A Demographic Picture of Preindustrial France

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In this essay, I study the basic demographic features of preindustrial France using INED *enquête* Louis Henry's data (Séguy, 2001). I try to describe the structure and dynamics of deaths, marriages, and childbirths, using both anonymous and nominative files. I do not engage in population reconstructions, for which this data was already thoroughly used (results summarized in Dupâquier's *Histoire de la population française* (1988), and whole bibliography in Renard, 1997). I rather look at individual behaviour and life events, their distribution across society and their evolution over time[1]. This helps me to sketch in conclusion the portrait of the typical *Ancien Régime* peasant family.

1 Deaths

The death file records 135457 rural deaths and 21990 urban deaths spanning from 1740 to 1829. I first clean the database, especially missing values for the year of birth, the year of death, and the age. As there is always at least two informations among three, this makes possible to infer the missing values from the equation *year of birth* + *age at death* = *year of death*, which is accurate to one year. The imprecision does not matter as there are few missing values (less than 1 % missing ages, and only a few missing birth and death years). I also check for inconsistent ages, defined by the fact that they do not respect the accounting identity *year of death - year of birth - age at death* $\in \{0, 1\}$. There are less than 0.3% such observations, that I remove from the sample since it is impossible to know where the error comes from.

In Figure 1, I use the cleaned sample to compute the annual number of deaths in France from 1740 to 1829 (knowing that the initial sample is drawn at 1/500). One does not see obvious trends. Let us stress that those apparent "stagnations" are not due to the sampling process, which does not balance between years: on the contrary, they suggest that over the long run of our timespan, population increase is compensated by mortality decline such that the number of deaths remain more or less constant.

Besides, plotting the ratio of urban to rural deaths shows a slight relative increase of rural deaths which is consistent with the dawn of rural flight (Figure 2). The urban deaths' relative peak in 1794, indicated by the vertical dashed line, is likely to be due to the bloody civil war in the Vendée and the climax of the Terror – I come back to that later. It corresponds itself to a peak in absolute number of deaths, visible in Figure 1: with 1,1 million of deaths, it is above the mean annual number of deaths over the timespan (a meaningful measure since the trend is constant), close to 0,9 million, by 230000 excess deaths. This order of magnitude is consistent with usual estimations of human losses due to the War of the Vendée (around 170000, Martin,

[1] As this essay already contains a lot of figures, I do not plot some results. I mark them with a reference to this footnote: [1]. Of course, they are available on request.

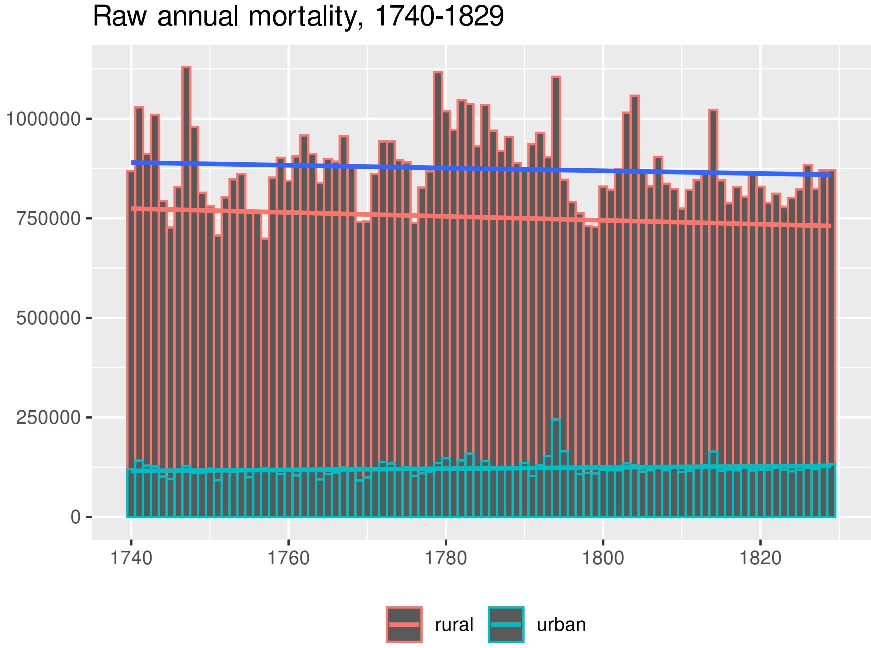

Figure 1: Annual number of deaths in France, computed from the sample, with rural, urban and total linear trends

2014), plus at least 40000 victims of the Terror (Martin, 2012) – of course, those losses are spread over more years than strictly 1794. Besides, the excess deaths in those years are a straightforward explanation for the trough around 1800 (people that would have died at this time if no civil war being already dead).

1.1 Distribution of age at death

1.1.1 Whole sample

Let us now look at the age at death. I first consider the sample over the whole timespan. In Figure 3, I plot the distribution discretized by year. The weight of infant mortality is striking: it represents almost one quarter of deaths. It has a great effect on mean age at death, that increases from 29 to 41 for people surviving after 1 year old. Given the fat-tailedness, mean age at death is not that informative: half of the deaths happen before 20, yet nearly a quarter after 60. Figure 3 reveals that ages multiple of 5 (and especially multiple of 10) are strongly over-represented at older ages, which cannot be a natural phenomenon. I check that this is not due to the presence of replacement ages (ages randomly attributed by Henry's team to some missing ages according to sample characteristics): they are indeed not numerous enough to account for the observed peaks at ages in 10 and in 5. I conclude that these replacement ages display the same peaks only because they are distributed according to the original data, and that the original ages mentioned on death certificates are indeed peaked in 10 and 5 simply because ages were not precisely known at the time, leading the priest to write down a rough estimation at 5 or 10 years precision. To correct for that initial bias that distorts the distribution, I average the number of deaths at age larger than 15 over 10 years spans centered about ages in 10, and I split ages in 5 between the

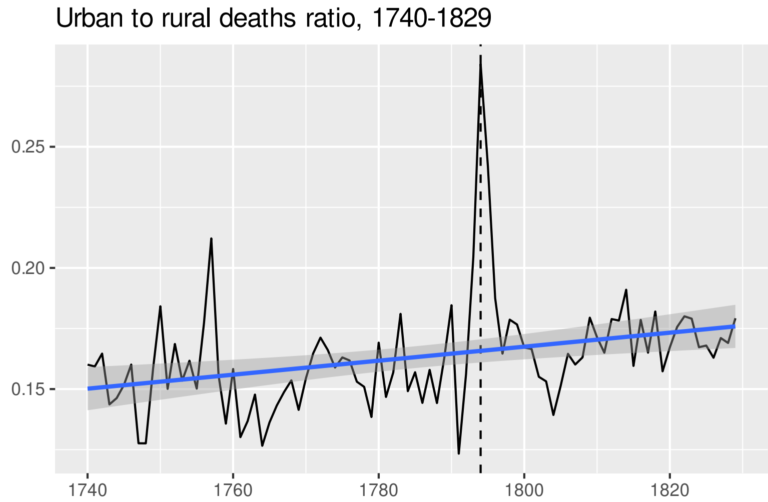

Figure 2: Annual ratio of urban to rural deaths in France, with linear trend (standard errors in shaded area). Vertical dashed line is 1794.

older and younger spans. The result in Figure 4 illustrates the asymmetric aspect of this bimodal distribution, with a number of deaths not varying much between 15 and 85 years of age, and the force of mortality reaching again infant levels only after ages 70.

1.1.2 1740 cohort

Previous exercise is useful to get a quick glance on the data, but it has the drawback of putting together individuals over a very long timespan – nearly one century of years of death, and nearly two centuries of years of birth, since the older year of birth in the database is 1641. Moreover, life expectancy at birth is preferably computed for a true cohort. Thus, I use the fact that the sample's size and timespan allow to characterize quite precisely the cohort born in 1740: that subsample contains 1917 individuals, and by definition records deaths from age 0 to 89. The raw data, presented in Figure 5, displays features close to the whole sample, including the peaks at ages in 10 and 5. Therefore, I apply an averaging procedure similar to the previous one; furthermore, I take into account the missing ages (older than 89) by taking the proportions of deaths at ages $[\![90, 94]\!]$ and $[\![95, 99]\!]$ that occurred between 1820 and 1829 (regardless of the cohort). The result is presented in Figure 6, with the corresponding force of mortality. I also compute conditional life expectancies by age, in Figure 7. Individuals born in 1740 have a life expectancy at birth equal to 31 years: 30 years for men and 32 years for women. Conditional full life expectancy increases then quite steeply with age: an individual aged 1 can expect to live 39 years, 49 years for an individual aged 5, and 59 years for an individual aged 25.

Let us note that this exercise is limited by the relative imprecision of recorded years of birth. As most death certificates indicated the age rather than the year of birth, and as this age itself was sometimes loosely estimated (cf. previous section), a significant (yet unknown) fraction of years of births is likely to be false, thus also the data's 1740 cohort. However, it is reasonable to suppose that individuals falsely recorded as born in 1740 were anyway born in close years and "compensate" for people truly born in 1740 and absent from the recorded cohort, such that our "1740" cohort still provides relevant information on people born at that time.

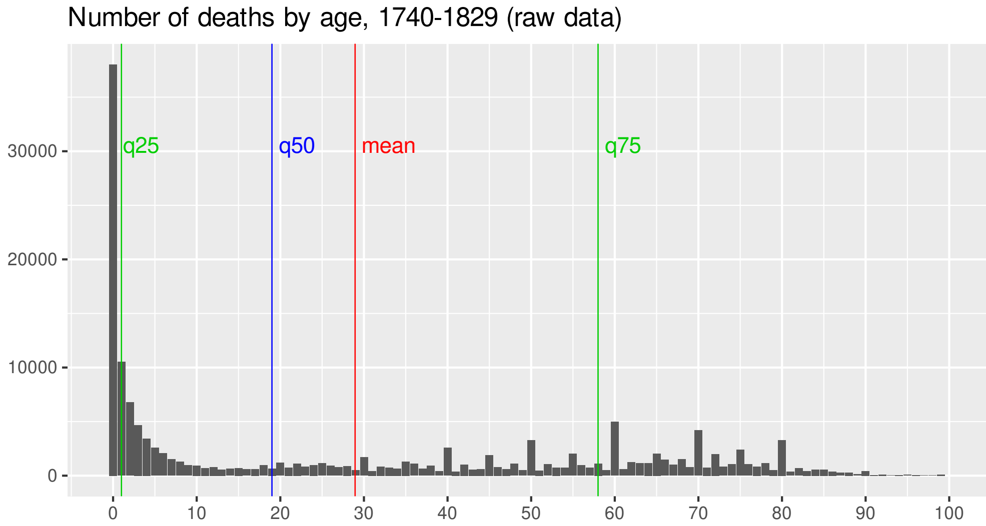

Figure 3: Number of deaths in the sample by age, with quartiles and mean

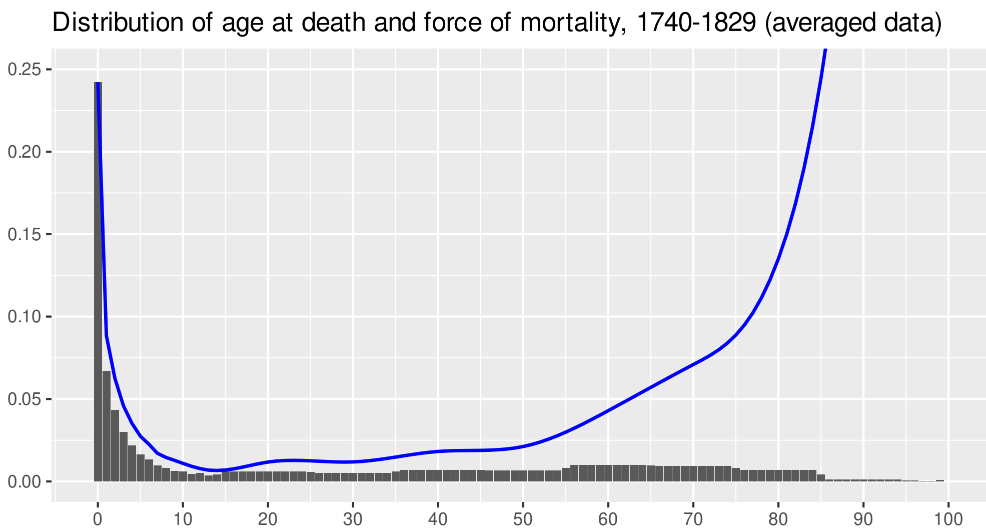

Figure 4: Corrected distribution of age at death, with force of mortality smoothed by spline (blue curve)

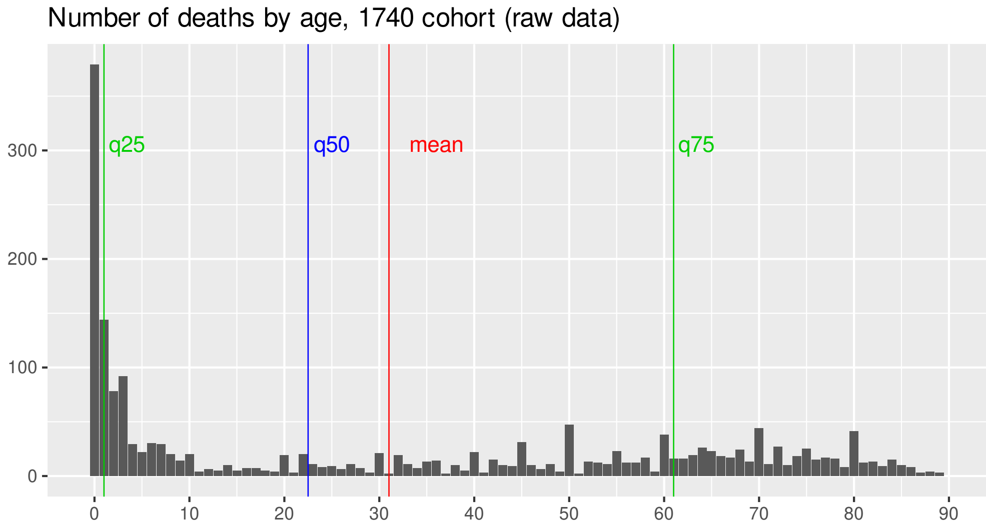

Figure 5: Number of deaths of individuals born in 1740 by age, with quartiles and mean

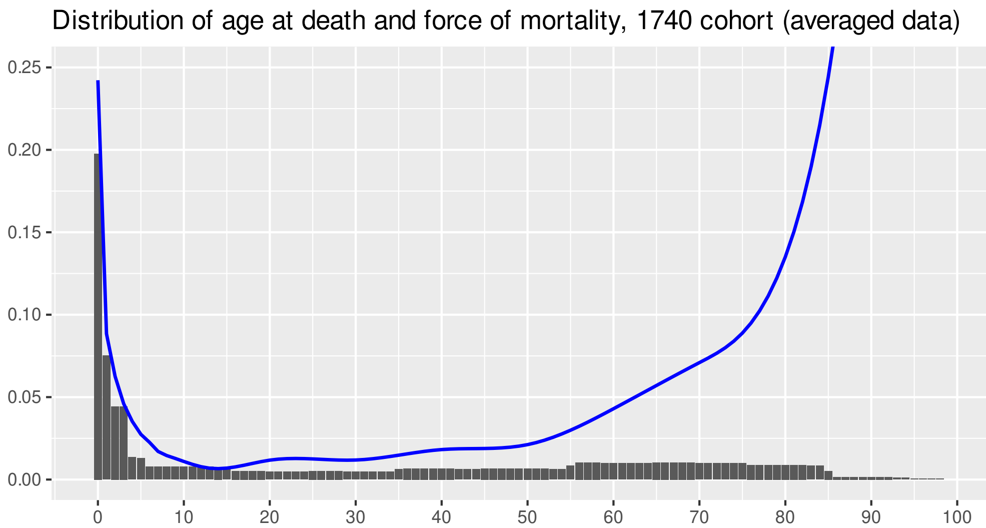

Figure 6: Corrected distribution of age at deaths for individuals born in 1740; blue curve is the force of mortality smoothed by spline.

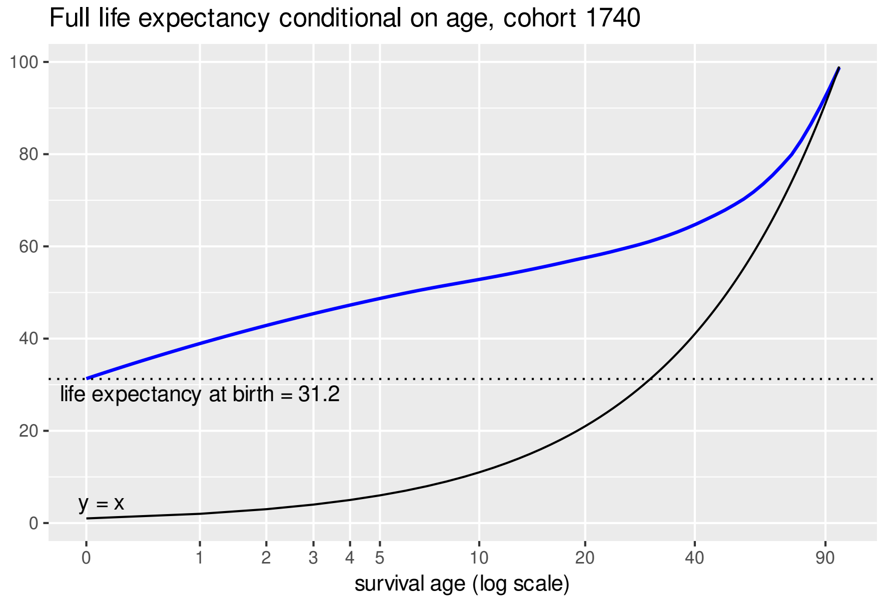

Figure 7: Blue curve is the mean length of life conditional on surviving at the considered age, for individuals born in 1740, computed on corrected data and smoothed by local regression. Black curve is the set of zero remaining life expectancy locii (full life expectancy equal to age).

1.2 Age at death density estimations

In this section, I consider again the sample as a big cross-section to estimate densities of age at death. This approach is certainly limited by the large timespan of observations; at the same time, this allows to look at variables with many missing values and few people involved in some categories, like profession. Therefore, I consider splitting the sample in two time periods to be the good trade-off: I put the break in 1789, between old and new regime. I first estimate kernel densities by splitting again the samples in four, according to sex and rural/urban (Figure 8, with means in vertical lines). One can see that infant mortality is higher among men than among women, and higher in the countryside than in cities, whereas women and urban die older.

1.2.1 The excess mortality among urban young men

There is a noticeable excess mortality of urban men around 25, especially in the 1789-1829 period. Henry, 1988 observes a similar excess mortality of young men with respect to young women in various countries in the 18th and 19th centuries, and suggests this might be due to service in the military – although this pattern is also present in countries with small military – or to work accidents – although one should then expect to see also excess mortality at younger ages at which men were already working (pp. 95-96). The first reasoning, applied to my age at death density estimations, can be true only if soldiers deaths are recorded in the cities, for example in garrison towns or because the percentage of men enlisting in higher in the cities. The second one leads to ask like Henry why the peak of excess mortality is not observed before 25: one could however imagine that the risk of work accidents is cumulative, such that workers already exposed to work accidents are more likely to die, and thus die more some years after having begun to work. It is also worth remaking that the 1789-1829 period, in which the excess mortality of urban young men is the strongest, is marked by the deadly revolutionary and Napoleonic wars. Removing the peaceful Restoration years (1816-1829), I find a peak even higher[1], which goes in the direction of the war hypothesis. Recalling the aforementioned peak of urban relative to rural deaths around 1794 observed in Figure 2, a year which is itself a peak of absolute deaths (cf. Figure 1) due to the War in the Vendée, the war hypothesis would imply an even higher excess mortality of young urban men in 1794: this is indeed what I find[1], one more argument in favor of it.

To further investigate this, I estimate the density of age at death according to broadly defined social groups. To that purpose, I use the last digit of the profession variable in the database, which divide professions into ten categories according to their rank in the society. After some trial and error, I put together nobles, clerics and teachers, *robins* (recently ennobled bureaucracy), bourgeois and students, merchants, professionals, industrialists and officers, masters, wealthy farmers and petty officers in a big upper group ("nobility, clergy and bourgeoisie"). This group could be viewed as quite heterogenous, although it may actually not be much more heterogenous than "the nobility" or "the clergy" alone. Above all, the estimated densities of included subgroups do not differ significantly from each other[1], or are estimated too imprecisely if let alone: the numerical weight of top categories in the society being tiny, it is even more the case in the sample – only 104 deaths are recorded as nobles. Then, I consider a group of independent peasants and qualified workers, like craftsmen, and that also includes soldiers, a group of poorer workers (mainly day workers, but also apprentices), and finally domestic servants[2]. The parent's profession is sometimes recorded for children, but to avoid biases at younger ages I begin at age 5, and I look only at men. The results in Figure 9 are consistent with the hierarchy of social groups, the "upper class" living longer than the other. However, the rank between qualified and unqualified workers is inverted, due to the excess mortality of young men of the former group. The "qualified" category remains too heterogenous, so I use the rural/urban criterion to differentiate between urban qualified workers/soldiers and independent peasants (Figure 10): I see that the excess mortality of young men is due to the former group, and higher at the less peaceful period, which once again points toward soldiers. Because of the predominance of missing values in the profession variable, I cannot rigorously disentangle craftsmen and soldiers[3], but I find that the 894 deaths precisely recorded as "soldiers" are concentrated around 20-25, as expected, and that this is not the case for other numerous urban qualified workers professions[1]. Although soldiers were thus clearly driving the excess mortality of urban young men, servants also display the same pattern with surprisingly high magnitude (Figure 9). I have no sure explanation, except that servants may change profession at older ages.

1.3 Evolution of age at death

Now, I look at the long run evolution of age at death, computed by year of death (which means putting together all deaths occurred in a certain year). Main results are presented in Figure 11. I look at the trends of various indicators (life expectancy at birth, life expectancy at age 5 and median age at death), separately for men/women and rural/urban. The general trend is clearly an increase, with a gain around 5 years of life over the timespan. However, this increase is not linear and homogenous. In particular, the 1740-1780 period is characterized by a stagnation of life expectancy and a decline of median age at death, both stronger among men than among women and in the countryside than in the cities. Around 1775, median age at death collapses to ca. 10 years old in the countryside! Nevertheless, the life expectancy is steadily rising at the same time. This clearly suggests a phase of increasing infant and/or child mortality in those years. I check

[2]I let aside beggars, disabled and retired.

[3]I don't know if the proportions of recorded professions match the reality. From that perspective, only Figure 8 is fully reliable.

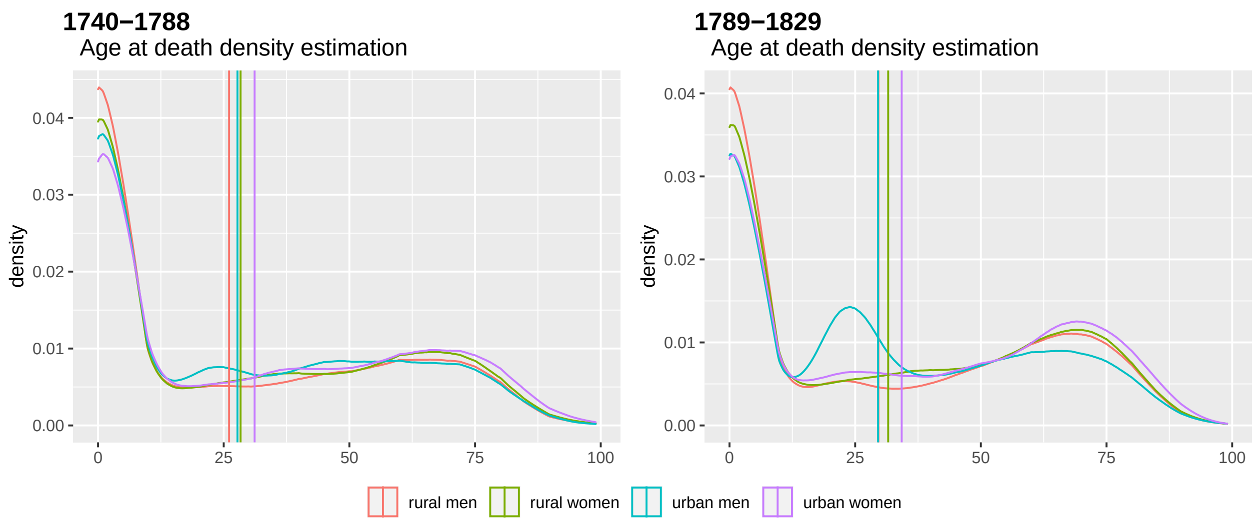

Figure 8: Kernel density estimations of age at death (triangular kernel, bandwidth = 4), with sample means in vertical lines (life expectancy at birth) The minimal sample size is 4847 (urban women died between 1789 and 1829).

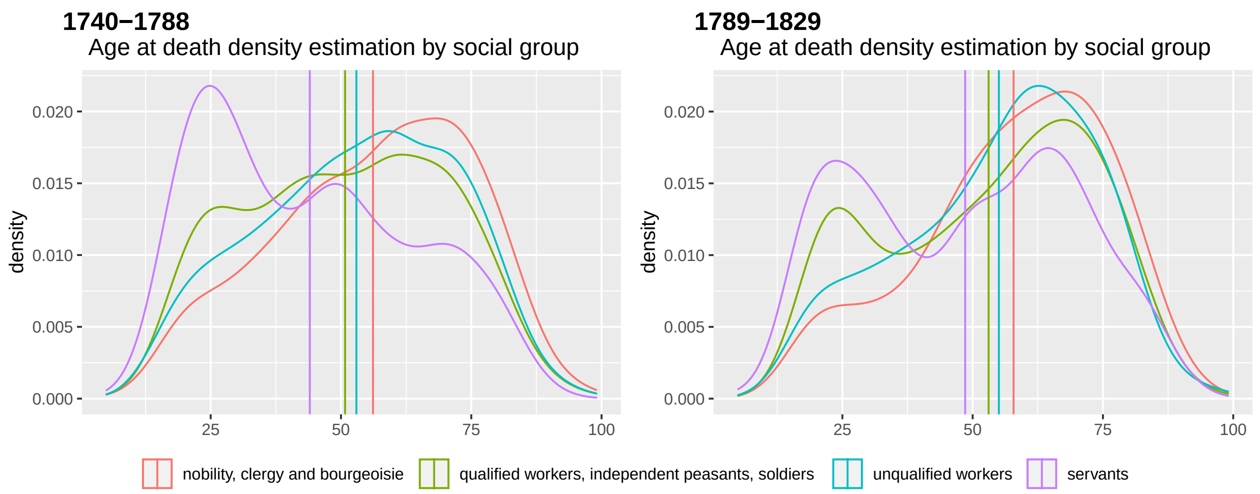

Figure 9: Kernel density estimations of age at death for men at age ≥ 5 (gaussian kernel, bandwidth = 5) , with sample means in vertical lines (full life expectancy at age 5). The minimal sample size is 335 (servants died between 1789 and 1829).

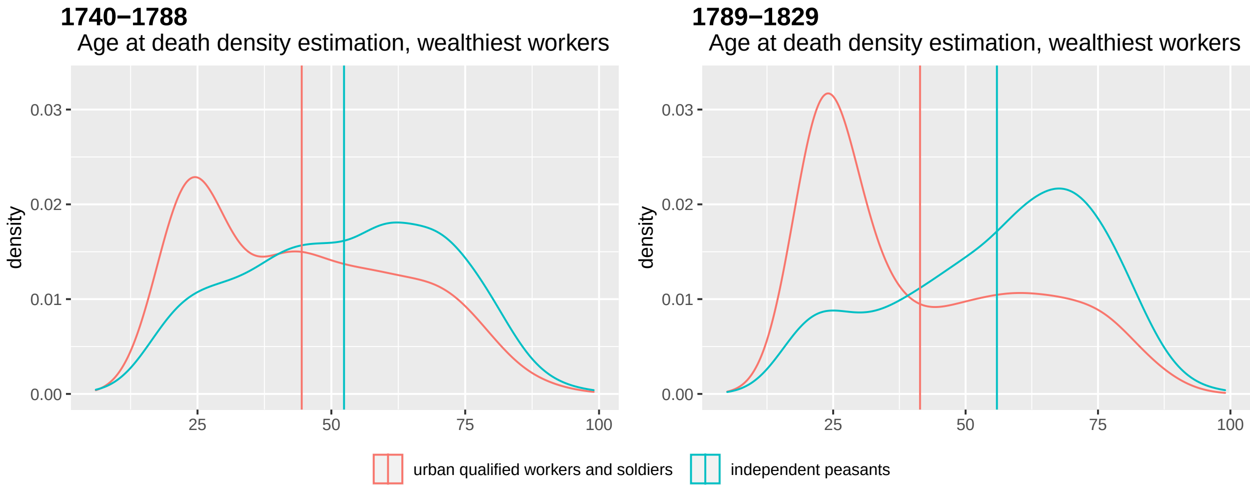

Figure 10: Kernel density estimations of age at death for men at age ≥ 5 (Gaussian kernel, bandwidth $= 5$), with sample means in vertical lines (full life expectancy at age 5). The minimal sample size is 640 (urban qualified workers and soldiers died between 1740 and 1788).

that in Figure 12, by plotting the evolution of the fraction of deaths occurring at young ages (age 0 and ages 1 to 10): although the graph for the countryside suggests a general decline in mortality at young ages, this decline happens after 1780, and the proportion of infant deaths (at age 0) is indeed increasing until the 1770s. One also recognizes the difference between countryside and cities: infant deaths are already a small fraction in cities and more or less stagnate, whereas child deaths strongly decrease. These results seem to indicate that the countryside was facing a strong problem of infant mortality around the middle of the 18th century that was already "solved" in cities, in which women could probably enjoy better delivery conditions; health conditions of children were also improving faster in cities. All of this is consistent with the rural misery observed by contemporary observers like Arthur Young during his 1787-1789 travels (Young, 2012, 1792).

2 Marriages

The (anonymous) marriages file records 44383 marriages contracted between 1740 and 1829. I clean its falsely missing values and inconsistent ages and years of marriage in the same way as for the deaths. Some observations seem dubious due to extreme ages at marriage (like a 88 years old women marrying with a 33 years old man in 1745), but are nevertheless not impossible. Seemingly illegal ages at marriage (under the legal age) are also problematic, yet remain rare: there are a few mainly during the Empire, as the *Code civil* of 1804 set nubility at 15 for women and at 18 for men, an increase as compared to the revolutionary law of 1792 (resp. 13 and 15). Without further knowledge of law enforcement on that issue at the time, I keep them.

Figure 13 shows the evolution of the number of marriages, that I split between cities and countryside. The long term trend is increasing, which is consistent with population increase, yet this seems to concern only the countryside. Urban marriages are more or less constant on the long run, which means a decreasing ratio of urban to rural marriages. This goes in contradiction with what we could expect from the rise of cities and the beginnings of rural flight. The answer

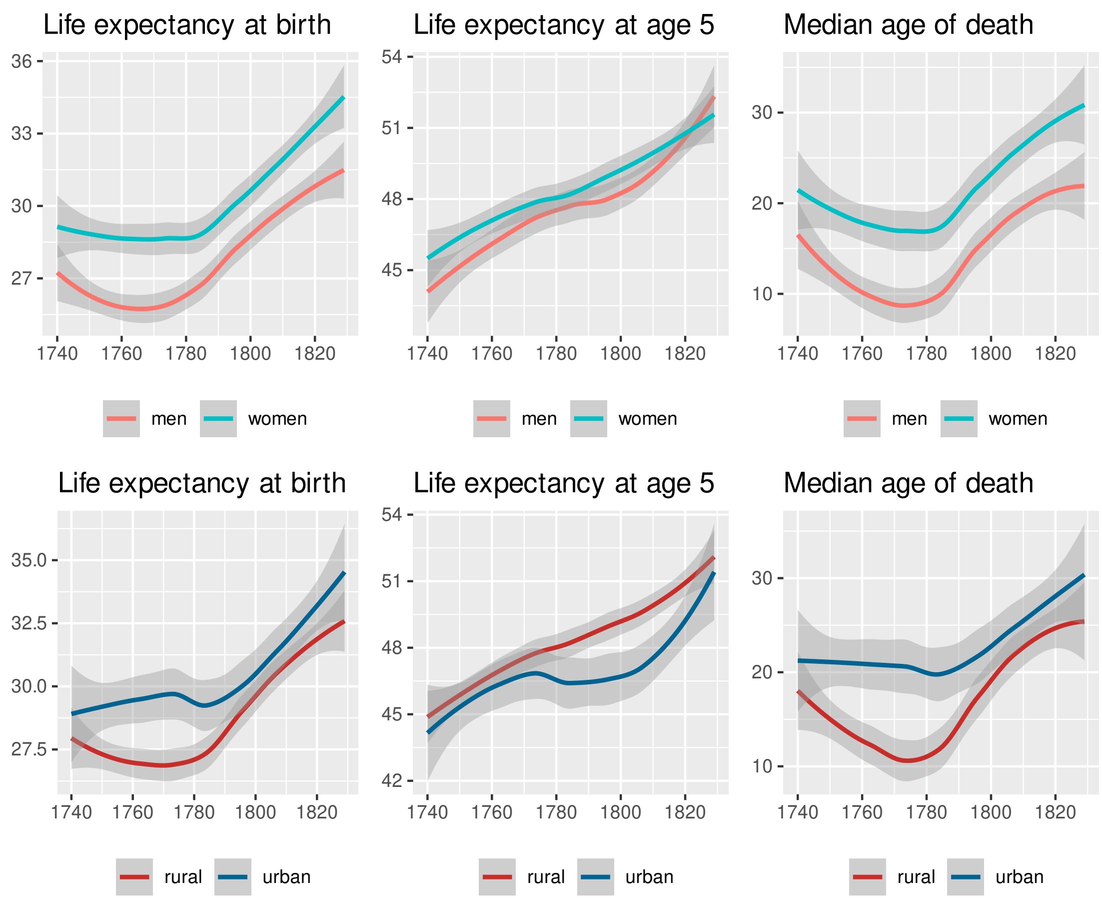

Figure 11: Evolution of life expectancy at birth, full life expectancy at age 5 and median age at death, all computed by year of death and smoothed by local regression (standard errors in shaded area)

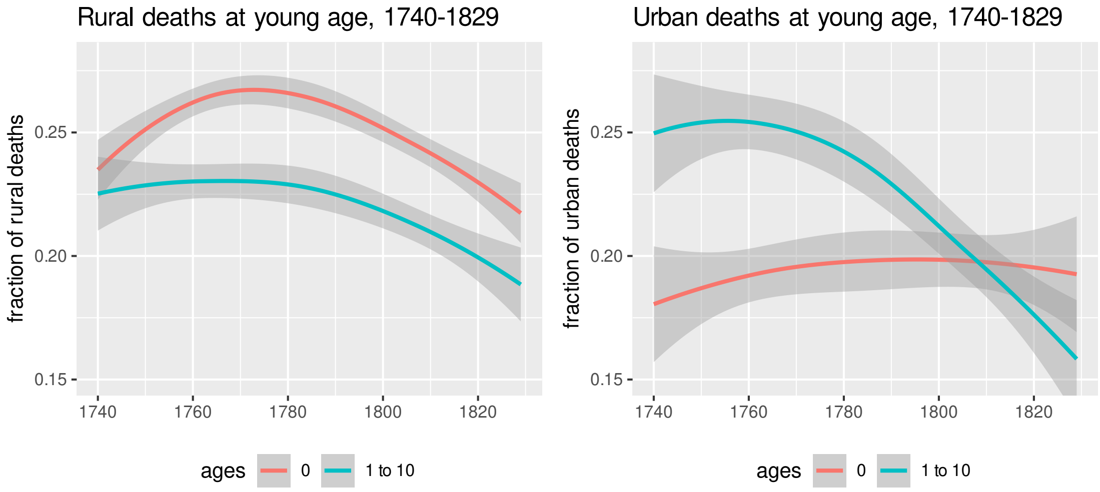

Figure 12: Proportion of deaths at young ages among all deaths, by year of death, smoothed by local regression (standard errors in shaded area)

could be that the new urban population marries less because it is less stable, or that eg. young men go back to their home village to marry. Some extreme years appear like 1813, in which marriages nearly double as compared to close years. Armengaud (1970) already observed that peak in the *Service de la Statistique générale de la France* census data, and suggested it was due to military events, whereas troughs like 1806 happen in time of economic crisis. In a later study on 1813 marriages in Toulouse, he concurs with the idea brought forward by Adolphe Landry that these were anticipated marriages to avoid conscription just after the disastrous Russian campaign, in which the *Grande Armée* more or less collapsed, leading Napoléon to raise almost one million new recruits as soon as he got back (Armengaud, 1973). The same conscription avoidance strategy may explain the peaks in 1793 and 1794, if one thinks to the famous *levée en masse* of 0.6 millions recruits in 1793 to fight external and inner enemies of the Revolution.

Looking at the general trends of marriages, I also consider two other variables of interest with few missing values, the presence of signatures and the characterization as first marriage or not. The presence of a true signature (other than a cross or a circle) gives an interesting picture of the rise of literacy, that I plot in Figure 14: in one century, the proportion of marriages with at least one signature seems to have increased from one third to one half. Is worth noting that when there is only one signature, it is almost always the husband's one. Although this might indeed indicate that men were more educated than women at the time, I do not exclude the possibility that in some times only the husband was asked to sign, especially if the woman had not reached matrimonial majority (25 years old for women during the old regime, 21 after 1792). In all cases, this gives a striking example of what some have called "masculine domination".

I then look at the proportion of marriage certificates for which the groom or the bride is indicated as widowed or divorced, over all certificates on which this information is present for both spouses. Missing value might bias the result if the information is less reported for first marriages – their number is anyway small enough (around 5%) to consider the obtained proportions as accurate order of magnitudes. Over the period, around one fifth of marriages are remarriages, which is a significant fraction. Moreover, although marriages of a previously married man with a single woman dominate, the inverse case represents a non negligible proportion, and at the

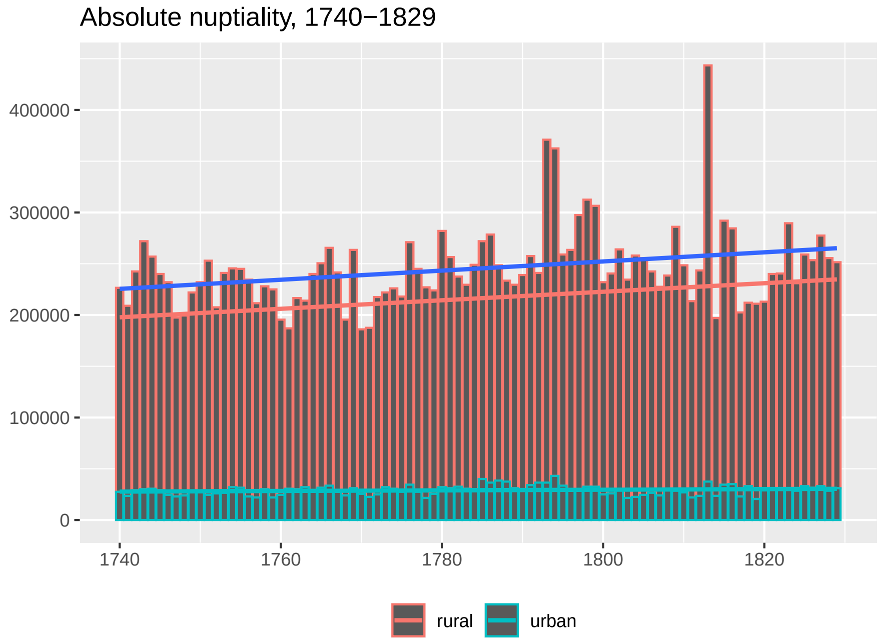

Figure 13: Annual number of marriages in France, computed from the sample, with rural, urban and total linear trends

beginning of the period roughly half of remarriages include a non single woman. The most striking fact is the general decline of remarriage, although one may have expected from the legalization of divorce in 1792 to foster remarriages. Interestingly, the trends for all remarriages versus "man only" remarriages (red lines in Figure 15) indicate that general decline of remarriage is mainly due to the decline of remarried women: this could be due to a strengthening of social norms condemning the remarriage of widows in the bourgeois era, or to a decrease of their material needs to remarry for economic reasons. More generally, the decline over all categories could also simply be linked to the aforementioned progress of life expectancy that may have decreased widowhood on the long run.

2.1 Age at marriage

I now look at the distribution of age at marriage. There is a clear break in age reporting on marriage certificates: before 1792, only one quarter of certificates report numerical ages, but more than 95% after 1792[1]. This corresponds to the law of September 20 establishing civil marriage and compelling precise registration. Besides, during the old regime, a significant and growing fraction of certificates mention majority or minority instead of age (a third of all certificates just before 1792)[1]. Looking at the proportions of grooms and brides recorded as "minor" over all those whose majority/minority is recorded, I find it much lower than the proportion of minors as computed on the sample of grooms and brides whose numerical age is reported before 1792, and using the then legal definitions of matrimonial majority. It might me as much a bias in age versus majority report, as the result of varying understandings and definitions of majority across

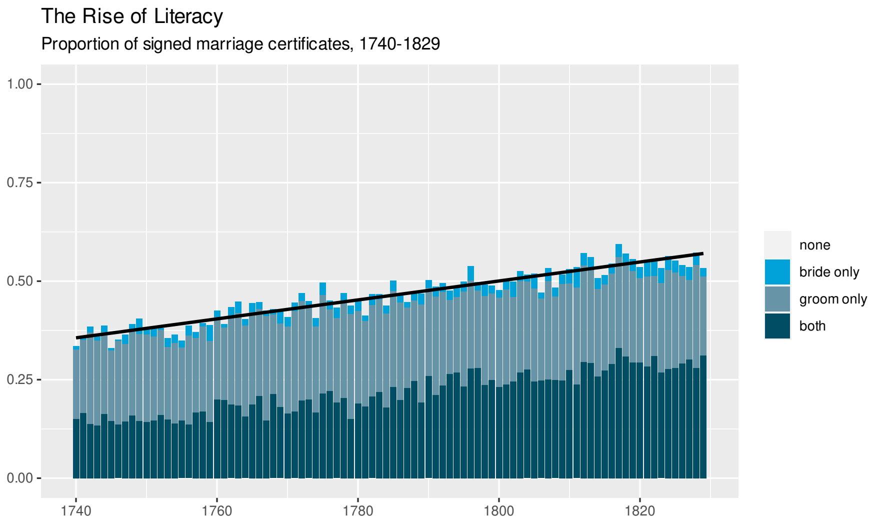

Figure 14: Proportion of marriage certificates signed by one or both spouses, with linear trend

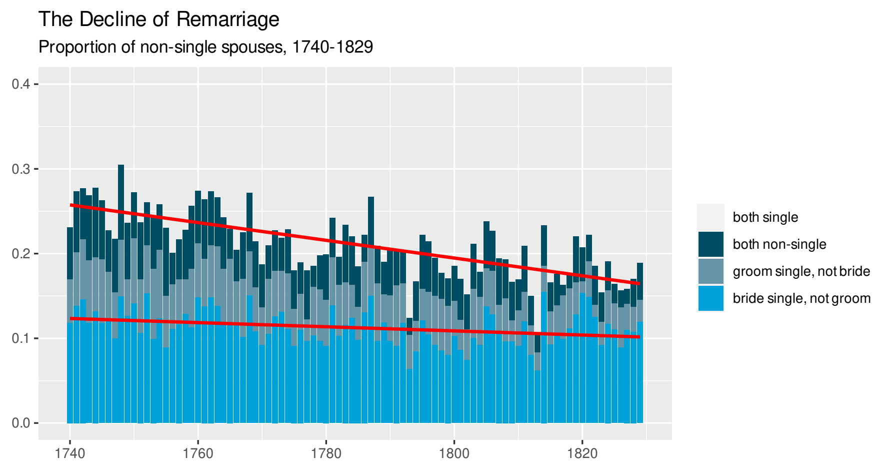

Figure 15: Proportion of marriage certificates in which one of the spouses has already been married among all marriage certificates on which this information is present for both spouses, with linear trends for all remarriages and "man only" remarriages

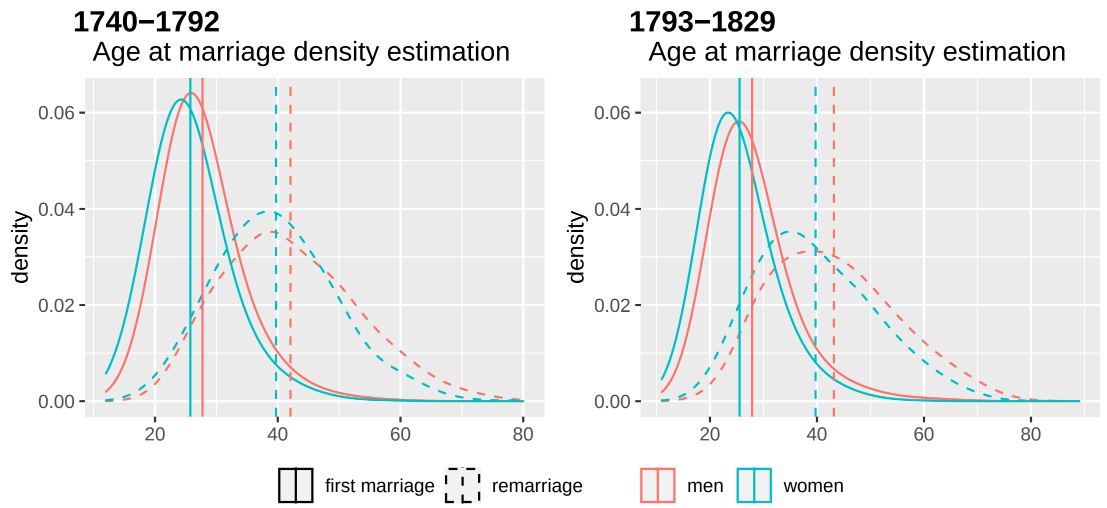

Figure 16: Kernel density estimations of age at marriage (Gaussian kernel, bandwidth = 4), with sample means in vertical lines. The minimal sample size is 644 (women remarrying before 1792).

parishes before 1792[4]. The likeliness of the latter leads me to look only at numerically reported ages, although this lets the possibility of geographic bias in age versus majority report.

2.1.1 Density of age at marriage

1792 seems the right date to split the sample between ancient and new mariage laws (cf. supra). I estimate the density of age at marriage on those two subsamples, differentiating also by sex and by marriage rank. Results presented in Figure 16 show that men marry later than women, consistently with legal differences in majority. Traditional views according to which women are nubile before men probably mix with dowry and property questions. To establish a new home, male peasants had to afford a sufficient amount of land for a family, which delayed marriage probably well after their first relationships. This also explains the quite advanced age at first marriage, around 27-28 years old for men. For women, who marry first around 25-26 years old on average, delaying marriage was an efficient birth control method. More generally, marriages at older ages appear common, with around half of remarriages taking place after 40 years old.

The difference between both periods is anyway not striking. Would it mean that changes in marriage law in 1792 and 1804 (civil code) had no effect? To better account for time changes, I turn to annual measures.

2.1.2 Evolution of age at marriage

In Figure 17, I plot the evolution of age at first marriage in terms of mean, median and mode, for men and women. All measures point toward a "rise and fall" of age at marriage in the 18th and 19 centuries. The trend reversal happens around the Revolution, or in preceding years (especially for women). This suggests that the 1792 and 1804 laws might have been consequences rather than causes of social change regarding age at marriage. If one refers to the "access to land" story,

[4]The royal *Ordonnance de Blois* of 1579 set the matrimonial majority at 25 for women and 30 for men in the French kingdom, whereas canon law used to set the matrimonial age at nubility, ie. resp. at age 12 and 14. Majority could also refer to civil majority, which was varying across local customs and laws.

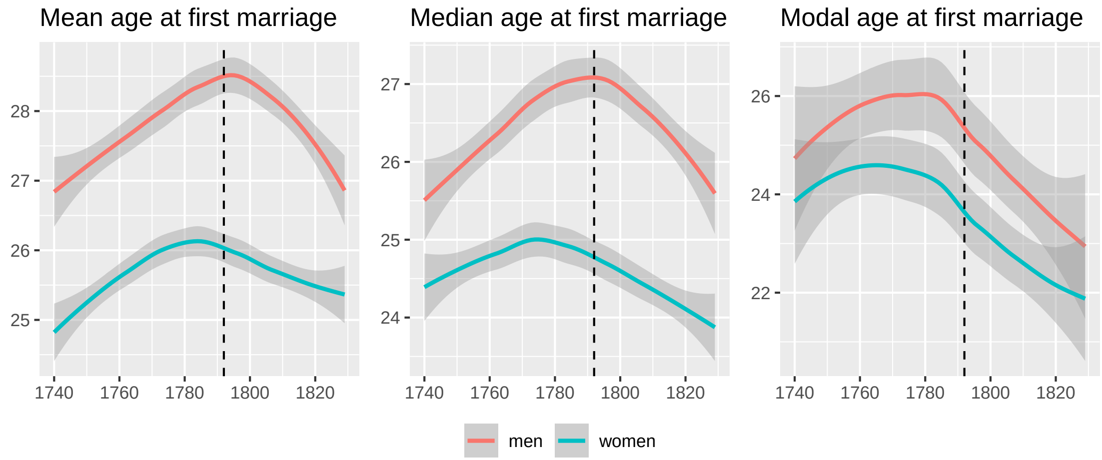

Figure 17: Evolution of mean, median and modal age at first marriage, all computed by year of marriage and smoothed by local regression (standard errors in shaded area). Vertical dashed line is 1792.

the first phase may be due to increased difficulties to access land due to demographic growth (Goldstone, 2010), whereas this effect might have been offset by the rise of wage labor with growing proto-industrialization in the second phase, that relaxed the land constraint for rural masses.

3 Legitimate childbirths

The nominative files record 34812 reconstituted families made of couples married between 1670 and 1819, and their 106300 children. There are 54248 boys and 51256 girls, hence a sex ratio of 1.06, a "natural" value suggesting that selective abortions or infanticides before birth registration were not significantly practiced. I also clean some inconsistent observations in the database (especially wrongly gathered families). The mean number of children per family is 3 in the parents file (includes also childless marriages), and 4.4 in the children file (includes only marriages with children). Both mean and median time periods between the births of the first and last children are 8 years. Both mean and median inter-birth intervals are 1.6 year. This does not reveal a significant effort to space births. Median interval between the civil year of marriage and the civil year of first birth is 1 and mean 1.5, which also means that most newly weds did not wait a lot to engage in reproductive behavior, although some probably voluntarily did (10% waited three years or more).

To properly study reproductive behaviour, I remove womens' second marriages that would downward-bias the mean number of childrens, and that I identify by observations for which a "previous husband" name is present. The proportion of marriages removed so, around 11%, is consistent with the results about remarriages based on anonymous data.

3.1 Distribution of the number of children

I first plot the distribution of the number of children by married couple, computed over all the sample. Since the number of born children is a quite incomplete measure of reproductive

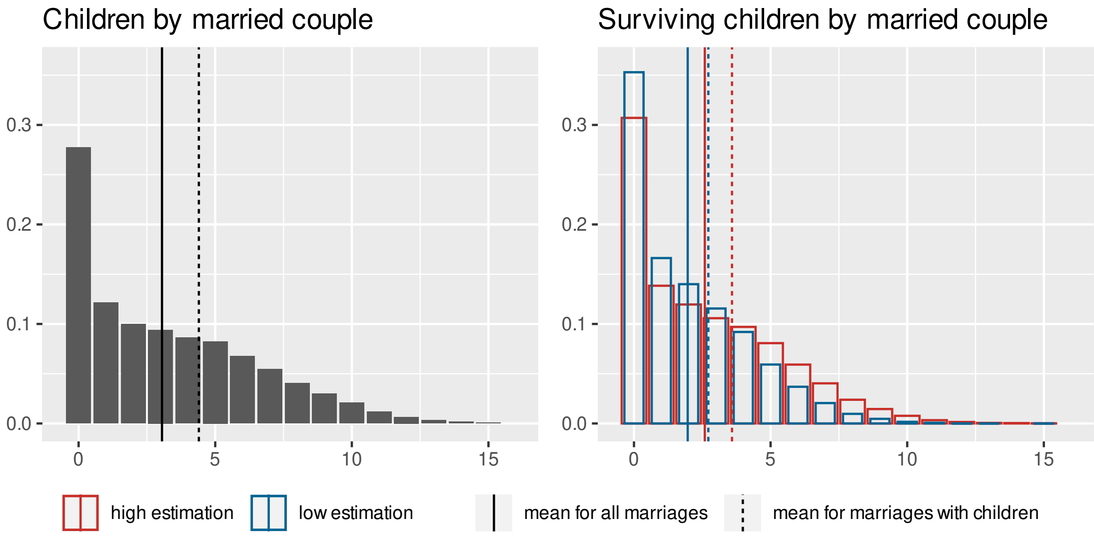

Figure 18: Distribution of the number of children by married couple (women's remarriages excluded). Surviving children are children that survive more than one full civil year.

behavior at a time of considerable infant mortality, I also compute the number of surviving children, defined by surviving more than one full civil year (eg. children that do not die in 1700 nor 1701 if they are born in 1700). This is not straightforward since 62% of childrens' years of death are missing, and mean number of surviving children based on the remaining sample is implausibly low (less than one surviving children by married couple!). Year of death reporting seem thus to be biased, with year of death that would be more reported when closer to year of birth, which makes sense. Therefore, I make two hypotheses: first, that all unreported year of deaths are more than one year after year of birth; second, that this is the case for only 69% of them (according to the anonymous file's distribution of deaths), that I draw randomly. This gives upper and lower bounds, assuming resp. complete bias versus no bias. Results are presented in Figure 18. Between 5 and 10% married couples experiencing childbirths had no surviving child at all[1], such that around one third of married couples remained childless when infant mortality is taken into account (and this result excludes women's remarriages, which had necessarily less or even no children). On the other side, more than the half of couples experiencing childbirth had at least four, and almost one third had at least six, but the average number of surviving children was lower: around 3 for couples experiencing childbirth, and between 1,8 and 2,4 for all married couples with non-remarried woman. This last bracket is the one that should be compared with modern figures, yet keeping in mind that this does not take into account births out of wedlock.

These are once again very synthetic indicators since observations are gathered across a large timespan. I thus turn to the evolution of the number of children over the long run.

3.2 Evolution of the number of children

In Figure 19, I compute the mean number of children and surviving children by year of marriage, using the same definitions as before. I find the same long term pattern of rise and fall as for age at marriage, even though the reversal happens sooner, with childbirths declining from the 1760s and surviving children even from ca. 1750. All other things being equal, the decline of

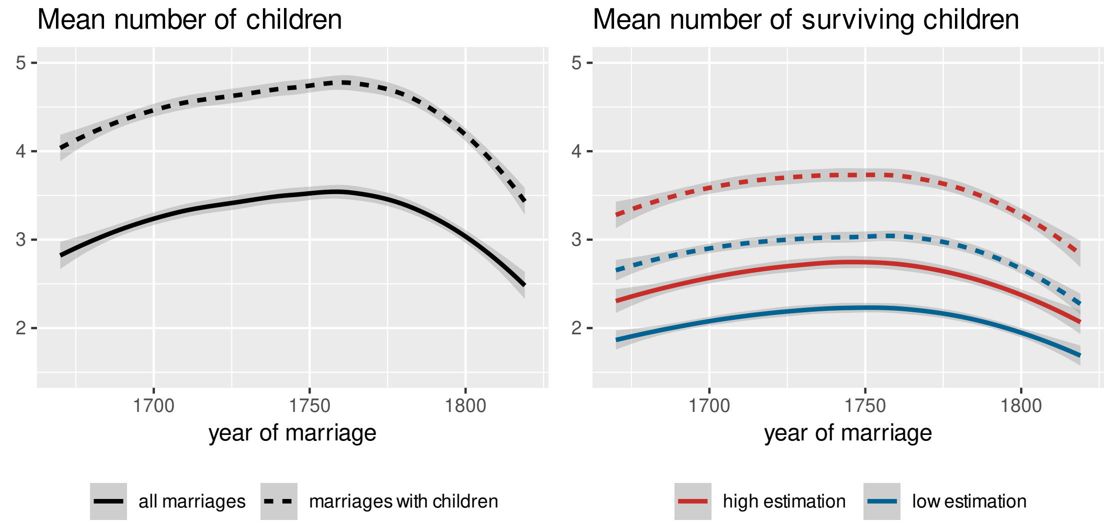

Figure 19: Evolution of the mean number of children by year of marriage for couples married between 1640 and 1819, women's remarriages excluded. Smoothing by local regression (standard errors in shaded area). Surviving children are children that survive more than one full civil year.

age at first marriage recorded in the anonymous data should foster an increase in the number of children, but this seems not to be the case. Let us note that marrying younger is theoretically not contradictory with delaying births if people use birth control methods, in which case this might explain the decline in fertility at the end of the period. The rise of fertility in the first half of the period is not easier to explain: better health conditions might have lowered the proportions of miscarriages, but various social factors come probably into play. In any case, it is worth remarking that the mean number of surviving children varies less than the overall number of children, infant mortality flattening the curve of reproductive behavior.

Concluding remarks

In this essay, I attempted to get a broad picture of preindustrial France's demographic features out of the *enquête Henry*. The idealtypic *Ancien Régime* rural family was founded by individuals between 25 and 30, that would probably die around 60 (cf. Figure 7), although life expectancy was much lower due to huge infant mortality. If they had children – the contrary was frequent –, they would probably have 4 or 5 of them (every year and a half), among which 1 or 2 would die infant. In addition, they had good chance to lose another one before he leaves the family home.

Of course, preindustrial demographics were not purely *histoire immobile*, as Le Roy Ladurie said about French peasants, and I tried to identify some of those long lasting changes. I did not engage into regional variations: this would be a direction of interest for further research. I also considered each file of the *enquête* Henry mostly individually, yet there is still a lot to do by crossing them.

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