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Marital fertility and wealth during the fertility transition: rural France, 1750–1850[1]

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It has been long established that the demographic transition began in eighteenth-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 rural villages in France, 1750–1850. For the first time, the wealth–fertility relationship during the onset of the French fertility decline can be analysed. Where fertility is declining, wealth is a powerful predictor of smaller family size. This article 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 where fertility is high.

Three great events, the industrial revolution, the French Revolution, and the silent revolution of the demographic transition, were critical in shaping the modern world. All three emerged in eighteenth-century Europe. Britain was the pioneer of industrialization; France was the pioneer of conscious fertility control. Is there a connection between these revolutions? The root causes of 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, micro economic theory, and more recently unified growth theory, have treated the early French fertility decline as noise, the extreme tail end of a normal distribution.[2] This is the intellectual equivalent of treating Britain as the exception in explaining the industrial revolution.[3] At the time aggregate fertility fell (1776),[4] France was by far the largest country in Europe, excluding Russia, with a population of almost 30 million people representing 27.7 per cent of the total population of western Europe.[5] France should therefore be considered as the exemplar of the transition to low fertility.

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[2] For demographic transition theory, see Notestein, 'Population'. On microeconomic theory, see Becker, 'Economic analysis'; idem, *Treatise*. On unified growth theory, see Galor, 'From stagnation to growth'.

[3] Comparison borrowed from van de Walle, *Female population*, p. 5.

[4] See Cummins, 'Why did fertility decline?', pp. 76–8, for details.

[5] Calculated from Maddison, *World economy*.

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Empirically there are no obvious aggregate-level socio-economic triggers for the European fertility transition. This has led some to argue that the fertility transition was fundamentally a non-economic event.[6] 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 analyse the wealth–fertility relationship *during* the onset of the French fertility decline. In addition to reporting the empirical patterns, this article puts forward a 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.

Over the past two centuries, fertility in most of the world has undergone a sustained and seemingly irreversible transition. In France, this revolutionary new behaviour became widespread towards the end of the eighteenth century. Before this, the evidence suggests that human fertility was uncontrolled within marriage.[7] 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.[8] Understanding this change between the pre-industrial and the modern growth eras is a central research question for economics and social science. As of 2012, 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.[9] 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 parents adjusted their fertility behaviour to take account of the new mortality schedule. The European Fertility Project (hereafter referred to as the EFP) led by Coale at Princeton University during the 1970s and 1980s 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 nineteenth century was almost completely unrelated to infant mortality decline and other socio-economic changes.[10] *Time* was the best indicator for the onset of sustained fertility decline: excluding France, 59 per cent of the provinces of Europe began their fertility transition during the decades of 1890–1920.[11] Therefore, the transition was an 'ideational change' and not an 'economic adaptation'. Recent criti-

[6] For example, Cleland and Wilson, 'Demand theories'.
[7] Ibid., p. 12.
[8] Clark, *Farewell*; Galor and Weil, 'Population'.
[9] Thompson, 'Population'; Landry, *Révolution démographique*; Notestein, 'Population'.
[10] Watkins, 'Conclusions', p. 448.
[11] Ibid., pp. 431–43.

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cisms have somewhat diluted the authority of the Princeton view. Brown and Guinnane argue that the EFP's conclusions were biased by the level of aggregation; the sub-national districts used (departments, counties, cantons, and so on) were too large and internally heterogeneous to be useful as distinct fertility regimes.[12] Further, the socio-economic data collected were not the most relevant to parents' fertility decisions.

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

The exceptional fertility decline of France is a central feature of the European demographic transition. This spectacular break from the past has never been satisfactorily explained. Weir reports annual estimates of fertility levels for France in 1740–1911.[13] 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 eighteenth century on, fertility appears to begin a steady and consistent decline from very high levels (80–90 per cent of the Hutterites) to very low levels (approximately 31 per cent 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).[14]

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,[15] 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).[16] 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 to 1792, and found a positive relationship between marital fertility and income.[17]

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.

[12] Brown and Guinnane, 'Two statistical problems'.
[13] Weir, 'New estimates'.
[14] See Cummins, 'Why did fertility decline?', pp. 76–8, for more details.
[15] This study also uses the Henry demographic data and the data is explained in detail in section II.
[16] Weir, 'Family income', p. 15.
[17] Hadeishi, 'Economic well-being', p. 489.

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The rest of this article is comprised of four sections. Section I details the data and its summary characteristics. Section II is an examination of the wealth–fertility associations, while section III evaluates explanations for the French fertility transition. Section IV concludes.

I

The demographic data to be analyzed is a subsample of the Louis Henry-led INED demographic survey,[18] hereafter referred to as the Enquête Henry.[19] 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.[20] The techniques of family reconstitution, invented by Henry, were applied to generate the demographic data. Family reconstitution is a simple idea. As Wrigley et al. put 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'.[21] The result of the Enquête Henry is a goldmine of individual-level information on the demographic characteristics of pre-industrial France.

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 reflect 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 are unusable. The potential bias which the selection criteria introduces (that is, richer 'stayers' are more likely to appear than poorer migrants) can be mitigated by comparing demographic rates between fixed wealth groupings.[22]

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'.[23] 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 article 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.[24] The TSAs were originally

[18] Institut National Etudes Démographiques, http://www.ined.fr

[19] The summary papers of the Enquête Henry are: Henry, 'Fécondité . . . sud-ouest'; idem, 'Fécondité . . . sud-est'; Henry and Houdaille, 'Fécondité . . . nord-ouest'; Houdaille, 'Fécondité . . . nord-est'. A summary of all studies using the Henry data (before 1997) is listed in Renard, 'Enquête Louis Henry'. Detailed discussion of the database can be found in Séguy and Méric, 'Enquête Louis Henry'; Séguy and Colençon, 'Enquête Louis Henry'; Séguy and la Sager, 'Enquête Louis Henry'; Séguy, Colençon, Méric, and la Sager, *La population de la France*.

[20] Weir, 'Family income', p. 2; Séguy et al., *La population de la France*, p. 41.

[21] Wrigley, Davies, Oeppen, Schofield, *English population*, p. 12.

[22] On wealth and mobility, see Kesztenbaum, 'Places', p. 174.

[23] van de Walle, 'Alone', p. 264.

[24] The data used in this analysis are sourced from serie Q3, *Tables Des Successions et Absences*, from the *Archives Départementales* in Alpes-Maritime, Dordogne, Lozere, and Seine-St Denis.

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constructed for tax purposes and recorded all deaths in a *bureau de l'enregistrement*,[25] 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 separate estimates for real estate (*immeubles*) and 'movable' goods, such as furniture, livestock, cash, and other financial assets (*mobilier*).[26] 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 *bureau*, it is possible that the values calculated here are underestimates of the true property wealth of individuals.[27] However, this bias only affects a small minority of the sample. According to Bourdieu, Postel-Vinay, and Suwa-Eisenmann, 85 per cent of individuals in the 'TRA' sample (also based on the TSAs) had one property record, leaving 15 per cent with two or more.[28] Attempts to assess the accuracy of the wealth information in the TSAs are limited by the fact that 'very few alternative sources exist'.[29] However, Bourdieu et al. test the validity of the TSAs against other published data and find them to yield consistent results.[30]

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 start post-1810), there were only 12 '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[31] Enquête Henry–TSA communes are Cabris (in the Alpes-Maritime department, 25 kilometres 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 kilometres from Mende), and Rosny-sous-Bois (about 10 kilometres outside Paris).[32]

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.[33] How representative

[25] The lowest-level tax jurisdiction in France; Piketty, Postel-Vinay, and Rosenthal, 'Wealth concentration', p. 250.

[26] Hereafter property wealth refers to *immeubles* and cash wealth refers to *mobilier*.

[27] Communes were aggregated into *bureaux*. Typically a *bureau* held 10–20 communes. See Bourdieu, Postel-Vinay, and Suwa-Eisenmann, 'Défense', p. 33.

[28] Bourdieu, Postel-Vinay, and Suwa-Eisenmann, 'Wealth accumulation', p. 7.

[29] Ibid., p. 6.

[30] Ibid., p. 7.

[31] 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. Not all male deaths in the Enquête Henry data were successfully matched to the TSAs. On average 70% were found; 71% in Cabris, 64% in Saint-Paul, 72% in Saint-Chély, and 74% in Rosny. The missing links are attributable to inconsistencies in names and ages at death which are inevitable in parish and fiscal records of this period. Further, in the TSA for Saint-Paul water damage made some entries illegible.

[32] This is the same village studied previously by Weir, 'Family income'. All of these communes, apart from Rosny-sous-Bois, had a population of approximately 1,700 in 1821. Rosny-sous-Bois had a population of 822 (Houdaille, 'La mortalite', p. 88).

[33] Henry, 'Fécondité . . . sud-est', p. 856.

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are these villages? Table 1 reports the top 20 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 per cent 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.

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 omission between villages makes comparison with the averages difficult too). Rosny-sous-Bois had a mixed economy of grain-farming and viticulture.[34] Both Cabris and Saint-Paul-la-Roche are typical rural agricultural villages (farmers and labourers account for 70 per cent of recorded occupations). In Saint-Chély-d'Apcher, a small proto-industrial centre, weavers, at 25 per cent, are the most frequently reported occupation.[35]

The sample covers the fertility experience of individuals who died between 1810 and 1870 and who were born between 1720 and 1820. The relevant 'fertile period' covered is roughly 1750–1850. The sample is entirely rural: at this time approximately 80 per cent of the French population lived in villages of a similar size to those in the sample.[36] 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 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.[37] Contrasting individual villages with that of France, we can see that Rosny-sous-Bois and Cabris have a relatively large drop in marital fertility, whereas 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.[38]

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 is a *decline* regime, 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.[39]

[34] Weir, 'Family income', p. 2.

[35] Malte-Brun, *La France illustrée*, p. 24. Religiosity is one factor not analysed here. This feature seems to be unusually strong in Saint-Chély-d'Apcher: Jones, *Liberty and locality*, p. 215, 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'.

[36] Sharlin, 'Urban-rural differences', p. 235. As the sample is entirely rural, the origin of the decline in urban centres cannot be tested for. Almost everywhere in Europe, fertility declined first in urban areas; ibid., p. 249.

[37] I_g was calculated from the Enquête Henry for the decades 1740–60 and 1800–1820; the figure reports the differences. There were not enough observations to calculate this for four of the Enquête Henry villages. Source for France: Weir, 'New estimates', pp. 330–1.

[38] van de Walle, *Female population*, pp. 170–89.

[39] To be specific the *decline/non-decline* division is motivated by the fertility trends reported in fig. 1 and the pattern of the infant mortality rates (reported in an earlier analysis, Cummins, 'Why did fertility decline?').

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Table 1. *Top 20 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 labourer (9)	Land owner (16)	Agricultural labourer (5)	Land owner (7)	Land owner (6)
4	Labourer (7)	Weaver (2)	Land owner (4)	Day labourer (7)	Bricklayer/stonemason (2)
5	Land owner (5)	Baker (1)	Working proprietor (3)	Farmer (6)	Gardener (2)
6	Day labourer (4)	Stonemason (1)	Blacksmith (3)	Agricultural labourer (4)	Working proprietor (2)
7	Weaver (4)	Construction joiner (1)	Carpenter (2)	Stonemason (3)	Day labourer (2)
8	Stonemason (2)	Surgeon (1)	Day labourer (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)	Day labourer (<1)	Tailor (<1)	Shoemaker (1)	Agricultural labourer (1)
14	Journeyman (1)	Carpenter (<1)	Butcher (<1)	Baker (1)	Shoemaker (1)
15	Domestic servant (1)	Shepherd (<1)	Beggar (<1)	Wagoner (1)	Locksmith (1)
16	Working proprietor (1)	'Bourgeois' (<1)	Notary (<1)	Saddler (1)	Surgeon (1)
17	Gardener (1)	Teacher (<1)	Lord (<1)	Jurist (<1)	Saddler (1)
18	Fibre comber (<1)	Brick maker (<1)	Officer (<1)	Doctor (<1)	Cartwright (1)
19	Construction joiner (<1)	Mayor (<1)	Paper maker (<1)	Wood worker (<1)	Rentier (1)
20	Shepherd (<1)	Soldier (<1)	Rope maker (<1)	Tailor (<1)	Village policeman (1)
Other occupations (%)	27	6	9	24	0
Proportions Recorded (%)	38	46	20	32	42

Source: Linked Enquête Henry–TSA sample. *Source:* As for tab. 1.

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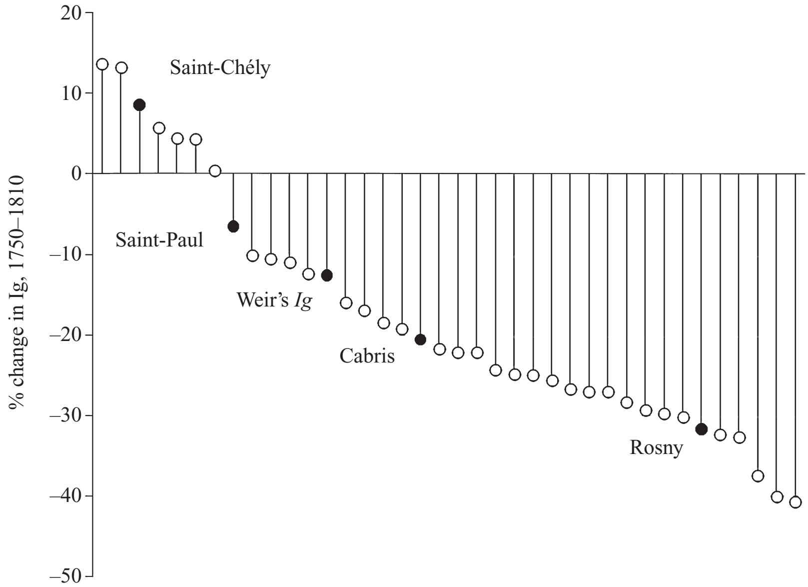

Figure 1. *Fertility decline in 37 Henry villages and France, 1750–1810*
Note: Ig, the index of marital fertility, is the ratio of observed births within marriage to that expected from the Hutterites given the same female age structure and proportions married.
Sources: Weir, 'New estimates', pp. 330–1; Linked Enquête Henry–TSA sample.

The principal research question in this article is: what was the relationship between wealth and fertility in transition-era France? Usually, economists relate fertility choices to income, not wealth. For instance, Becker developed a simple family budget constraint, written as:[40]

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

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.

Friedman proposed that current consumption depended not upon current income, but upon permanent income, the *permanent income hypothesis*.[41] Income is made up of two components:

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

[40] Becker, *Treatise*, p. 145.
[41] Friedman, *Theory*.

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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'.[42] The transitory component I_t, It 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.[43]

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 lifetime wealth accumulation, can be used as a proxy for this permanent income.

The TSA wealth data provide 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:

$$W = f\left(\frac{1}{n}\right), \; s.t. \; A_c \leq A_c^{\star} \tag{4}$$

where W is wealth, A_c is the age of the child, and $A_c^{\star}$ 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.[44]

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 *Age at Death* and *Age at Death*^{2} on $\sqrt{Real\ Wealth}$.[45] Simple calculations confirm first impressions: There are life course effects. As people grow older, they generally become richer. Past 64, wealth becomes negatively associated with age. The net age effect, however, is remarkably

[42] Ibid., p. 21.
[43] Ibid., p. 22.
[44] The analysis in section III 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.
[45] The resulting coefficients are $\sqrt{Real\ Wealth} = -20.18 + 2.04 * Age\ at\ Death - 0.016 Age\ at\ Death^2$. The age coefficients were both significant at the 5% level and the adjusted R^2 was 0.004.

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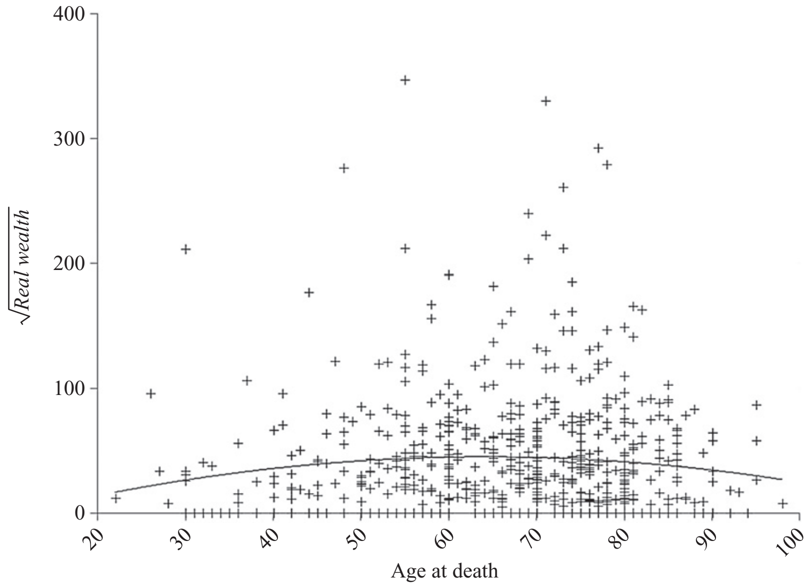

Figure 2. *Life course effects*
Source: Linked Enquête Henry–TSA sample.

weak. For the vast majority of the sample, those who died under 80, there is no statistically significant relationship between real wealth and age.[46] The absence of a large life course effect allows the use of the wealth data in the detection of differential fertility.[47]

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.[48] 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 and Gutmann and Watkins, 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.[49] The division split the sample into even thirds, with those dying with the sum of 0–141 francs being designated to group 1, those with wealth at death between 141 and 2,100 francs designated to group 2, and those with a wealth at over 2,100 designated to group 3.

Table 2 reports the average number of children born (henceforth 'gross fertility') and the number of children surviving to 10 years ('net fertility'). These values

[46] This result was obtained from an OLS regression, following equation 5, but only for those who died under 80.
[47] As the goal is to sort villagers into three broad wealth terciles, the role of *inter vivos* bequests and their effects on wealth at death (beyond those associated with age) is not explicitly accounted for here.
[48] Levy-Leboyer and Bourgignon, *Macroeconomic model*.
[49] Weir, 'Family income'; Gutmann and Watkins, 'Socio-economic differences'.

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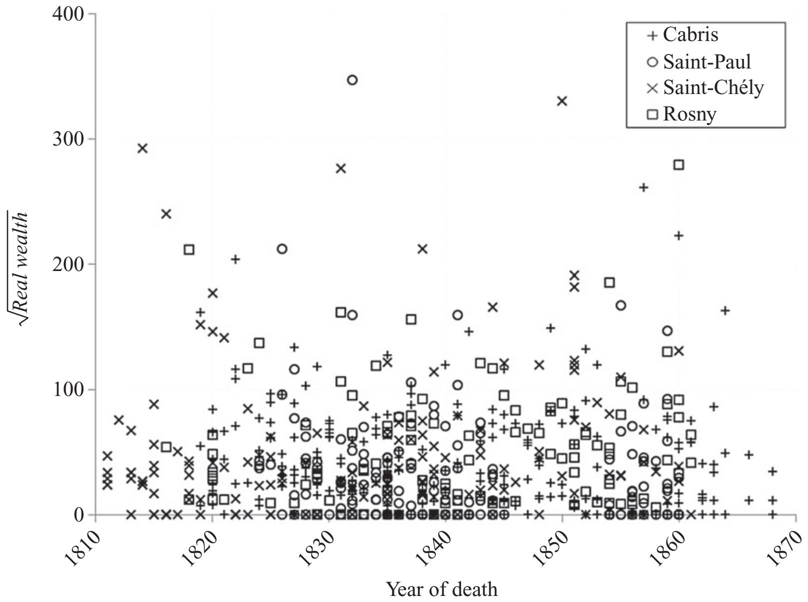

Figure 3. *Real wealth by year of death (males)*
Source: As for fig. 2.

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

Note: Net family size is corrected for under-registration of child deaths. The method used for doing this is described in section III.
Source: As for tab. 1.

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 per cent larger than the poorest (over 23 per cent if we measure this in 'net' terms). Where fertility is declining, the wealth–fertility relationship is reversed. The differential between the richest and the poorest tercile's family size is now minus 30 per cent (26 per cent 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

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rich achieved in those villages where fertility was declining? Further, why was net fertility so low among 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 and the Napoleonic Wars.

II

Equations 5 to 8 detail the demographic influences upon gross and net fertility.

$$GrossF = MFR * MD \tag{5}$$

$$NetF = GrossF - CED \tag{6}$$

$$MFR = f(FAgeM, r * CED) \tag{7}$$

$$MD + EU - FAgeM = \min(FAgeD, FAgeMD, 50) - FAgeM \tag{8}$$

where *GrossF* and *NetF* are gross and net fertility respectively. *CED* is children who 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 7 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:

$$GrossF = f(C, D, CED, FAgeM, EU, REV, NWARS, VILLAGE, WEALTH) \tag{9}$$

$$NetF = f(C, D, FAgeM, EU, REV, NWARS, VILLAGE, WEALTH) \tag{10}$$

where *C* represents a constant, *D* is a fertility regime fixed effect, and *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.

Infant and child mortality affect fertility both mechanically (in the case of net fertility, equation 6) and also, perhaps, through their effect on the marital fertility rate via a replacement effect (equation 7). Under-registration of births in French parish registers was rare; Catholic villagers would rush to baptize their child; an unbaptized child would be condemned to purgatory. Parents were less incentivized

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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	166.6
Uncorrected	181.2	197.9	162.0

Note: Rates are per 1,000 births, for children surviving to 10 years.
Source: As for tab. 1.

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.[50] This technique takes advantage of the common tendency for parents to give a later-born child the same name as a previously deceased child.

A simplified version of the same name technique was employed with the wealth terciles within the linked Enquête Henry–TSA sample. First, the number of repeated names within a family was summed. This was then compared with the number of recorded child deaths. Where the number of repeated names exceeded the number of child deaths, the child deaths were corrected 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 suggests 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. First, the number of child deaths can never exceed the number of births. This induces a positive correlation between fertility and mortality. Second, 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., the proportion of children dying before the age of 10 is included as an

[50] Houdaille, 'La mortalite'.

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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

Note: *a* The nos. 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.
Source: As for tab. 1.

independent variable in the regressions.[51] This removes the structural correlation between mortality and fertility but does not remove the endogeneity. For robustness, each model is re-estimated with net fertility (gross fertility minus the corrected number of child deaths) as the dependent variable. This is imperfect but does allow the direct modelling 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.

The regression models to be estimated are summarized in equations 9 and 10, 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).[52] Fertility typically has a tendency to be overdispersed (where the mean is greater than the variance) and this is true for the Enquête Henry data. Gross fertility has a

[51] Guinnane, Moehling, and Ó Gráda, 'Fertility of the Irish', p. 472.
[52] Cameron and Trivedi, *Microeconometrics*, p. 668.

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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., a zero-inflated model is introduced here 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 (*DFAgeM*35).[53]

$$Prob(Sterile) = f(C + DFAgeM35) \tag{11}$$

The zero-inflated model allows zero births in two ways: first, through the probability of sterility channel (equation 11), and second, through the estimated count from a negative binomial or Poisson regression of equations 9 and 10.

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 11, was preferred over both the Poisson and negative binomial specifications. The Vuong statistics (reported in tables 5 and A2) for all 12 zero-inflated Poisson and zero-inflated negative binomial models were positive and significant different 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 is significant, the zero-inflated negative binomial coefficients and standard errors are reported. Where it is not, the Poisson coefficients and standard errors are reported. For each choice, the alternative is presented in the appendix (table A2). The 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 the age of 10 (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 9. 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 that is exhibiting significant fertility decline, and *Decline Regime* = 0 otherwise (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

[53] The choice of this variable follows Guinnane et al. exactly. They justify this choice based on data availability and the sudden increase in estimated sterility in non-controlling populations; Guinnane et al., 'Fertility of the Irish', p. 471.

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Table 5. *Zero-inflated regressions on family size*

	Gross fertility			*Net fertility*		
Model no.	*I*[b]	*II*[c]	*III*	*IV*[b]	*V*[c]	*VI*
Specification[a]	*ZINB*	*ZINB*	*ZIP*	*ZIP*	*ZIP*	*ZIP*
Demographic variables						
Proportion of children dead	0.337**	0.328**	0.313**			
	(0.112)	(0.109)	(0.106)			
Age at marriage, female	–0.048***	–0.046***	–0.048***	–0.053***	–0.051***	–0.053***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Age at end of union, female	0.037***	0.037***	0.038***	0.041***	0.041***	0.041***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Second marriage, male	–0.014	–0.014	–0.046	0.105	0.107	0.082
	(0.113)	(0.111)	(0.110)	(0.119)	(0.119)	(0.120)
Event effects						
Revolution	–0.099+	–0.099+	–0.098+	–0.091	–0.090	–0.090
	(0.054)	(0.053)	(0.053)	(0.060)	(0.060)	(0.061)
Napoleonic Wars	–0.030	–0.033	–0.021	–0.009	–0.013	–0.003
	(0.059)	(0.058)	(0.057)	(0.067)	(0.067)	(0.067)
Main wealth effects						
Wealth tercile 2	0.032	0.159*	0.119	–0.003	0.094	0.037
	(0.055)	(0.078)	(0.090)	(0.063)	(0.096)	(0.115)
Wealth tercile 3	–0.096+	0.103	0.137	–0.074	0.109	0.131
	(0.056)	(0.083)	(0.095)	(0.063)	(0.100)	(0.120)
Decline wealth effects						
Wealth tercile 2		–0.246*			–0.170	
		(0.108)			(0.126)	
Wealth tercile 3		–0.357**			–0.304*	
		(0.110)			(0.129)	
Cabris*wealth tercile 2			–0.130			–0.062
			(0.130)			(0.156)
Cabris*wealth tercile 3			–0.259+			–0.225
			(0.133)			(0.160)
Saint-Paul*wealth tercile 2			0.144			0.195
			(0.169)			(0.206)
Saint-Paul*wealth tercile 3			–0.153			–0.106
			(0.183)			(0.218)
Rosny*wealth tercile 2			–0.292+			–0.164
			(0.154)			(0.182)
Rosny*wealth tercile 3			–0.625***			–0.511**
			(0.154)			(0.183)
Constant	1.234***	1.123***	1.116***	0.820**	0.721*	0.725*
	(0.248)	(0.247)	(0.245)	(0.288)	(0.292)	(0.294)
Zero-inflation (logit)						
Marriage over 35, female	3.153***	3.17***	3.135***	3.389***	3.441***	3.425***
	(0.68)	(0.669)	(0.673)	(0.723)	(0.717)	(0.726)
Constant	–3.362***	–3.343***	–3.335***	–3.420***	–3.436***	–3.448***
	(0.339)	(0.332)	(0.324)	(0.371)	(0.378)	(0.381)
A	0.110***	0.005*	0.001	0.000	0.000	0.000
Vuong	2.20*	4.47***	2.35**	2.17*	2.20*	2.18*
Likelihood ratio	–969	–963	–959	–875	–872	–870
N	423	423	423	423	423	423

Notes: Significance levels: $^{+}p \leq 0.10$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.
a Where ZINB refers to a zero-inflated negative binomial model and ZIP refers to a zero-inflated Poisson model.
b Village-level fixed effects included, but not reported.
c Decline regime fixed effect not reported.
Source: As for tab. 1.

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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.[54] 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 suggests 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 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.[55] Rosny-sous-Bois was also the village with the sharpest drop in marital fertility between 1750 and 1810 (see figure 1).

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 kilometres to the north.[56]

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 all the demographic and 'event' variables listed in the regression. The wealth terciles in the non-decline villages have estimated levels of

[54] van de Walle, 'Infant mortality', p. 221.

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

[56] 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.

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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 tab. 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.
Source: As for tab. 1.

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, who are the pioneers of the decline in French fertility. The forces described by Malthus do not explain why fertility is declining.

Is it possible that these wealth patterns are a product of the life course? Section II 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 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.[57] All of the non-wealth regressors from model II are included in the regressions, but they are not reported.

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

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Table 7. *Comparing 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	0.159	0.157	0.158	0.094	0.092	0.077
	(0.078)	(0.115)	(0.108)	(0.096)	(0.144)	(0.130)
Wealth tercile 3	0.103	0.037	0.143	0.109	0.015	0.163
	(0.083)	(0.125)	(0.112)	(0.100)	(0.157)	(0.132)
Decline wealth effects						
Wealth tercile 2	−0.246*	−0.758*	−0.228⁺	−0.170	−0.687⁺	−0.145
	(0.108)	(0.346)	(0.137)	(0.126)	(0.403)	(0.159)
Wealth tercile 3	−0.357**	−0.978**	−0.297*	−0.304*	−1.005*	−0.222
	(0.110)	(0.345)	(0.140)	(0.129)	(0.403)	(0.162)
N	423	140	283	423	140	283

Notes: Significance levels: ⁺$p \leq 0.10$, *$p \leq 0.05$, **$p \leq 0.01$.
Source: As for tab. 1.

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 was the rich who reduced their fertility first.

III

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 labour force structure of the economy, income, or 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

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decline in French fertility arose around the turn of the twentieth century.[58] Recent theories are far from abundant. Here we will initially focus upon those forwarded by Wrigley and Weir.[59]

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 eighteenth to late nineteenth century was always close to one, suggesting that the population was still finely constrained by available resources.[60] As previously mentioned, almost 80 per cent of the French population were rural, and nearly 70 per cent lived off farming at the time of the decline.[61] Chesnais also points out that 'farming remained primitive' and that there were numerous indicators of overpopulation (such as increases in wheat prices from the 1760s to the 1820s).[62] 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.[63] 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.

Many scholars, including Weir, and, more recently, Murphy and Gonzalez-Bailón, have explicitly linked the Revolution to the fertility decline.[64] 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).[65] Furthermore, it is widely accepted that many localities began their fertility transition long before 1789.[66] 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

[58] van de Walle, *female population*, p. 6, briefly discusses this mostly forgotten literature, criticizing its 'outdated and weak statistical content', and states that the work amounted to no more than a series of hypotheses.

[59] 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, *Demographic transition*, p. 338, questions this interpretation by pointing out that other countries adopted the same principles but did not 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 Régime, and followed the same fertility pattern elsewhere post Revolution.

[60] Wrigley, 'Fall', p. 55.

[61] Chesnais, *Demographic transition*, p. 335.

[62] Ibid., p. 336.

[63] Weir, 'Life under pressure', p. 31.

[64] Weir, 'Fertility transition'; Murphy and Gonzalez-Bailón, 'Smaller families'.

[65] Cummins, 'Why did fertility decline?', pp. 76 –8.

[66] Chesnais, *Demographic transition*, p. 338.

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of the Revolution were germinating long before 1789. Could these forces have 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'.[67] 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 labour. For the new rural bourgeoisie, children became 'superfluous as labourers and costly as consumers'.[68] The decline of fertility in France in the early-to-mid-nineteenth century was primarily due to the decline of the demand for children by this new class. It was only after 1870 that France joined the rest of Europe in a fertility transition which transcended the social order.[69]

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.[70]

Table 8 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 factor in his hypothesis is the changing cost of children, due to the substitutability of wage labour by poorer socio-economic terciles. This does not uniquely identify a particular French characteristic as this process must surely have 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 as they were in France, if not more so.

In France, serfdom had long disappeared by the eighteenth century, and most peasants owned some land, in contrast to most of Europe. The fertility decline

[67] Weir, 'Fertility transition', p. 613.

[68] Ibid., p. 613.

[69] Ibid., p. 614.

[70] The division for property was: all those with 0-value at death in tercile 1; all those with property over 0 and less than 2,000 francs in tercile 2; and all those with over 2,000 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.

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Table 8. *Zero-inflated regressions with the components of wealth*

	Gross fertility			Net fertility		
Wealth	*Total*	*Property*	*Cash*	*Total*	*Property*	*Cash*
Non-decline villages						
Tercile 2	0.159*	0.152+	0.108	0.094	0.112	0.134
	(0.078)	(0.086)	(0.099)	(0.096)	(0.107)	(0.123)
Tercile 3	0.103	0.018	0.102	0.109	0.068	0.112
	(0.083)	(0.089)	(0.080)	(0.100)	(0.108)	(0.099)
Decline villages						
Tercile 2	–0.246*	–0.234**	–0.072	–0.170	–0.129	–0.089
	(0.108)	(0.114)	(0.125)	(0.126)	(0.137)	(0.150)
Tercile 3	–0.357**	–0.253**	–0.200+	–0.304*	–0.209	–0.168
	(0.110)	(0.111)	(0.111)	(0.129)	(0.133)	(0.133)

Notes: Significance levels: $^{+}p \leq 0.10$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$.
Source: As for tab. 1.

originated among the wealthiest of this property-holding class.[71] According to Chesnais, roughly 63 per cent of the population was represented by landowners and their families in 1830 while the comparable figure for Britain is 14 per cent.[72] For the linked Enquête Henry–TSA sample the proportion holding some property wealth at death was 70 per cent in Cabris, 41 per cent in Saint-Paul, 71 per cent in Saint-Chély, and 61 per cent in Rosny: all significantly higher than the English average.

The widespread ownership of land among 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 nineteenth century.[73] For the eighteenth 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 income inequality in France between 1780 and 1830.[74] 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 lower classes), the rise of urban wages, and most importantly the confiscation and selling of church properties.[75]

The decreasing level of inequality implies that the environment for social mobility was more fluid in late eighteenth- and early nineteenth-century France than anywhere else in Europe. 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

[71] In aggregate terms, European nobility restricted their fertility far earlier than the rest of the population. See Livi-Bacci, 'Social-group forerunners'.
[72] Chesnais, *Demographic transition*, p. 337.
[73] Piketty et al., 'Wealth concentration', p. 250. Of course, inequality and the proportion of landowners in the population are separate concepts and any link between them is dependent on other factors. For the sample studied here, Saint-Chély had the highest proportion of landowners (71%) and the second highest level of inequality, as measured by the Gini coefficient (0.818).
[74] Morrisson and Snyder, 'Income inequality', p. 74, also argue that inequality rose between 1830 and 1860 but never to the pre-Revolutionary level.
[75] Ibid., pp. 70–4.

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Table 9. *Inequality in the sample villages*

	Mean wealth	*Median wealth*	*Gini coefficient*
Non-decline villages			
Saint-Paul-la-Roche	2,597	128	0.861
Saint-Chély-d'Apcher	5,430	825	0.818
Decline villages			
Cabris	3,867	1,370	0.705
Rosny-sous-Bois	5,351	1,730	0.722

Source: As for tab. 1.

sizes.[76] The Revolution served 'to increase the thirst for equality and stimulate the social ambition of families, both for themselves and their progeny'.[77] The old social stratifications under the Ancien Régime, 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. 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'.[78]

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 preliminarily 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 9 reports Gini coefficients based on total real wealth, by village, for the linked Enquête Henry–TSA sample.[79] Figure 4 illustrates inequality via Lorenz curves for each of the sample villages. 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. Of course, this correlation is provisional: the sample size here is

[76] Dumont, *Dépopulation*.
[77] Chesnais, *Demographic transition*, p. 334.
[78] Becker and Tomes, 'Equilibrium theory', p. 1166.
[79] The calculated inequality measures are based upon the linked data and therefore exclude many 'leavers' (and unsuccessful matches), as discussed in section I. Wealth distributions are extremely sensitive to outliers and the exclusion/inclusion of even one person of extreme wealth is enough to change the Gini coefficient completely.

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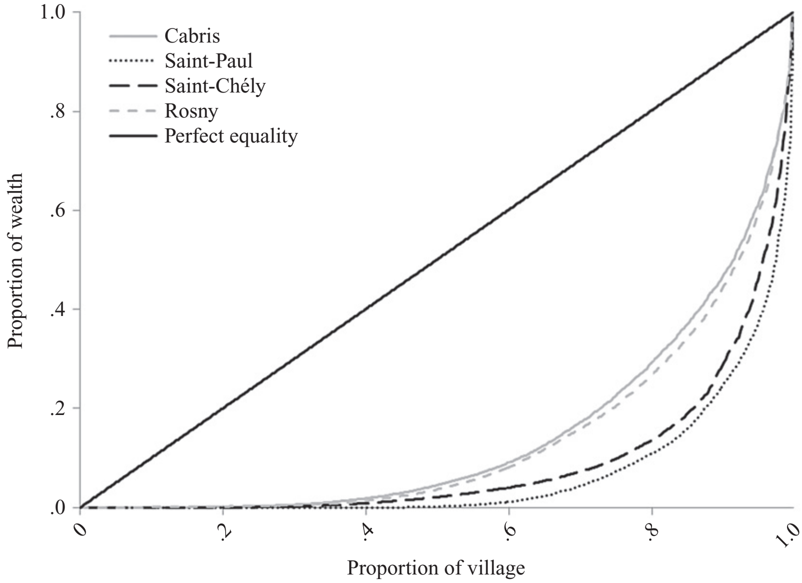

Figure 4. *Lorenz curves for the sample villages*
Source: As for fig. 2.

Table 10. *Father's wealth as a determinant of son's wealth*

	Coefficient on father's wealth
Decline regime villages	0.725***
	(0.172)
Father's wealth*Decline regime	–0.327
	(0.270)
n	60
Adj. R^2	0.237

Notes: Significance levels: *** $p \leq 0.001$. Regression is based on the square root of father and son's wealth. Constant and decline dummy included in regression but not reported.
Source: As for tab. 1.

small and differences in patterns of observed wealth between villages could be a result of differences in the practice of *inter vivos* bequests.

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, it was possible to investigate this relationship. Table 10 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

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fertility is stagnating (0.725 vs. 0.398). 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.

IV

Through linking the Henry demographic dataset to individual measures of wealth, the socio-economic correlates of the fertility transition have been examined in this article. 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. Further, 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 I: WEALTH BY VILLAGE AND ALTERNATIVE MODEL SPECIFICATIONS

Table A1. *Wealth, by village*

	Mean	*Standard deviation*	*n*
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

Source: As for tab. 1.

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Table A2. *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	0.320**	0.321**	0.314**			
	(0.105)	(0.105)	(0.107)			
Age at marriage, female	–0.047***	–0.046***	–0.048***	–0.053***	–0.051***	–0.053***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Age at end of union, female	0.037***	0.036***	0.038***	0.041***	0.041***	0.041***
	.(004)	(0.004	(0.004)	(0.005)	(0.005)	(0.005)
Second marriage, male	–0.022	–0.017	–0.045	0.105	0.107	0.082
	(0.110)	(0.110)	(0.110)	(0.119)	(0.119)	(0.120)
Event effects						
Revolution	–0.098+	–0.099+	–0.098+	–0.091	–0.090	–0.090
	(0.052)	(0.052)	(0.053)	(0.060)	(0.060)	(0.061)
Napoleonic Wars	–0.032	–0.034	–0.021	–0.009	–0.013	–0.003
	(0.057)	(0.057)	(0.058)	(0.067)	(0.067)	(0.067)
Main wealth effects						
Wealth tercile 2	0.031	0.158*	0.118	–0.003	0.094	0.037
	(0.053)	(0.077)	(0.091)	(0.063)	(0.096)	(0.115)
Wealth tercile 3	–0.093+	0.104	0.136	–0.074	0.109	0.131
	(0.054)	(0.083)	(0.095)	(0.063)	(0.100)	(0.120)
Decline wealth effects						
Wealth tercile 2		–0.246*			–0.170	
		(0.106)			(0.126)	
Wealth tercile 3		–0.359***			–0.304*	
		(0.108)			(0.129)	
Cabris*Wealth tercile 2			–0.130			–0.0620
			(0.130)			(0.156)
Cabris*Wealth tercile 3			–0.258+			–0.225
			(0.133)			(0.160)
Saint-Paul*Wealth tercile 2			0.145			0.195
			(0.169)			(0.206)
Saint-Paul*Wealth tercile 3			–0.152			–0.106
			(0.183)			(0.218)
Rosny*Wealth tercile 2			–0.292+			–0.164
			(0.154)			(0.182)
Rosny*Wealth tercile 3			–0.625***			–0.511**
			(0.154)			(0.183)
Constant	1.23***	1.122***	1.117***	0.820**	0.721*	0.725*
	(0.242)	(0.244)	(0.246)	(0.288)	(0.292)	(0.294)
Specification[a]	*ZINB*	*ZINB*	*ZIP*	*ZIP*	*ZIP*	*ZIP*
Zero-inflation (logit)						
Marriage over 35, female	3.119***	3.156***	3.138***	3.389***	3.441***	3.425***
	(0.668)	(0.663)	(0.675)	(0.723)	(0.717)	(0.726)
Constant	–3.312***	–3.323***	–3.340***	–3.420***	–3.436***	–3.448***
	(0.322)	(0.329)	(0.371)	(0.378)	(0.381)	(0.319)
A	2.34**	2.38**	4.36***	4.90***	5.12***	5.05***
Vuong	–969	–963	–959	–875	–872	–870
Likelihood ratio	423	423	423	423	423	423
N	2.34**	2.38**	4.36***	4.90***	5.12***	5.05***

Notes: Significance levels: $^{+}p \le 0.10$, $^{*}p \le 0.05$, $^{**}p \le 0.01$, $^{***}p \le 0.001$.
a Where ZINB refers to a zero-inflated negative binomial model and ZIP refers to a zero-inflated Poisson model.
b Village-level fixed effects included, but not reported.
c Decline regime fixed effect not reported.
Source: As for tab. 1.