces an endogeneity problem into the analysis[11].

Taken together, consumption smoothing and the differential net cost of children over the life cycle will generate a steep age-wealth profile. Was this in fact the case in transition-era France?

Figure 2 reports the aggregate life course wealth pattern, with a quadratic curve reflecting the coefficients of an OLS regression of *ageatdeath* and $ageatdeath^2$ on the $\sqrt{RealWealth}$[12]. Simple calculations confirm first impressions: There are life course effects. As people grow older, they

[11]The analysis in section 3, assumes that *wealth* is determining fertility, and not vice versa. However, the strength of the fertility effect on *wealth* (equation 4) will be a negative function of fathers' age, and robustness tests are performed based upon this

[12]The resulting coefficients are

$$\sqrt{RealWealth} = -20.18 + 2.04 * Ageatdeath - 0.016 * Ageatdeath^2 \tag{5}$$

The *age* coefficients were both significant at the 5% level and the adjusted R^2 was 0.004.

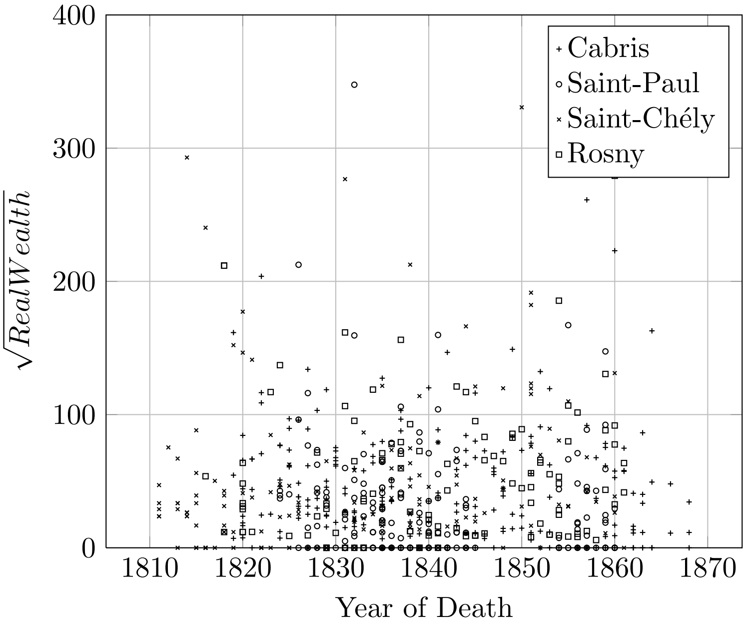

Figure 3: Real Wealth by Year of Death (Males)

become richer. Past 64, wealth becomes *negatively* associated with age. The net age effect, however, is remarkably weak. For the vast majority of the sample, those who died under 80, there is no statistically significant relationship between real wealth and age[13]. The absence of a large life course effect allows the use of the wealth data in the detection of differential fertility.

2.3 Wealth Groupings and Raw Averages

The nominal levels of wealth reported in the TSAs were converted to real levels, with a base year of 1855, using a cost of living index from Levy-Leboyer and Bourguignon (1990). There is a statistically insignificant effect of year of death on real wealth, with a linear fit completely flat for the sample period (figure 3). For the analysis, the sample will be split into three wealth groups, or 'terciles'. As there was no time trend in the evolution of real wealth during this period, the division of wealth is calculated over the entire sample, disregarding sub-period. The choice of three wealth cuts follows Weir (1995) and Gutmann and Watkins (1990), and makes sense when we consider that these villages were primarily agricultural and the socio-economic stratification, as perceived by the population themselves, was probably relatively simple. The division split the sample into even thirds, with those dying with the sum of 0-141 Francs been designated to group 1, those with wealth at death between 141 and 2,100 Francs designated into group 2, and those with a wealth at over 2,100 been designated to group 3.

Table 2 reports the average number of children born (henceforth 'gross fertility') and the number of children surviving to ten years ('net fertility'). These values represent the actual gross and net reproductive success between the wealth terciles. The different demographic regimes have very different wealth-fertility relationships. Where fertility is high and unchanging, the wealth-fertility relationship is positive. The richest tercile here has a family size over 21% larger than the poorest (over 23% if we measure this in 'net' terms). Where fertility is declining, the weath-fertility relationship is reversed. The differential between the richest and the poorest tercile's family size

[13]This result was obtained from an OLS regression, following equation 5, but only for those who died under 80.

Table 2: Average Children Born and Surviving to 10 Years, per Wealth Tercile

	Wealth Tercile		
	1	2	3
Non-Decline Villages			
Children Ever Born	4.87	5.90	5.93
Net Family Size	3.22	3.76	3.97
Decline Villages			
Children Ever Born	5.50	4.88	3.88
Net Family Size	4.34	3.78	3.21

Notes: Net family size is corrected for under-registration of child deaths. The method to do this is described in section 3.1.

is now minus 30% (26% in 'net' terms). The varying family sizes of the sample follow a clear and direct wealth-pattern, once we control for the type of fertility regime revealed by the aggregate trends.

The raw averages discussed above say nothing on the mechanics of the fertility differentials between the terciles. How was the lower cross sectional fertility of the rich achieved in those villages where fertility was declining? Further, why was net fertility so low amongst the poorest terciles in the villages where fertility was not declining? Malthusian logic would immediately propose the female age at marriage, the classic European 'preventative' check as the driver behind these patterns. Also, differential infant and female mortality, between the wealth terciles, could be generating the variation. Does the wealth effect act through these channels? The following section details regressions designed to detect the wealth effects controlling for these demographic variables and also major events such as the French Revolution the Napoleonic Wars.

3 De-constructing the Wealth Effects

Equations 6 to 9 detail the demographic influences upon gross and net fertility.

$$GrossF = MFR * MD \tag{6}$$

$$NetF = GrossF - CED \tag{7}$$

$$MFRf(FAgeM, r * CED) \tag{8}$$

$$MD = EU - FAgeM = min(FAgeD, FAgeMD, 50) - FAgeM \tag{9}$$

Where $GrossF$ and $NetF$ are gross and net fertility respectively. CED is children ever died and MFR is the average marital fertility rate over the duration of the marriage, MD. Exposure to the risk of a birth is bounded by female age at marriage, $FAgeM$, and the end of the marital union, EU. EU is equal to the minimum value of; $FAgeMD$ (female's age at husband's death), $FAgeD$, (female age at death) and 50 (the age beyond which most women are sterile). Equation 8 includes CED as a determinant of MFR. This is intended to account for any replacement effect (r), where parents may have higher gross fertility due to infant or child deaths. In addition, exogenous forces, operating at the village and the national level, for instance the 1789 Revolution and the Napoleonic wars, are expected to influence fertility. To isolate the wealth effects on fertility, a simple model was constructed:

Table 3: Child Mortality by Fertility Regime and Wealth Tercile

	Wealth Tercile		
	1	2	3
Non-Decline Villages			
Corrected	326.8	342.1	335.1
Uncorrected	283.1	320.6	314.2
Decline Villages			
Corrected	201.5	211.0	166.6
Uncorrected	181.2	197.9	162.0

Per 1,000 births, for children surviving to ten years

$$GrossFf(C, D, CED, FAgeM, EU, REV, NWARS, VILLAGE, WEALTH) \tag{10}$$

$$NetFf(C, D, FAgeM, EU, REV, NWARS, VILLAGE, WEALTH) \tag{11}$$

Where C represents a constant, D is a fertility regime fixed effect, REV and $NWARS$ are categorical variables representing marriage during, or after, the Revolution and Napoleonic wars respectively. Village fixed effects are included ($VILLAGE$) and $WEALTH$ indicates husband's wealth tercile.

3.1 Infant and Child Mortality

Infant and child mortality affect fertility both mechanically (in the case of net fertility, equation 6) and also, perhaps, through their affect on the marital fertility rate via a replacement effect (equation 8). Under-registration of births in French parish registers was rare; Catholic villagers would rush to baptize their child; an unbaptized would be condemned to purgatory. Parents were less incentivized to ensure that a child's death was properly recorded. There is significant omission of child deaths in the Enquête Henry. A simple way to detect and measure this omission is to examine the frequency of first name repetition within a family, as Houdaille has done for each village of the Enquête Henry. This technique takes advantage of the common tendency for parents to give a later born child the same name as a previously deceased child.

I employed a simplified version of the same name technique to the wealth terciles within the linked Enquête Henry-TSA sample. First, I summed the number of repeated names within a family. This was then compared with the number of recorded child deaths. Where the number of repeated names exceeded the number of child deaths, I corrected the child deaths upwards to account for the probable omission of a death from the records. Table 3 reports the corrected and non-corrected values by fertility regime and wealth tercile.

There are huge differences in child mortality between the two regimes. *Non-decline* villages have significant under-registration of child deaths and high child mortality. *Decline* villages have lower omission rates and child mortality is lower than that of the *Non-decline* villages. Correcting for under-registration, there is no difference between the child mortality of the rich and the poor in the *Non-decline* villages. In the *decline* villages, the rich have slightly lower infant mortality than the poor. The wealthiest tercile in the *decline* villages have child mortality far below any other tercile in the sample, and their rate is half that of the richest tercile in the non-decline villages.

Is the decline in fertility related to a reduction in child mortality at this period? The evidence presented in table 3 strongly suggest that fertility decline is related to the level of infant mortality.

Care must be taken here; There are two compelling reasons to believe that there is two way causality between fertility and infant mortality. Firstly, the number of child deaths can never exceed the number of births. This induces a positive correlation between fertility and mortality. Secondly, parents may choose to replace a deceased infant. This replacement effect will result in parents having more births than otherwise. Any interpretation of a parent's *gross* family size must therefore factor in the effects of mortality. Following Guinnane et al. (2006, p.472), I include the proportion of children dying before age ten as an independent variable in the regressions. This removes the structural correlation between mortality and fertility but does not remove the endogeneity. For robustness, I reestimate each model with *net* fertility (*gross* fertility minus the corrected number of child deaths) as the dependent variable. This is imperfect but does allow the direct modeling of surviving children, net of infant mortality. *Net* fertility is perhaps the best empirical measure we have for the number of children demanded by parents, in a *Beckerian* sense, in historical populations.

3.2 Regressions

The regression models to be estimated are summarized in equation 10 and 11, with the proportion of children dead substituted for CED. Table 4 reports summary statistics.

As the dependent variables, *gross* and *net* fertility, are non-negative integers, a count data model is preferred to ordinary least-squares. In choosing the appropriate model specification, there are two main issues; Overdispersion and excess zeros. The Poisson distribution, the "starting point" for count data models assumes equality of (conditional) mean and (conditional) variance (equidispersion) (Cameron and Trivedi, 2005, p.668). Fertility typically has a tendency to be over-dispersed (where the mean is greater than the variance) and this is true for the Enquête Henry data. Gross fertility has a mean of 5.4 and a variance of 10.2. The negative binomial distribution treats dispersion as a parameter (α) to be estimated from the data.

In most cases, overdispersion is a result of excess zeros. The appearance of excess zeros in historical fertility datasets is primarily a result of sterility. Following Guinnane et al. (2006, p.471), I introduce a zero-inflated model to account for sterility. In the first stage the probability of sterility is predicted by a categorical variable indicating a female age of marriage of over 35[14] ($DFAgeM35$).

$$Prob(Sterile) fC + DFAgeM35 \tag{12}$$

The zero-inflated model allows zero births in two ways. First, through the probability of sterility channel (equation 12) and secondly through the estimated count from a negative binomial or Poisson regression of equations 10 and 11.

In practice, the choice of model was made by estimating all four competing models (the Poisson, negative binomial and their zero-inflated equivalents) and comparing the model fits using actual and predicted values for the dependent variables. The zero-inflated model, incorporating equation 12, was preferred over both the Poisson and negative binomial specifications. The Vuong statistics (reported in tables 5 and 17) for all twelve zero-inflated Poisson and zero-inflated negative binomial models were positive and statistically significant from zero, indicating that the zero inflated model is preferred.

The estimated dispersion parameter (α), estimated in the zero-inflation models and reported in table 5 was not significantly different from zero in only two of the six model formulations. Where α

[14]The choice of this variable follows Guinnane at al. exactly. They justify this choice based on data availability and the sudden increase in estimated sterility in non-controlling populations (Guinnane et al., 2006, p.471).

Table 4: Summary Statistics

	Mean	Standard Deviation	N
Demographic Variables			
Gross Fertility	5.44	3.20	423
Net Fertility	3.97	2.45	423
Proportion of Children Dead	0.23	0.22	423
Age at Marriage, Female	23.23	4.89	423
Proportion of Marriages Over 35, Female	0.03	0.18	423
Age at End of Union, Female	46.91	6.93	423
Proportion Second Marriage, Male	0.06	0.24	423
Wealth Variables[a]			
All	4,466.92	10,559.06	423
Tercile 1	38.18	53.37	120
Tercile 2	899.28	555.77	144
Tercile 3	11,040.44	15,083.90	159
Non-Decline			
All	4,773.60	13,219.63	178
Tercile 1	30.18	54.12	58
Tercile 2	981.77	556.51	65
Tercile 3	14,257.00	20,961.30	55
Decline			
All	4,244.11	8,120.29	245
Tercile 1	45.66	51.99	62
Tercile 2	831.42	549.39	79
Tercile 3	9,339.37	10,498.50	104

[a] The number of observations do not reflect exact terciles because the wealth split was made over all collected data. Some observations had to be dropped from the analysis because they did not include all the required demographic information.

is significant, I report the zero-inflated negative binomial coefficients and standard errors. Where it is not, I report the Poisson coefficients and standard errors. For each choice, the alternative is presented in the appendix (table 17). There difference between the two, in terms of the estimated coefficients and their standard errors, is minuscule.

Table 5 details the results of six regressions on children ever born (gross fertility) and children ever born *minus* children dead before ten (net fertility). The reported coefficients are the expected change in the natural log of either gross or net fertility for a one unit increase in the independent variable.

For the gross fertility regressions, the proportion of children dead is included as a regressor; for the net fertility regressions it is omitted. The rationale for the selection of the regressors follows directly from equation 10. Three variations of models are estimated for each of these dependent variables, with each model testing the data for different kinds of wealth patterns. Model I is a global test and treats wealth effects as operating upon the sample as a whole, with no separate *decline* or village level effects. Model II includes an interaction term, $Wealth\ Tercile * Decline\ Regime$, where $Decline\ Regime = 1$ if the individual lives in a village which is exhibiting significant fertility decline, and $Decline\ Regime = 0$ other wise (see figure 1). Finally model III allows the wealth effects to vary by village.

In all models, the demographic variables are highly significant, consistent between all six regressions, and act in the expected directions. Infant mortality, as measured by the proportion of dead offspring is closely associated with gross fertility. The regressions suggest that declines in infant mortality should lead directly to reductions in fertility. The EFP calculated a *zero* correlation between provincial measures of infant mortality and fertility for France in 1870 (van de Walle, 1986, p.221). However, at the individual-level, the connection between the two was real and significant.

The Revolution is associated with lower gross and net fertility (although the standard errors are large), but the effect of the Napoleonic wars is always small and insignificant. Of course, as these 'event' variables are coded by year of marriage, they may be picking up other omitted time dependent effects. Despite this caveat, the evidence strongly suggest a close association of the Revolutionary era with the reduction in marital fertility.

Wealth is included as a categorical variable in the regressions reported in table 5 and the omitted category is wealth tercile 1, the poorest. The reported coefficients can be interpreted as the effect on fertility of being a member of either wealth tercile 2 or 3, relative to to wealth tercile 1. Globally, there is a statistically significant, but small, negative relationship between wealth tercile and gross fertility (model I). However, this result disappears when the same model is applied to net fertility (model IV). There are no consistent or significant global wealth effects on fertility in the linked Enquête Henry-TSA sample. However, once the demographic regime is controlled for, and the wealth-fertility effects are allowed to vary between the regimes; there are large, consistent and significant patterns to report.

The Main Wealth Effects reported in models II and V refer to the wealth-fertility associations in the *non-decline* villages, and are not significantly different from zero. The values are positive but the standard errors are large. In the *decline* villages, there is an entirely different association of wealth and fertility. For both gross and net fertility, it is the richest terciles of the decline villages who have the lowest fertility. Allowing the wealth effects to vary by village, in models III and VI, we can see that it is Rosny-sous-Bois which has the strongest negative wealth effects[15]. Rosny-sous-Bois was also the village with the sharpest drop in marital fertility between 1750 and 1810 (see figure 1).

[15]The analysis presented here concerns the cross sectional difference in fertility but if we compare this result to Weir's results for Rosny in 1747 (a slightly positive income-fertility association 1995, p.15) it is suggestive that the changing relationship of wealth/income and fertility applies to changes over time as well as over space.

Table 5: Zero-Inflated Regressions on Family Size

	Gross Fertility			Net Fertility		
Model#	I[b]	II[c]	III	IV[b]	V[c]	VI
Specification[a]	ZINB	ZINB	ZIP	ZIP	ZIP	ZIP
Demographic Variables						
Proportion of Children Dead	.337**	.328**	.313**			
	(.112)	(.109)	(.106)			
Age at Marriage, Female	−.048***	−.046***	−.048***	−.053***	−.051***	−.053***
	(.006)	(.006)	(.006)	(.007)	(.007)	(.007)
Age at End of Union, Female	.037***	.037***	.038***	.041***	.041***	.041***
	(.004)	(.004)	(.004)	(.005)	(.005)	(.005)
Second Marriage, Male	−.014	−.014	−.046	.105	.107	.082
Event Effects						
Revolution	−.099†	−.099†	−.098†	−.091	−.090	−.090
	(.054)	(.053)	(.053)	(.060)	(.060)	(.061)
Napoleonic Wars	−.030	−.033	−.021	−.009	−.013	−.003
	(.059)	(.058)	(.057)	(.067)	(.067)	(.067)
Main Wealth Effects						
Wealth Tercile 2	.032	.159*	.119	−.003	.094	.037
	(.055)	(.078)	(.090)	(.063)	(.096)	(.115)
Wealth Tercile 3	−.096†	.103	.137	−.074	.109	.131
	(.056)	(.083)	(.095)	(.063)	(.100)	(.120)
Decline Wealth Effects						
Wealth Tercile 2		−.246*			−.170	
		(.108)			(.126)	
Wealth Tercile 3		−.357**			−.304*	
		(.110)			(.129)	
Cabris*Wealth Tercile 2			−.130			−.062
			(.130)			(.156)
Cabris*Wealth Tercile 3			−.259†			−.225
			(.133)			(.160)
Saint-Paul*Wealth Tercile 2			.144			.195
			(.169)			(.206)
Saint-Paul*Wealth Tercile 3			−.153			−.106
			(.183)			(.218)
Rosny*Wealth Tercile 2			−.292†			−.164
			(.154)			(.182)
Rosny*Wealth Tercile 3			−.625***			−.511**
			(.154)			(.183)
Constant	1.234***	1.123***	1.116***	.820**	.721*	.725*
	(.248)	(.247)	(.245)	(.288)	(.292)	(.294)
Zero-Inflation (Logit)						
Marriage Over 35, Female	3.153***	3.17***	3.135***	3.389***	3.441***	3.425***
	(.68)	(.669)	(.673)	(.723)	(.717)	(.726)
Constant	−3.362***	−3.343***	−3.335***	−3.420***	−3.436***	−3.448***
	(.339)	(.332)	(.324)	(.371)	(.378)	(.381)
α	.110***	.005*	.001	.000	.000	.000
Vuong	2.20*	4.47***	2.35**	2.17*	2.20*	2.18*
Liklihood Ratio	−969	−963	−959	−875	−872	−870
N	423	423	423	423	423	423

Significance levels: † $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

[a] Where ZINB refers to a zero-inflated negative binomial model and ZIP refers to a zero-inflated Poission model.

[c] Village level fixed effects included, but not reported.

[c] *Decline* regime fixed effect not reported.

Table 6: Expected Fertility, holding non-wealth influences Constant

	Wealth Tercile		
	1	2	3
Non-Decline Villages	6.19	7.25	6.86
	(-)	(1.08)	(1.09)
Decline Villages	6.39	5.85	4.95
	(-)	(1.11)	(1.12)

Notes: The expected levels are calculated by exponentiating the sum of the reported coefficients in table 5. A female age at marriage of 25, and a complete period of exposure to the risk of a birth (until aged 50) were assumed. The proportion of children dying is set at zero, as is the categorical variable for husband's second marriage. The time-dependent effects of the Revolution and the Napoleonic wars are not included and the couple is sterile. The values reported here are larger than the raw averages because of the exclusion of the non-wealth effects on fertility.

The negative wealth-fertility associations in Cabris are not statistically significant at the standard levels, but their magnitude and direction is indicative that the same process, albeit at an earlier stage, is operating there, as in Rosny-sous-Bois , over 900 kilometers to the North[16].

How large are these effects? It is easier to judge the magnitude of the respective wealth effects by transforming the coefficients in table 5 to expected levels. Further, by applying constant values to the estimated non-wealth coefficients, the wealth effects on levels can be isolated and compared. These values, using the wealth coefficients from models II and IV, are reported in table 6.

The 'expected fertility' values in table 6 can be understood as the pure wealth effects controlling for the all the demographic and 'event' variables listed in the regression. The wealth terciles in the *Non-decline* villages have estimated levels of fertility which, once the standard errors (from the regression) are accounted for, do not vary significantly. This means that the differences in the raw averages, reported in table 2 are almost entirely accountable to the regressors reported in table 5. The classical Malthusian preventative checks, operationalized here as female age at marriage and the length of the reproductive span are driving the reproductive advantage of the rich in the *Non-decline* villages. In the *decline* villages, the story is completely different. Here, the rich, wealth tercile 3 have an estimated gross fertility level of 4.95 children, significantly different from the poorest *decline* village wealth tercile (6.39). This strongly implies that it is the rich, the top third of the wealth distribution in these *decline* villages rural villages, who are the pioneers of the decline in French fertility. The forces described by Malthus do not explain why fertility is declining.

3.3 Robustness

Is it possible that these wealth-patterns are a product of the life course? Section 2.1 discussed some theoretical reasons why wealth could vary with life course, and how family size could influence wealth. Figure 2 demonstrated that the aggregate life course pattern of wealth accumulation was

[16]The negative, and large, coefficient of wealth tercile 3 on both gross and net fertility in Saint-Paul-la-Roche is also indicative. Saint-Paul-la-Roche experienced some very slight marital fertility decline, and it appears that this was associated with the richest terciles there - although this effect is not significant.

Table 7: Comparing the Wealth Effects on Fertility by Husband's Age

	Gross Fertility			Net Fertility		
Age at Death of Husband	All	< 66	> 65	All	< 66	> 65
Main Wealth Effects						
Wealth Tercile 2	.159	.157	.158	.094	.092	.077
	(.078)	(.115)	(.108)	(.096)	(.144)	(.130)
Wealth Tercile3	.103	.037	.143	.109	.015	.163
	(.083)	(.125)	(.112)	(.100)	(.157)	(.132)
Decline Wealth Effects						
Wealth Tercile 2	$-.246^{*}$	$-.758^{*}$	$-.228^{\dagger}$	$-.170$	$-.687^{\dagger}$	$-.145$
	(.108)	(.346)	(.137)	(.126)	(.403)	(.159)
Wealth Tercile3	$-.357^{**}$	$-.978^{**}$	$-.297^{*}$	$-.304^{*}$	-1.005^{*}	$-.222$
	(.110)	(.345)	(.140)	(.129)	(.403)	(.162)
N	423	140	283	423	140	283

Significance levels: $\dagger\ p \leq .10$, $*\ p \leq .05$, $**\ p \leq .01$, $***\ p \leq .001$

actually quite flat. However, the possibility that the level of fertility has a significant causal effect on the level of wealth held at death is an important issue for this analysis.

The test employed to detect these patterns is simple. If children are a net cost, or a net benefit, to parents, we should expect this effect to vary over the life course. There should be clear markers; Fathers who die young should have a very different wealth-fertility relationship to those who die old. More specifically, young fathers benefit less from transfers from offspring while older fathers benefit more. This will bias the wealth coefficients in expected directions. Does this bias undermine the results of the analysis?

Table 7 reports the replication of model II from table 5 for different age bands of fathers; those who died under 66 , and those who died above[17]. All of the non-wealth regressors from model II are included in the regressions, but they are not reported.

The wealth coefficients reported in the 'All' column of table 7 are the exact wealth coefficients from Model II in table 5. They can be compared directly with the wealth coefficients for the bottom and top half of the age at death distribution. In relation to the *non-decline* villages, the wealth coefficients are larger for older fathers than they are for younger fathers, in general. This is consistent with the idea that children are contributing to parental wealth - the longer a father lives - the greater the opportunity for wealth transmissions from offspring. This pattern would be expected to bias the wealth coefficients for the richer wealth terciles upwards, and this appears to be the case. However, this effect is not significantly different from zero.

For the *decline* villages, the wealth-fertility associations are again different, both for younger and older fathers. The negative wealth effect is stronger for younger fathers, perhaps as a result of children contributing to family wealth later on in a father's life - just as in the *non-decline* villages. In cross section, the wealth-fertility pattern detected in table 5 is still evident. The expected bias from the influence of net child transfers on the estimated coefficients does not alter the main conclusion from this analysis: In the *decline* villages it the rich who reduce their fertility first. Before we ask why fertility declined in these villages, we will look at the mechanics of fertility

[17]The average age at death in the linked Enquête Henry-TSA sample was a (relatively high) 66.

decline.

4 The Mechanics behind the Fertility Patterns

The analysis of the previous section unearthed wealth-fertility correlations controlling for the Malthusian positive and preventative checks. The significant negative association of wealth and fertility for Rosny-sous-Bois and Cabris (the *decline* regime villages) must therefore represent an implementation of fertility limitation strategies within marriage. There are two ways for couples to control their desired family size. Firstly, they can stop bearing children once they reach a certain target family size: this is known as 'stopping' behavior. Secondly, they can increase their birth intervals: 'spacing' behavior.

The European demographic transition has overwhelmingly been attributed to 'stopping' behavior (Alter, 1992, p.15). However, the aggregation of those pursuing different reproductive strategies may blur the true picture. Mroz and Weir closely analyzed the Enquête Henry data and their model suggests that spacing strategies were employed by the French after the revolution (1990, p.82). This section will test the linked Enquête Henry-TSA sample for different reproductive patterns within the wealth terciles. As Van Bavel has stated; "research explicitly analyzing stopping and spacing has hardly ever differentiated between social status groups" (2002, p.7).

4.1 'Stopping'

The Henry demographic dataset allows the calculation of fertility measures such as Age Specific Fertility Rates, Coale's index of marital fertility, the Total Marital Fertility Rate and the Coale and Trussell fertility control measures 'M' and 'm' (referred to as big and little m respectively). The Coale-Trussell parameters are calculated from the Age Specific Fertility Rates and represent deviations from the age pattern of 'natural fertility'. An 'M' value of 1, and an 'm' value of zero indicate no fertility control. Typically, researchers look for an 'm' value greater than .200 for an unambiguous sign of a controlling population. 'M', is harder to interpret, but may catch 'spacing' effects.

Appendix C details the statistical derivation of the Coale-Trussell parameters. However, these measures have been criticized in the literature and are far from foolproof. Specifically, simulation models report that 'm' does a poor job at identifying populations where a minority are practicing effective fertility control[18]. Table 8 summarizes the calculated age specific marital fertility rates, total marital fertility rates and the Coale and Trussell fertility control parameters.

The reproductive advantage of the richest tercile in the non-decline villages is emphasized by the high value for 'M', 0.927. This means that the richest tercile here has a fertility level close to that of the 'natural' fertility schedule. For the *non-decline* villages, 'M' has decreased and the scale of the decrease is, again, closely related to economic status. The richest have the lowest level of fertility and the poorest wealth tercile have the highest. Focusing on 'm': the parameter indicating significant deviation from a 'natural' age pattern of marital fertility, the results indicate no unambiguous signs for stopping behavior in any of the regimes. However, this value is largest for the richest tercile in the decline villages (0.146). Despite failing to be significant and above the 0.200 threshold, the value is indicative of a small proportion of 'stoppers'.

Another way to detect 'stopping' behavior is to look at the average age women have their last birth. These values are reported for the regime and wealth tercile combinations in table 9. The values are calculated only for those women and their husbands who died after 50. The

[18] See Okun (1994) for more details.

Table 8: Demographic Measures by Fertility Regime

	Wealth Tercile		
	1	2	3
***Non-Decline* Villages**			
Age Specific Marital Fertility Rates			
20-25	0.364	0.313	0.373
25-30	0.357	0.360	0.432
30-35	0.302	0.389	0.349
35-40	0.268	0.321	0.303
40-45	0.155	0.176	0.158
45-50	0.008	0.027	0.000
Total Marital Fertility	7.75	8.43	8.70
Coale Trussell Measures			
'M'	0.802***	0.795**	0.927
S.E.	0.105	0.087	0.092
'm'	0.029	−0.141	0.064
S.E.	0.119	0.095	0.113
***Decline* Villages**			
Age Specific Marital Fertility Rates			
20-25	0.302	0.250	0.216
25-30	0.343	0.313	0.261
30-35	0.313	0.273	0.228
35-40	0.242	0.209	0.164
40-45	0.133	0.100	0.084
45-50	0.009	0.007	0.009
Total Marital Fertility	7.58	6.82	5.86
Coale Trussell Measures			
'M'	0.768**	0.682***	0.587***
S.E.	0.096	0.085	0.087
'm'	0.058	0.104	0.146
S.E.	0.107	0.099	0.100

Significance levels: $*\ p \leq .05$ $**\ p \leq .01$ $***\ p \leq .001$

Table 9: Age at Last Birth by Fertility Regime

	Wealth Tercile		
	1	2	3
Non-Decline Villages	37.81	38.62	36.92
Decline Villages	37.80	35.90	35.37

mean age at last birth in populations practicing 'natural fertility' is approximately 38-39 years (Trussell and Wilson, 1985, p.280). Amongst the villages where fertility was not declining, there is no significant variation to report. Age at last birth is high, around 37-38 years for all wealth terciles. For the villages where fertility was declining, the top two wealth terciles do show evidence for 'stopping' behavior; the mean age at last birth is significantly below that of a 'natural' fertility population.

4.2 'Spacing'

Having established evidence for the presence of 'stopping' behavior amongst the wealthiest terciles in the *decline* villages, the question of 'spacing' arises. It is far easier to detect 'stopping' in population sub-groups then it is to detect 'spacing'. One way to detect spacing is to model the birth intervals directly using a Cox proportional hazards model. The results will describe the effects of the independent variables in terms of a 'hazard rate', which is defined as the instantaneous probability of the event in question, in this case a birth, and is therefore directly related to the length of the birth interval.

The formulation of the birth interval model follows similar analyses by Alter (1988), Van Bavel (2004), Van Bavel and Kok (2004) and Bengtsson and Dribe (2006). After consideration of the varying inclusion of demographic factors in these studies, it was decided to concentrate on those factors most commonly found to affect the birth interval. This was done with the aim of producing a parsimonious model which could capture the wealth effects (if any) on the duration of the birth interval. The demographic factors included were the age of the mother (in 5 year age bands), net parity (children alive at the start of the interval), and the life status of the previous born child. The tested models will use both closed intervals, where the interval is closed by another birth, and open intervals, where a woman will remain at 'risk' until she is over 50 or her husband dies. To control for the presence of under-registration of child deaths, the models are replicated for a sub-sample containing families who have no repeated child names[19].

The Cox proportional hazards model is based on the following identity:

$$h_i(t) = h_0(t)exp(\beta' x) \tag{13}$$

The hazard rate h for individual i is a multiplicative function of the baseline hazard h_0 and the regression coefficients $\beta' x$, (Cleves et al., 2004, p.147-8). The great advantage of the Cox proportional hazard model is that the functional form of h_0 , the baseline hazard, is left unspecified. The central assumption of the Cox model is that the hazards are proportional. Post regression diagnosis using Schoenfeld residuals and visual inspection revealed that the inclusion of *net parity* was leading to a violation of the proportional hazards assumption. Therefore, it was decided to stratify the sample

[19]The expected bias from the under-registration of child deaths will be to attribute shorter birth intervals to those groups whose child mortality is under-recorded. As the group who experienced the largest drop in fertility, wealth tercile 3 in the *decline villages* have little under-registration this is not a major concern

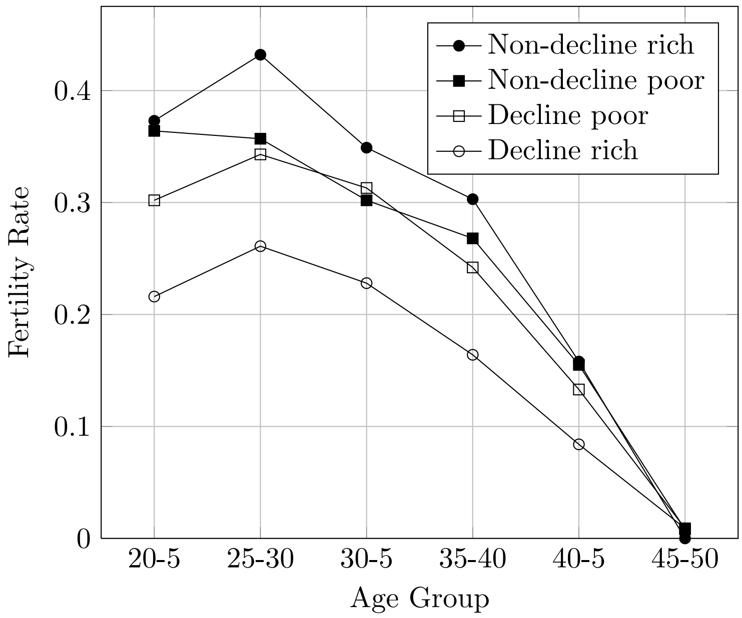

Figure 4: The Age Pattern of Marital Fertility for Rich and Poor

by *net parity*. In effect this divides the sample into separate groups with separate base line hazards but common coefficients for the other regressors (Therneau and Grambsch, 2000, p.44).

Table 10 reports the results of the four Cox regressions. The natural fall off in fecundity by age is reflected by the falling hazard ratios for age groups past the 25-29 reference category in all formulations. The presence of an infant has a large and significant negative effect on the hazard of a birth. As with the count models, the wealth effects are reported as interactions in the Cox models. The 'Main' wealth effects, analogous to the *non-decline* village wealth effects are not consistently statistically significant. The interactions however, reflecting the *decline* village wealth effects have a significant negative effect[20].

In order to calculate the net wealth effects, the wealth interactions were multiplied, producing the values reported in table 11. For the *non-decline* villages, the hazard ratio for a birth increases with the wealth category, indicating that the top two wealth terciles have shorter birth intervals than the poorest tercile. For the *decline* villages, the opposite is true. The richest here have much longer birth intervals than the poorest tercile. The mean birth interval for each wealth tercile varies with the hazard rates, and are also reported in table 11. These results indicate that 'spacing' strategies played a role in the declining fertility of the richer terciles in the sample.

Figure 4 illustrates the age pattern of marital fertility for the richest and poorest terciles in both fertility regimes (the top and bottom thirds of the wealth distribution respectively). As the Coale-Trussell estimates indicated, the age pattern of marital fertility does not vary to a large extent between these sub-groups. However, the level of the fertility rate at each age group varies enormously. There is a large positive 'upward shift' in the age fertility schedule between the poorest and richest wealth groups in the *non-decline* villages. For the *decline* villages, this shift is downward.

To what extent can the lower fertility of the rich in the *decline* villages be attributed to stopping versus spacing? A simple decomposition exercise can indicate the relative significance of these two

[20]This applies to all formulations bar the closed interval, no repeated names sample. The interaction terms are not significant here because of the smaller sample size and the effective exclusion of successful 'stoppers' from the risk group.

Table 10: Cox Regression on the Hazard of a Birth

	All Parents		Parents with no repeated offspring names	
Birth Intervals:	Open	Closed	Open	Closed
Women's Age				
15-19	.789	.721	.774	.706
	(.181)	(.166)	(.230)	(.210)
20-24	.999	.952	.967	.909
	(.069)	(.067)	(.083)	(.08)
30-34	.801***	.961	.754***	.982
	(.048)	(.057)	(.058)	(.076)
35-39	.563***	.784***	.534***	.723**
	(.041)	(.058)	(.052)	(.072)
40-44	.208***	.681***	.172***	.684*
	(.023)	(.078)	(.027)	(.107)
45-49[a]	.031***	.349*	.000	.000
	(.014)	(.163)	(.000)	(.000)
Infant Alive	.177***	.188***	.213***	.232***
	(.018)	(.019)	(.031)	(.035)
Event Effects				
Revolution	.723***	.791***	.772**	.863†
	(.042)	(.047)	(.061)	(.068)
Napoleonic Wars	1.046	1.007	1.044	.983
	(.054)	(.052)	(.069)	(.065)
Main Wealth Effects				
Wealth Tercile 2	1.223**	1.075	1.173	.998
	(.095)	(.084)	(.157)	(.134)
Wealth Tercile 3	1.148†	1.104	1.172	.978
	(.095)	(.092)	(.156)	(.103)
Decline Wealth Effects				
Wealth Tercile 2	.697***	.774*	.679*	.833
	(.075)	(.084)	(.109)	(.134)
Wealth Tercile 3	.614***	.700**	.602**	.809
	(.069)	(.078)	(.095)	(.128)
N - Number of Intervals	8,219	6,783	5,058	4,041
Likelihood Ratio, χ^2	695.62	308.14	371.21	132.35

Significance levels: † $p \leq .10$, $*\ p \leq .05$, $**\ p \leq .01$, $***\ p \leq .001$

[a] The coefficients for the closed birth analysis are extremely small because no births in the 45-9 age range were 'closed' by another birth.
[b] *Decline* regime fixed effect not reported.

Table 11: Net Hazard Ratios and Mean Birth Interval (Months)

	Wealth Tercile		
	1	2	3
Non-Decline Villages			
Hazard rate	1.000	1.222	1.148
Interval	30.60	27.74	27.57
Decline Villages			
Hazard rate	0.958	0.816	0.675
Interval	32.08	33.23	36.41

Table 12: Stopping vs. Spacing for the Rich in the *Decline* Villages

(1) Expected Fertility[a]	(2) Expected Fertility: Stopping[b]	(3) Expected Fertility: Spacing[c]
3.42	3.88	4.22

[a] Expected fertility is the number of years of exposure to the risk of a birth (Age at last birth (from table 9)-25), divided by the mean birth interval (from table 11)/12. All calculations hold marriage age constant at 25.
[b] Using wealth tercile 1's mean birth interval.
[c] Using wealth tercile 1's age at last birth.

strategies. Holding marriage age constant at 25, we can use the observed age at last birth (table 9) and mean birth intervals (table 11) to calculate the effect of the change in each on fertility. Table 12 reports calculations for the richest wealth tercile of the *decline* villages, the tercile with the most significant fertility decline in the sample. Firstly, column 1 reports the expected fertility of this group from their observed average age at last birth and mean birth interval. Next I calculate a 'stopping', exclusive of 'spacing', expected fertility using wealth tercile 3's mean birth interval and *wealth tercile 1's* observed average age at last birth. Similarly, column 3 of table 12 reports expected fertility for wealth tercile 3 using wealth tercile 3's age at last birth and *wealth tercile 1's* mean birth interval. It is evident that a single method strategy is not capable of producing the level of births that are actually recorded. Both strategies have large effects on fertility, but the exercise suggest that it is 'stopping' which is quantitatively the largest influence.

5 Why did fertility decline in France?

The rich of the *decline* villages used both stopping and spacing to reduce their fertility. What induced them to do so? Any socio-economic explanation for early French fertility decline must consider that England, with a higher level of GDP per capita, a smaller agrarian sector and a larger urbanization rate, lagged behind French fertility trends by over 100 years. This one fact casts doubt on the explanatory power of demographic transition theory, the microeconomic theory of fertility and unified growth theory. All of these theories rely on changes in either the labor force structure of the economy, income, and the returns to human capital in initiating a substitution of child quantity for quality. None of them can explain why France was first.

The French have long been preoccupied with the unusual characteristics of their demographic history. An intellectual climate obsessed with depopulation and the decline in French fertility arose around the turn of the twentieth century[21]. Recent theories are far from abundant. Here I will initially focus upon those forwarded by Wrigley and Weir[22].

5.1 Neo-Malthusian Explanation

Wrigley interprets the early French fertility decline as "a variant form of the classic prudential system of maintaining an equilibrium between population and resources to which Malthus drew attention": The preventative check now operated through marital fertility directly, and not indirectly through age at marriage. The net reproduction rate in France from the late 18th to late nineteenth century was always close to one, suggesting that the population was still finely constrained by available resources (Wrigley, 1985, p.55). As previously mentioned, almost 80% of the French population were rural, and nearly 70% lived off farming at the time of the decline (Chesnais, 1992, p.335). Chesnais also points out that "farming remained primitive" and that there were numerous indicators of overpopulation (such as increase in wheat prices from the 1760s-1820s) (1992, p.336). These features certainly lend themselves to a Malthusian interpretation of the fertility pattern.

The testable implication of this hypothesis, as stated by Weir, is that there should be a strong positive relationship between real income and fertility (1984b, p.31). However, this 'neo-Malthusian' reasoning for the early decline for French fertility fails to be supported by the individual-level data collected in this analysis. If the restriction on births was a response to an economic constraint, we would expect those closest to subsistence to initiate fertility control. This is clearly not the case for the four villages in the sample. Where fertility is declining, the wealth-fertility relationship is negative. Fertility decline here is apparent for the richer terciles of the *decline* villages; they are the first to employ this new variant of the preventative check, but this cannot be a 'neo-Malthusian' response.

5.2 The Revolution

Many scholars (Weir (1984a), and more recently Murphy and Gonzalez-Bailón (2008)) have explicitly linked the Revolution to the fertility decline. At a superficial (and highly aggregated) level, the events appear simultaneous. However, econometric tests on the aggregate fertility rate place the decline in fertility before the Revolution (1776, see Cummins (2009)). Further, it is widely accepted that many localities began their fertility transition long before 1789 (Chesnais, 1992, p.338). In the data collected for this analysis, Rosny-sous-Bois and Cabris have substantially declining fertility rates before the Revolution. However, the ideological and socio-economic causes of the Revolu-

[21] Etienne van de Walle briefly discusses this mostly forgotten literature, criticizing its "outdated and weak statistical content", and states that the work amounted to a no more than a series of hypotheses (1974, p.6).

[22] Another popular explanation for the French fertility decline is the change in the inheritance laws which accompanied the Revolution. The Napoleonic code replaced primogeniture with equal partition. In order to preserve a concentration of wealth within the family, parents now had to curb their family size, as wealth could not solely be assigned to the eldest male. Chesnais questions this interpretation by pointing out that other countries adopted the same principles but didn't experience a fertility decline. Further, primogeniture was not practiced widely in the North, except amongst the aristocracy, and the South-West of France, where primogeniture was common, had relatively low fertility in the Ancien Regime, and followed the same fertility pattern elsewhere post Revolution (1992, p.338).

Table 13: Zero-Inflated Regressions with the Components of Wealth

	Gross Fertility			Net Fertility		
	Total	*Property*	*Cash*	*Total*	*Property*	*Cash*
Non-Decline Villages						
Tercile 2	.159*	.152†	.108	.094	.112	.134
	(.078)	(.086)	(.099)	(.096)	(.107)	(.123)
Tercile 3	.103	.018	.102	.109	.068	.112
	(.083)	(.089)	(.080)	(.100)	(.108)	(.099)
Decline Villages						
Tercile 2	−.246*	−.234**	−.072	−.170	−.129	−.089
	(.108)	(.114)	(.125)	(.126)	(.137)	(.150)
Tercile 3	−.357**	−.253**	−.200†	−.304*	−.209	−.168
	(.110)	(.111)	(.111)	(.129)	(.133)	(.133)

Significance levels: $* \; p \leq .05$ $** \; p \leq .01$ $*** \; p \leq .001$

tion were germinating long before 1789. Could these forces have also contributed to the fertility revolution as well as the political?

An economic rationale for the decline in French fertility, associated with the Revolution has been forwarded by Weir. He states "evidence on fertility by social class is scarce, but tends to support the idea that fertility control was adopted by an ascendant "bourgeois" class of (often small) landowners" (1984a, p.613). The Revolution enabled an element of the rural population to increase their control over the land, while others lost out and became more reliant on wage labor. For the new rural bourgeoisie, children became "superfluous as laborers and costly as consumers" (Weir, 1984a, p.613). The decline of fertility in France in the early to mid 19th century was primarily due to the decline of the demand for children by this new class. It was only after 1870 when France joined the rest of Europe in a fertility transition which transcended the social order (Weir, 1984a, p.614).

The results of this analysis support Weir's hypothesis on the French fertility transition. The new class of landowners created by the Revolution would certainly lie within the top wealth category as constructed here. The results clearly show, as Weir expected, that fertility decline was initiated by this wealthy tercile. Further, the effect of the Revolution on family size is large, negative and significant. This is captured in the count model regressions by coding a categorical variable for those who married after 1789. A more precise testable implication of Weir's hypothesis is that those who have greater property wealth should have the lowest fertility. Further, the cash component of total wealth at death should be an insignificant predictor for family size. By splitting the wealth measures into the property and cash components we can test for this in the sample data. Once the value is separated, the distribution is split into even thirds with respect to cash and property separately[23].

Table 13 reports the results of a zero-inflated Poisson regression, with exact model specification of models II and IV from table 5, but this time dividing wealth into its constituent parts. Only the relevant wealth coefficients and their standard errors are reported.

The results agree with Weir's predictions. Compared to cash wealth alone, property wealth is a better predictor of the total negative wealth effect in the *decline* villages. However, the driving

[23]The division for property was all those with zero value at death in tercile 1, all those with property over zero and less than 2000 Francs in tercile 2, and all those with over 2000 Francs property wealth going to tercile 3. For cash, all those with 0 wealth at death were designated to tercile 1, those with over 0 and under 155 Francs in tercile 2, and all those over 155 in tercile 3.

factor in his hypothesis is the changing cost of children, due to the substitutability of wage labor by poorer socio-economic terciles. This does not uniquely identify a particular French characteristic as this process must surely have been existed in other countries. At this time, the English population was far less reliant on the agricultural sector and children must have been as expensive, if not more so, as they were in France.

5.3 Social Capillarity

In France, serfdom had long disappeared by the 18th century, and most peasants owned their own land, in contrast to most of Europe. The fertility decline originated amongst the wealthiest of this property holding class[24]. According to Chesnais, almost 63% of the population was represented by landowners and their families in 1830 while the comparable figure for Britain is 14% (1992, p.337).

The widespread ownership of land amongst the rural population is a unique feature of the French socio-economic landscape at this time. Because of this, Piketty et al. argue that economic inequality was lower in France than in England during the 19th century (2006, p.250). For the 18th century, Morrisson and Snyder argue that inequality was higher in France, although they warn that their estimate has a wide margin of error. Co-incident with the aggregate decline in French fertility, Morrisson and Snyder argue that there were significant decreases in economic inequality in France between 1780 and 1830[25] They summarize the developments that led to increasing equality during this period: the abolishment of feudal rights and the abolishment of the *dime* (a tax which "disproportionately" affected the poor), the rise of urban wages and most importantly the confiscation and selling of church properties (Morrisson and Snyder, 2000, p.70-4).

The decreasing level of inequality implies that the environment for social mobility was more fluid in late 18th and early 19th century France than anywhere else in Europe. Arsène Dumont, writing a century after the onset of the transition, placed social mobility as the *raison d'être* of the French fertility decline and termed "social capillarity" as the phenomenon driving the limitation of family sizes (Dumont, 1890). The Revolution served "to increase the thirst for equality and stimulate the social ambition of families, both for themselves and their progeny" (Chesnais, 1992, p.334). The old social stratifications under the Ancien Regime, where hereditary rights had determined social status, were weakened by the Revolution. All of this served to facilitate individuals' social ambition, and the limitation of family size was a tool in achieving upward social mobility[26]. This phenomenon, while associated with the Revolution, originated before the political climax of 1789.

The testable proposition of this hypothesis is that fertility should be negatively related to the opportunities for social mobility. A crude proxy for the social mobility environment is the level of economic inequality. Becker and Tomes state:

> Considerable inequality among different families in the same generation is consistent with a highly stable ranking of a given family in different generations, or an unstable ranking is consistent with only moderate inequality in the same generation. (1979, p.1166).

[24]In aggregate terms. The nobility restricted their fertility far earlier than the rest of the population, see Livi-Bacci (1986).

[25]Morrison and Snyder also argue that inequality rose between 1830 and 1860 but never to the pre-Revolutionary level (Morrisson and Snyder, 2000, p.74).

[26]Recently, the issue of social mobility and relative status in understanding Europe's fertility decline has been coming to the fore. Skirbekk 2008 and Van Bavel (2006) discuss the issue explicitly. Van Bavel finds a negative relationship between family size and children's subsequent socio-economic status (p.15) and suggests that these intergenerational motivations may be important in understanding the fertility transition (2006, p.16).

Table 14: Inequality

	Mean Wealth	Median Wealth	Gini Coefficent
Non-Decline Villages			
Saint-Paul-la-Roche	2,597	128	.861
Saint-Chély-d'Apcher	5,430	825	.818
Decline Villages			
Cabris	3,867	1,370	.705
Rosny-sous-Bois	5,351	1,730	.722

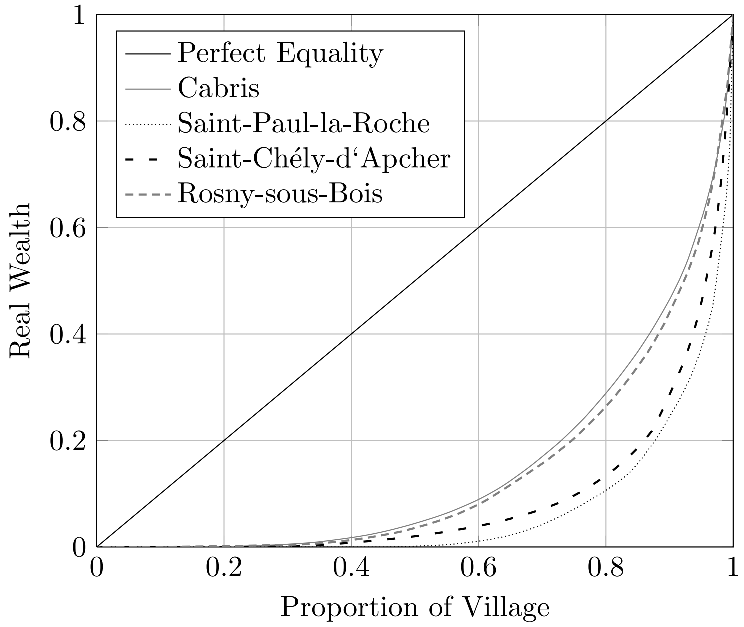

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Figure 5: Lorenz Curves for the Sample Villages

In a society with a large rural, landless majority and a small group of elites, the prospects for social mobility are limited. It makes no sense to control fertility if family size has no impact upon a family's relative social standing. The economic distance between the bottom and the top status groups is too great, and therefore upward social mobility is unattainable for the majority of the population. However, changes in the distribution of wealth/income between groups in the population reflect a changing environment for the possibility of social mobility. As economic inequality declines, fertility is induced to decline also, as parents now realize that social mobility is possible and the prospects for it are affected by family size.

One way to evaluate the strength of this hypothesis is to examine the level of economic inequality in cross section in the individual wealth data collected for transition-era France. Table 14 reports Gini coefficients based on total real wealth, by village, for the sample. The levels of inequality are very high, and typical of the pre-industrial era. For the villages where fertility is declining, the Gini coefficient is significantly lower than where it is not. This suggests that the level of inequality was associated with the onset of the fertility transition.

Table 15: Father's Wealth as Determinant of Son's Wealth

	Coefficient on Father's Wealth
Decline Regime Villages	.725***
	(.172)
Fathers Wealth*Decline Regime	−.327
	(.270)
N	60
Adj.R^2	.237

Significance levels: $* \ p \leq .05$ $** \ p \leq .01$ $*** \ p \leq .001$

Notes: Regression is based on the square root of father and son's wealth. Constant and decline dummy included in regression but not reported.

Another way to test the social mobility environment is to examine the relationship between father and son's wealth at death. Where the environment for social mobility is more open, father's wealth should have less importance in the determination of son's wealth, than would be the case where social mobility is limited. For a very small subsample, I was able to investigate this relationship. Table 15 reports the results of an OLS regression on son's wealth, with father's wealth as an independent variable.

Where fertility is high and not declining, father's wealth is a highly significant predictor of son's wealth. This relationship appears to be far weaker where fertility is declining. The effective coefficient on father's wealth in the determination of son's wealth in these decline regimes is almost one half of that of the villages where fertility is stagnating (.725 vs .398). This result should be treated with caution as it is based upon a small number of observations and the interaction coefficient for the *decline* villages is not statistically significant. Nevertheless, the father-son evidence suggests that the strength of the intergenerational transmission of wealth, its 'stickiness' within families, and the social mobility environment this implies, is associated with the presence of fertility decline.

Demographic transition theory, the microeconomic theory of fertility and unified growth theory cannot explain why French fertility fell first in Europe because they all predict that fertility should have declined in England before anywhere else. Wrigley's proposition of a neo-Malthusian response cannot be valid as it was the richest terciles who reduced their fertility, and Weir's explanation, again, does not uniquely identify France. What was unique to France was the pattern of landholding and relatively low level of economic inequality. There are many good reasons to suspect that social mobility may be a factor behind the decline. The level of inequality and the perseverance of wealth within families, both related to the social mobility environment were both found to be negatively associated with the presence of declining fertility.

6 Conclusion

Through linking the Henry demographic dataset to individual measures of wealth, the socio-economic correlates of the fertility transition have been examined in this paper. The principal result is the major difference in the wealth-fertility relationship at the individual-level. Where fertility is high and non-declining, this relationship is positive. Where fertility is declining, this relationship is negative. It is the richest terciles who reduce their fertility first. This result contributes to a revisionist interpretation of the European fertility decline. In opposition to the EFP's conclusions, this disaggregated analysis finds strong socio-economic correlates for the decline of fertility in France. The second principal result of this paper is that both stopping and spacing strategies were employed in achieving a lower family size for the richest terciles, for the villages where fertility was declining. Thirdly, existing theories on why fertility declined in France failed to be supported by the empirical data collected. However, a fresh look at an old hypothesis, does receive some support. Social mobility, as proxied by the level of inequality in the villages and the perseverance of wealth within families, is associated with fertility decline.

The evidence presented here demonstrates that socio-economic status mattered during the early French fertility decline but cannot, of course, claim to have cracked one of the greatest unsolved puzzles in economic history. The root causes behind the World's first fertility decline are still poorly understood. It is perhaps time to reassess conceptual models of the fertility transition. Empirically, a comparative analysis with other European countries based upon detailed individual-level information can hopefully illuminate the mystery of the early French fertility decline. This study is a first step towards re-establishing the French experience as paramount in our understanding of Europe's demographic transition.

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Appendix A Wealth by Village

Table 16: Wealth, by Village

	Mean	Standard Deviation	N
Wealth Variables			
Cabris			
All	4,283.88	8,145.72	172
Tercile 1	32.92	49.03	36
Tercile 2	837.60	545.47	58
Tercile 3	8,808.48	10,440.36	78
Saint-Paul-la-Roche			
All	2,278.54	4207.89	54
Tercile 1	43.46	58.70	22
Tercile 2	1,218.11	582.29	17
Tercile 3	6,758.49	5,993.27	15
Saint-Chély-d'Apcher			
All	5,860.15	15,489.65	124
Tercile 1	22.06	50.21	36
Tercile 2	898.06	528.14	48
Tercile 3	17,068.94	23,785.23	40
Rosny-sous-Bois			
All	4,150.40	8,115.40	73
Tercile 1	63.30	51.68	26
Tercile 2	814.32	573.35	21
Tercile 3	10,932.03	10,717.25	26

Appendix B Alternative Model Specifications

Table 17: Zero-Inflated Regressions on Family Size, Alternative Model Specifications

	Gross Fertility			Net Fertility		
Model#	I[b]	II[c]	III	IV[b]	V[c]	VI
Specification[a]	ZIP	ZIP	ZINB	ZINB	ZINB	ZINB
Demographic Variables						
Proportion of Children Dead	.320**	.321**	.314**			
	(.105)	(.105)	(.107)			
Age at Marriage, Female	−.047***	−.046***	−.048***	−.053***	−.051***	−.053***
	(.006)	(.006)	(.006)	(.007)	(.007)	(.007)
Age at End of Union, Female	.037***	.036***	.038***	.041***	.041***	.041***
	.(004)	(.004	(.004)	(.005)	(.005)	(.005)
Second Marriage, Male	−.022	−.017	−.045	.105	.107	.082
	(.110)	(.110)	(.110)	(.119)	(.119)	(.120)
Event Effects	(.054)	(.081)	(.095)	(.063)	(.100)	(.120)
Revolution	−.098†	−.099†	−.098†	−.091	−.090	−.090
	(.052)	(.052)	(.053)	(.060)	(.060)	(.061)
Napoleonic Wars	−.032	−.034	−.021	−.009	−.013	−.003
	(.057)	(.057)	(.058)	(.067)	(.067)	(.067)
Main Wealth Effects						
Wealth Tercile 2	.031	.158*	.118	−.003	.094	.037
	(.053)	(.077)	(.091)	(.063)	(.096)	(.115)
Wealth Tercile 3	−.093†	.104	.136	−.074	.109	.131
Decline Wealth Effects						
Wealth Tercile 2		−.246*			−.17	
		(.106)			(.126)	
Wealth Tercile 3		−.359***			−.304*	
		.108			(.129)	
Cabris*Wealth Tercile 2			−.13			−.062
			(.131)			(.156)
Cabris*Wealth Tercile 3			−.258†			−.225
			(.134)			(.16)
Saint-Paul-la-Roche*Wealth Tercile 2			.145			.195
			(.170)			(.206)
Saint-Paul-la-Roche*Wealth Tercile 3			−.152			−.106
			(.184)			(.218)
Rosny-sous-Bois *Wealth Tercile 2			−.292†			−.164
			(.155)			(.182)
Rosny-sous-Bois *Wealth Tercile 3			−.625***			−.511**
			(.155)			(.183)
Constant	1.23***	1.122***	1.117***	.820**	.721*	.725*
	(.242)	(.244)	(.246)	(.288)	(.292)	(.294)
Zero-Inflation (Logit)						
Marriage Over 35, Female	3.119***	3.156***	3.138***	3.389***	3.441***	3.425***
	(.668)	(.663)	(.675)	(.723)	(.717)	(.726)
Constant	−3.312***	−3.323***	−3.340***	−3.420***	−3.436***	−3.448***
	(.319)	(.322)	(.329)	(.371)	(.378)	(.381)
Vuong	2.34**	2.38**	4.36***	4.90***	5.12***	5.05***
Liklihood Ratio	−969	−963	−959	−875	−872	−870
N	423	423	423	423	423	423

Significance levels: † $p \leq .10$, ∗ $p \leq .05$, ∗∗ $p \leq .01$, ∗ ∗ ∗ $p \leq .001$

[a] Where ZINB refers to a zero-inflated negative binomial model and ZIP refers to a zero-inflated Poission model.
[b] Village level fixed effects included, but not reported.
[c] *Decline* regime fixed effect not reported.

Appendix C The Construction of the Coale-Trussel Parameters

In the Coale-Trussell fertility model, the shape of the age specific marital fertility schedule, in relation to that of a population practicing 'natural' fertility (m), is interpreted as a measure of fertility control. It takes the following form:

$$R_{ia} = n_a M_i exp(m_i v_a) \tag{14}$$

Where R_{ia} is the expected marital fertility rate for the a^th age group of the i^th population, n_a is the standard age pattern of 'natural' fertility , v_a is the typical age specific deviation of controlled fertility from 'natural' fertility. With these definitions it follows that M_i represents the ith populations fertility level and m_i measures fertility control (Xie and Pimentel, 1992, p.977).

Where M_i is close to one, the population in question has the same age pattern of fertility as a population practicing 'natural' fertility. Where m_i is close to 1, the population is a standard controlling population. Where m_i is close to zero, the population is practicing 'natural' fertility. A "justifiable rule of thumb" is to take positive values of $m_i >.200$ as evidence for fertility control, with values below .200 as inconclusive (Okun, 1994, p.200). Xie and Pimentel (1992, p.977 discuss the development of this model into a statistical model via the identity:

$$R_{ia} = T_{ia} B_{ia} \tag{15}$$

Where T_{ia} is the total exposure time in woman years and B_{ia} are the total births for the age group. In combination, and taking the natural log of both sides, we arrive at the following:

$$\log(B_{ia}) = \log(T_{ia} n_a) + \log(M_i + m_i v_a) \tag{16}$$

As Xie and Pimemtel discuss 1992, p.977: Where n_a and v_a are known, M_i and m_i can be calculated as the constant and the slope coefficient in a log-linear regression of births in age group a, population I on v_a. The term is included in the regression with its coefficient restricted to 1. It is assumed that births follow an independent Poisson distribution in each age interval. The distribution here will differ from family size over all women in the sample, but the legitimacy of assuming a Poisson distribution for each sub-sample of ASFRs is untested at this stage.

For each village, wealth tercile and period combination, I have calculated Age specific Marital Fertility Rates. The periodization for the demographic analysis is based upon year of birth of child, with the dividing year being 1800. Following this I have measured the level and scale of fertility control via the Coale-Trussell index of fertility limitation. I used Coale and Trussell's estimated values for n_a and v_a (listed in (Xie and Pimentel, 1992, p.979). [27].

Appendix D Age Specific Fertility Rates by Wealth Tercile and Village

[27]The Stata code for the Poisson regression used was deduced from the SAS and S-Plus code discussed in Schmertmann and Caetano (1999), http://www.demographic-research.org/Volumes/Vol1/5/html/3.htm.

Table 18: Fertility Differentials by Wealth, Whole Sample, Before 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	155	59	241	89	246	93
25-29	255	93	325	121	368	139
30-34	283	94	322	108	392	124
35-39	287	76	323	87	395	89
40-44	272	44	315	49	396	60
45-49	261	8	308	10	384	3
Age Specific Marital Fertility Rates						
20-24	0.381		0.369		0.378	
25-29	0.365		0.372		0.378	
30-34	0.332		0.335		0.316	
35-39	0.265		0.269		0.225	
40-44	0.162		0.156		0.152	
45-49	0.031		0.032		0.008	
Total Marital Fertility	7.67		7.67		7.28	
Coale-Trussell Measures						
'M'	0.841		0.841		0.857	
S.E.	1.092		1.077		1.074	
'm'	0.029		0.027		0.142	
S.E.	0.098		0.087		0.084	
Age at Marriage, Wives'	25.2		22.8		23.8	
Child Mortality Rate[a]	283.17		283.91		218.51	

[a] per 1,000 births, corrected (to age 10).

Table 19: Fertility Differentials by Wealth, Whole Sample, After 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	114	42	138	54	142	49
25-29	203	67	253	100	243	87
30-34	231	69	286	101	245	66
35-39	225	57	281	73	236	46
40-44	208	18	273	34	230	8
45-49	182	1	247	2	207	1
Age Specific Marital Fertility Rates						
20-24	0.368		0.391		0.345	
25-29	0.330		0.395		0.358	
30-34	0.299		0.353		0.269	
35-39	0.253		0.260		0.195	
40-44	0.087		0.125		0.035	
45-49	0.005		0.008		0.005	
Total Marital Fertility	6.71		7.66		6.04	
Coale-Trussell Measures						
‘M’	0.842		0.945		0.912	
S.E.	1.101		1.091		1.100	
‘m’	0.235		0.199		0.555	
S.E.	0.123		0.102		0.128	
Age at Marriage, Wives’	23.4		25.1		22.6	
Child Mortality Rate[a]	247.97		262.75		228.10	

[a] per 1,000 births, corrected (to age 10).

Table 20: Fertility Differentials by Wealth, Cabris, Before 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	63	26	129	46	136	45
25-29	89	29	166	63	210	74
30-34	90	30	163	47	227	67
35-39	90	21	159	34	226	47
40-44	86	9	150	22	221	29
45-49	84	3	45	4	218	3
Age Specific Marital Fertility Rates						
20-24	0.413		0.357		0.331	
25-29	0.326		0.380		0.352	
30-34	0.333		0.288		0.295	
35-39	0.233		0.214		0.208	
40-44	0.105		0.147		0.131	
45-49	0.036		0.028		0.014	
Total Marital Fertility	7.23		7.06		6.66	
Coale-Trussell Measures						
'M'	0.888		0.824		0.787	
S.E.	1.155		1.112		1.105	
'm'	0.221		0.127		0.142	
S.E.	0.177		0.129		0.117	
Age at Marriage, Wives'	21.9		21.2		23.1	
Child Mortality Rate[a]	251.78		256.76		180.04	

[a] per 1,000 births, corrected (to age 10).

Table 21: Fertility Differentials by Wealth, Cabris, After 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	37	13	34	12	48	15
25-29	62	20	81	31	83	19
30-34	70	18	102	28	95	22
35-39	70	13	105	22	88	11
40-44	70	5	105	9	89	2
45-49	70	0	100	0	82	0
Age Specific Marital Fertility Rates						
20-24	0.351		0.353		0.313	
25-29	0.323		0.383		0.229	
30-34	0.257		0.275		0.232	
35-39	0.186		0.210		0.125	
40-44	0.071		0.086		0.022	
45-49	0.000		0.000		0.000	
Total Marital Fertility	5.94		6.53		4.60	
Coale-Trussell Measures						
'M'	0.826		0.913		0.736	
S.E.	1.212		1.185		1.202	
'm'	0.425		0.402*		0.690**	
S.E.	0.238		0.198		0.251	
Age at Marriage, Wives'	23.6		26.4		26.7	
Child Mortality Rate[a]	156.61		155.50		154.92	

[a] per 1,000 births, corrected (to age 10).

Table 22: Fertility Differentials by Wealth, Saint-Paul-la-Roche, Before 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	43	11	27	8	36	9
25-29	49	17	36	14	40	13
30-34	41	12	35	16	40	9
35-39	41	12	35	16	40	9
40-44	31	5	35	5	35	5
45-49	27	0	35	0	34	0
Age Specific Marital Fertility Rates						
20-24	0.256		0.296		0.25	
25-29	0.347		0.389		0.325	
30-34	0.293		0.457		0.225	
35-39	0.282		0.371		0.216	
40-44	0.161		0.143		0.143	
45-49	0.000		0.000		0.000	
Total Marital Fertility	6.69		8.28		5.8	
Coale-Trussell Measures						
'M'	0.648		0.836		0.606	
S.E.	1.231		1.246		1.267	
'm'	−0.177		−0.111		−0.046	
S.E.	0.251		0.246		0.281	
Age at Marriage, Wives'	19.6		22.6		17.3	
Child Mortality Rate[a]	181.66		377.41		204.61	

[a] per 1,000 births, corrected (to age 10). [Very small number of obs.]

Table 23: Fertility Differentials by Wealth, Saint-Paul-la-Roche, After 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	32	9	34	12	23	7
25-29	49	15	37	14	30	13
30-34	56	10	35	15	26	8
35-39	56	10	35	15	26	8
40-44	48	4	30	0	22	0
45-49	42	1	27	0	16	0
Age Specific Marital Fertility Rates						
20-24	0.281		0.353		0.304	
25-29	0.306		0.378		0.433	
30-34	0.179		0.429		0.308	
35-39	0.273		0.258		0.16	
40-44	0.083		0.000		0.000	
45-49	0.024		0.000		0.000	
Total Marital Fertility	5.73		7.09		6.03	
Coale-Trussell Measures						
'M'	0.637		0.976		0.973	
S.E.	1.256		1.228		1.283	
'm'	0.049		0.405		0.670	
S.E.	0.261		0.288		0.381	
Age at Marriage, Wives'	23.1		20.6		26	
Child Mortality Rate[a]	294.83		265.56		400.85	

[a] per 1,000 births, corrected (to age 10). [Very small number of obs.]

Table 24: Fertility Differentials by Wealth, Saint-Chély-d'Apcher, Before 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	25	12	59	25	43	26
25-29	60	24	80	30	71	35
30-34	84	25	79	29	75	32
35-39	84	25	79	29	75	32
40-44	85	18	85	15	85	20
45-49	80	3	83	1	77	0
Age Specific Marital Fertility Rates						
20-24	0.480		0.424		0.605	
25-29	0.400		0.375		0.493	
30-34	0.298		0.367		0.427	
35-39	0.250		0.345		0.338	
40-44	0.212		0.176		0.235	
45-49	0.038		0.012		0.000	
Total Marital Fertility	8.38		8.50		10.49	
Coale-Trussell Measures						
'M'	0.875		0.896		1.197	
S.E.	1.204		1.156		1.152	
'm'	0.013		−0.025		0.113	
S.E.	0.193		0.162		0.158	
Age at Marriage, Wives'	27.3		23.3		25	
Child Mortality Rate[a]	423.71		344.76		365.24	

[a] per 1,000 births, corrected (to age 10).

Table 25: Fertility Differentials by Wealth, Saint-Chély-d'Apcher, After 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	42	18	57	26	48	22
25-29	78	26	102	45	87	45
30-34	87	35	114	48	79	31
35-39	87	35	114	48	79	31
40-44	70	7	108	21	74	5
45-49	50	0	94	2	68	1
Age Specific Marital Fertility Rates						
20-24	0.429		0.456		0.458	
25-29	0.333		0.441		0.517	
30-34	0.402		0.421		0.392	
35-39	0.300		0.355		0.333	
40-44	0.100		0.194		0.068	
45-49	0.000		0.021		0.015	
Total Marital Fertility	7.82		9.44		8.92	
Coale-Trussell Measures						
'M'	0.947		1.023		1.231	
S.E.	1.172		0.128		1.147	
'm'	0.164		0.004		0.377*	
S.E.	0.189		0.141		0.176	
Age at Marriage, Wives'	25.5		25.4		24.3	
Child Mortality Rate[a]	338.39		361.21		334.29	

[a] per 1,000 births, corrected (to age 10).

Table 26: Fertility Differentials by Wealth, Rosny-sous-Bois , Before 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	24	10	26	10	31	13
25-29	57	23	43	14	47	17
30-34	68	27	45	16	50	16
35-39	68	27	45	16	50	16
40-44	70	12	45	7	55	6
45-49	70	2	45	0	55	0
Age Specific Marital Fertility Rates						
20-24	0.417		0.385		0.419	
25-29	0.404		0.326		0.362	
30-34	0.397		0.356		0.320	
35-39	0.314		0.244		0.135	
40-44	0.171		0.156		0.109	
45-49	0.029		0.000		0.000	
Total Marital Fertility	8.51		7.33		6.72	
Coale-Trussell Measures						
'M'	0.959		0.821		0.956	
S.E.	1.205		1.245		1.223	
'm'	0.033		0.069		0.481	
S.E.	0.198		0.249		0.255	
Age at Marriage, Wives'	25.1		22.2		22.9	
Child Mortality Rate[a]	232.38		165.49		162.97	

[a] per 1,000 births, corrected (to age 10).

Table 27: Fertility Differentials by Wealth, Rosny-sous-Bois , After 1800

	Wealth Tercile 1		Wealth Tercile 2		Wealth Tercile 3	
Exposure and Births	Exp.	Births	Exp.	Births	Exp.	Births
20-24	3	2	13	4	23	5
25-29	14	6	33	10	43	10
30-34	18	6	35	10	45	5
35-39	18	6	35	10	45	5
40-44	20	2	30	4	45	1
45-49	20	0	26	0	41	0
Age Specific Marital Fertility Rates						
20-24	0.667		0.308		0.217	
25-29	0.429		0.303		0.233	
30-34	0.333		0.286		0.111	
35-39	0.250		0.114		0.111	
40-44	0.100		0.133		0.022	
45-49	0.000		0.000		0.000	
Total Marital Fertility	8.89		5.72		3.47	
Coale-Trussell Measures						
'M'	1.24		0.733		0.563	
S.E.	1.499		1.354		1.351	
'm'	0.536		0.267		0.703	
S.E.	0.459		0.36		0.409	
Age at Marriage, Wives'	25.8		23.4		23.8	
Child Mortality Rate[a]	129.70		258.33		159.31	

[a] per 1,000 births, corrected (to age 10). [Very small number of observations]