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Life Under Pressure: Questions for a Comparative History of Economy and Demography in France and England, 1670-1870

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ABSTRACT

The recent publication of Wrigley and Schofield's Population History of England, 1541-1871, is taken as an invitation to a comparative history, both for its empirical complementarity to the French studies by the Institut National d'Etudes Demographiques, and for its own attempts to draw such comparisons. The assertion of a comparative failure of the preventive check in France prior to 1790 is used by Wrigley and Schofield to interpret the French marital fertility decline after that date as a compensation for this failure. Both sides of this proposition are challenged on empirical grounds, using published data on vital rates 1740-1869 to estimate short-run models of the sort advanced by Lee in the Wrigley-Schofield volume, for both countries in three sub-periods. An extension of the analysis back to 1670 for France suggests that the positive check died of its own accord in the early 18th C., without the assistance of a more robust preventive check. The adoption of family limitation after 1790 appears to have reduced the extent to which marital fertility was responsive to price fluctuations in France. Additionally, the value of less aggregative analyses using family reconstitutions is emphasized for improving our understanding of the functioning of the Malthusian regime and its eventual demise.

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Chapter 1

1.1 INTRODUCTION

It should not be necessary, in the context of a short exploratory paper such as this, to enumerate the advantages of the comparative method. Nor should the choice of France and England occasion much surprise. The different character of economic and demographic development in the two countries has spawned a long tradition of comparative analysis; a tradition made all the more salient by the enormous implications for the world balance of power in the 18th and 19th centuries of the evolution of Europe's greatest powers. American authors have tended to focus on the two cases as 'models' of development, without much concern for the consequences of these developments on their own history. Perhaps the following rigid counterfactual will elicit more interest: if France and England were to have 'swapped' rates of population growth and net migration in the century following the Seven Year's War, that century's English settlers of North America would have been completely absent-- replaced by nearly five times as many Frenchmen. It would be New England, not Quebec, that would be fighting for its cultural preservation.

Americans have another long tradition: exploiting Anglo-Gallic competition to their own advantage. From these shores it is possible to view the Cambridge Group's publication of The Population History of England, 1541-1871, by E.A. Wrigley and R.S. Schofield, as a reassertion of English technical supremacy in quantitative historical study, following the early French domination of the field of historical demography established by Louis Henry and the Institut National d'Etudes Demographiques. The English achievement is more than this, however. The authors have also taken important steps toward furthering the integration of demographic history with social and economic history. This paper will question some of the conclusions drawn from their attempt, but it is motivated by a shared belief that the steps are on the proper path.

It must also be stressed that the English 'victory' is far from complete. Time series of vital rates cannot hope to demonstrate unambiguously the workings of social mechanisms nor the behavioral responses of individuals in society. For this, family reconstitution is essential and it is here that the French retain a substantial advantage. Thanks to the generosity of Louis Henry and INED, substantial portions of their national sample of family reconstitutions are available to me. The narrowly demographic focus of their research, while maintaining the highest standards of observation untainted by preconceived ideas, does limit the usefulness of their results in studying the interactions of economy, demography, and society. Nonetheless, this paper will demonstrate some of the ways in which they can be used to illuminate the dark corners of the 'black-box' relationships that make up the Malthusian regime.

Wrigley-Schofield's pessimistic view that family reconstitution "is unlikely ever to cover more than a tiny proportion of parishes" and that the INED sample in particular covers only 40 parishes out of a total of 40,000 (WS, pg. 193) seems inappropriate from the authors of so sophisticated a statistical exercise. One of the first surprising results any student of sampling theory learns is that the accuracy of a random sample depends on its absolute size, not its size in proportion to the population. Presidential candidates and television programs are made and unmade in the U.S. on the basis of sampling proportions far below one-tenth of one percent. As for its cost, there is no question that a repetition of the French national sample would be prohibitively expensive. It is also unnecessary--future reconstitutions should be directed toward the construction of carefully 'matched' samples, comparing villages to examine differences across economic systems (e.g., Levine, 1977) or countries. From the standpoint of comparative demographic history the question of who's ahead is irrelevant so long as the competition continues to produce work of high quality from which we all may learn.

This paper will begin with a formulation of Wrigley and Schofield's version of the comparative history of France and England in terms of the Malthusian model. A number of alternative explanations for a more pronounced positive check in one country than another will be advanced. The available evidence on long-run changes in mortality, nuptiality, and marital fertility will then be examined. Section 6 begins the analysis of short-run fluctuations in vital rates, 1740-1869, leading ultimately to the estimation of changes in the parameters of the short-run Malthusian mechanism over this period of rapid economic and social change. Because the empirical claims of Wrigley and Schofield may be more relevant to years before 1740, an analysis of France 1670-1739 is undertaken in Section 8, using wholly different data sources. The different nature of the data require different procedures for the construction of variables, and this must be accounted for in interpreting the results.

The concluding sections summarize these aggregate results, suggest the value of more micro-level studies of the behavioral mechanisms underlying them, and argue that the fertility transition must be studied as a phenomenon outside the functioning of the Malthusian economic-demographic system and not, as Wrigley and Schofield seem to imply for France, as a strengthening of that system.

1.2 WAS MALTHUS WRONG OR ENGLAND DIFFERENT?

1.2.1 France and England through English eyes

The essence of the Wrigley-Schofield view of pre-industrial England is neatly summarized in the statement "England patently did not conform to the high-pressure paradigm" (WS, p. 451). They thus reject Malthus' pessimistic interpretation for England, while retaining his equilibrium concept. What is the nature of this 'pressure'? "In contrast to the mortality-dominated high-pressure equilibrium sometimes regarded as generally present in all pre-industrial societies, England experienced a fertility-dominated low-pressure system" (WS, p. 451). The crux of the matter is that adjustments to equilibrium through mortality fluctuations (positive check) constitute high pressure, while fertility adjustment mechanisms (preventive check) characterize a low-pressure equilibrium.

Comparisons with France are made at several points. Eighteenth-century France is seen as a model of the high-pressure equilibrium, with wide fluctuations and high overall levels of mortality (WS, pp. 246-8, 479). As the authors carefully note, high levels and even high variability are not sufficient. Mortality must also be more sensitive to income movements in a high-pressure system. Ever-cautious, they state

> If, as Goubert once suggested, grain prices were a barometer of mortality in early modern France, any equilibrium attained must have been uncomfortably close to the high-pressure end of the spectrum (WS. p. 452).

The French are thus condemned out of their own mouths. But the authors venture further in their interpretation of French demographic history. It is not some peculiar character of mortality in France that produces the high (well-documented) and income-sensitive (unproven at the national level) character of the positive check. It is a failure of the preventive check mechanism to adjust that condemns 18th C. France to a life of high pressure. Again using a French scholar to make the crucial observation:

> Sauvy once calculated that the optimum population of France in the late 18th C. was 10-12 million at a time when her actual population was 24 million. If this was so, it suggests that older mechanisms of adjustment were comparatively ineffective (WS, p. 452).

It is then but a small leap to the interpretation of the French marital fertility decline as

> a successful transfer from the positive- to the preventive-check cycle with one important original feature--that instead of the link between real income and fertility being chiefly indirect through nuptiality, it became increasingly a direct link which by-passed nuptiality (WS, p. 479).

By the later 19th century France

> was achieving by fertility control within marriage what England had achieved by regulating the timing and incidence of marriage (WS, p. 480).

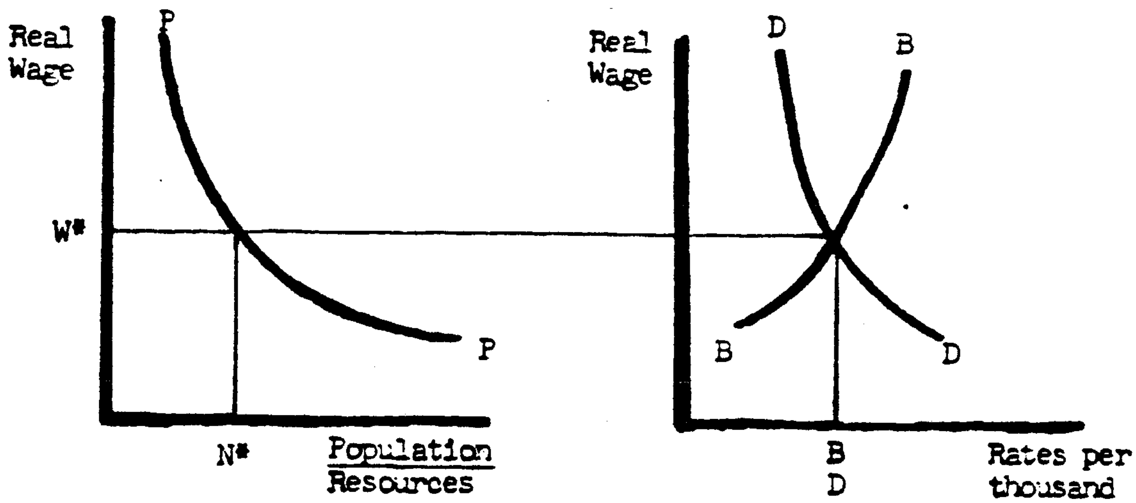
In the sections to follow, this interpretation will be shown to be unsupported by the best available evidence and, indeed, to detract from building a useful explanation of the French fertility transition. The first issue to be considered is the comparative 'pressure' of the pre-modern demographic regimes in France and England. Secondly, the responsiveness of fertility in France after 1790 should be compared with its earlier character to see if the preventive check was improved by the adoption of marital fertility control.

1.2.2 Malthusian analytics

It may help to focus the discussion of cross-national comparisons to illustrate the alternative interpretations in a simple diagrammatic representation of a Malthusian equilibrium. For a more extensive treatment of simple models of this sort, see Schultz, 1981. A more sophisticated application to pre-industrial England can be found in Lee, 1980. The three relationships that make up the simple Malthusian model are a production function with diminishing marginal returns to labor, the 'positive check' in which deaths are a negative function of real wages, and the 'preventive check' in which births are a positive function of real wages. Long-run equilibrium is at zero population growth in the simplest case of no sustained economic growth.

To avoid confusion in making comparisons between France and England as a consequence of their very different absolute sizes, the production function is defined over (N/R), the ratio of population to resources. In the next diagram I have shown what I believe to be the gist of the Wrigley-Schofield version of the comparative history. The English

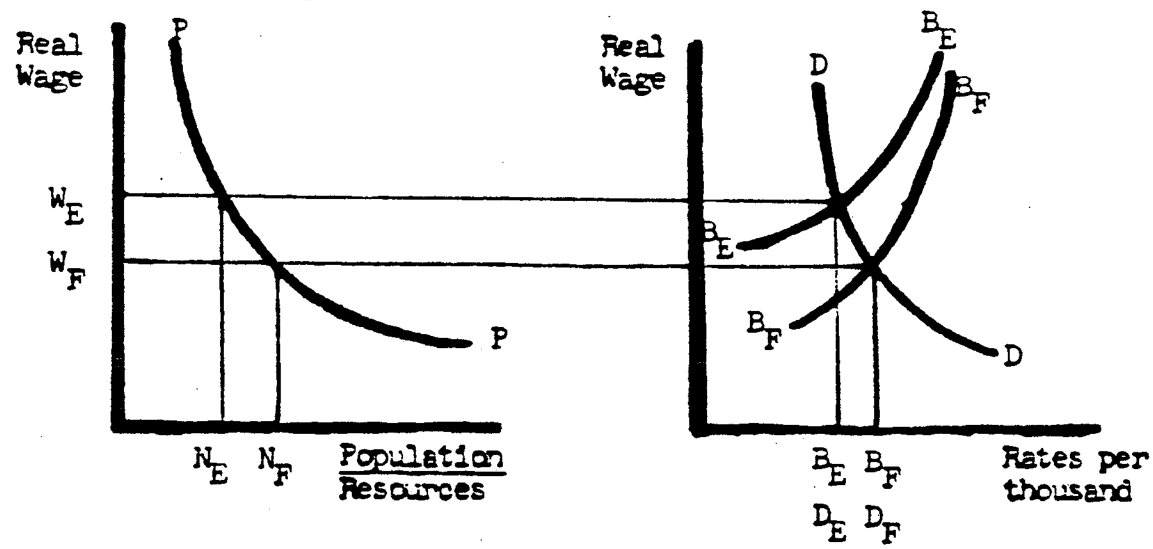
1. Malthusian equilibrium



model differs from the French only in the admirable restraint exercised by the English over fertility, primarily through delayed marriage. This low-pressure equilibrium situation provides a higher standard of living at lower relative population densities. Mortality rates are lower, and, since the sensitivity of mortality to wage fluctuations is reduced at higher wages, the positive check is kept at bay.

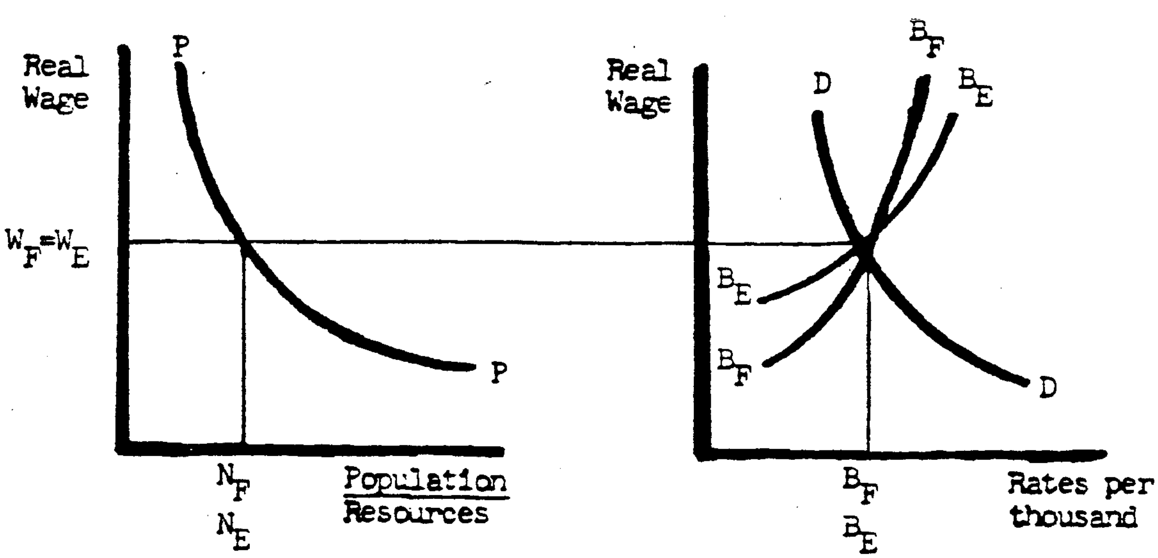
A second, conservative interpretation of low-pressure equilibrium is given in the third diagram. Here the equilibrium standard of living, ratio of population to resources, and vital rates are all identical, but deviations from equilibrium produce greater fertility responses in England than in France. Thus, most of the accomodation to the iron law of wages is through the less painful mechanism of nuptiality restraint instead of mortality crises as in a high-pressure

2. English "Admirable Restraint"



system. In this version the elasticities of the positive check are identical in the two countries, but the greater elasticity of the preventive check in England should produce less violent oscillations.

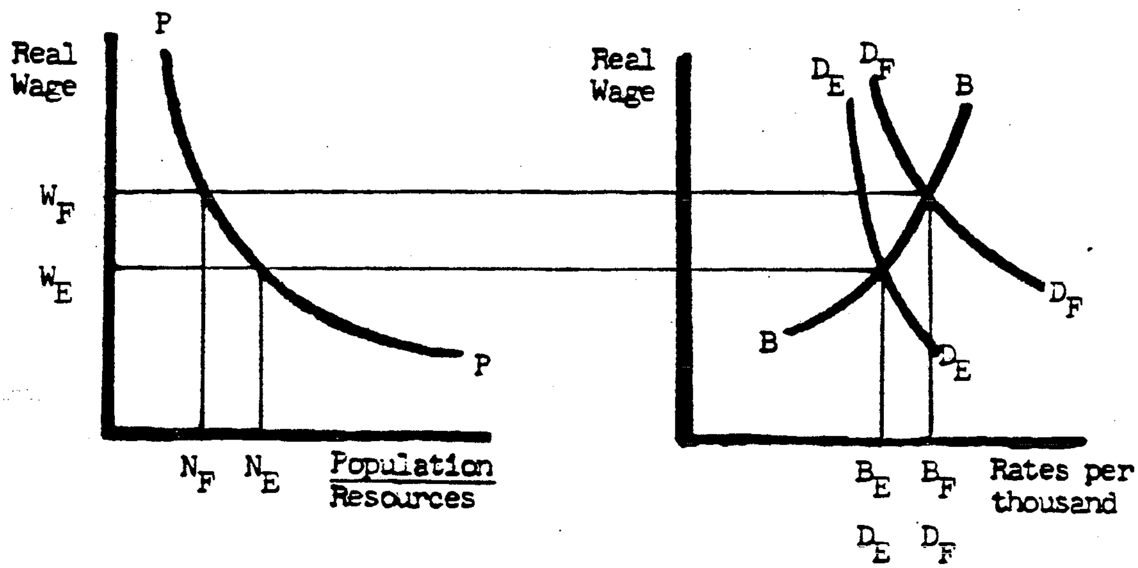
3. Simple English low-pressure



Before turning to a preliminary examination of some evidence on the responsiveness of fertility and mortality in France and England, it is worth considering alternative ways in which equilibrium systems of different 'pressures' might be produced. Economic growth was not unknown in the early modern era (DeVries, 1976). Lee estimates an absorption rate of .4% for pre-industrial England (the rate at which population can grow without producing declines in real wages). If we suppose that this was somewhat higher than the absorption rate for France (Crouzet, 1966), then England would have been permitted lower death rates and higher birth rates than France.

A more demographic alternative is that mortality conditions were different between the two countries while preventive check mechanisms were largely identical. In some ways this seems a more logical explanation than the behavioral implications of the Wrigley-Schofield version of low-pressure equilibrium. After all, both England and France conform to Hajnal's (1965) Western European marriage pattern. Plausible exogenous sources of mortality differences are discussed in a later section. For now, we may confine our attention to the observation, illustrated in the fourth diagram, of the difficulty in distinguishing between shifts of the mortality function and shifts of the fertility function. All demographic levels and elasticities of response may be the same as in the admirable restraint case; the only distinguishing feature will be that the 'healthier' country will have a lower standard of living, while the England of Wrigley-Schofield should have higher real wages. Unfortunately, there is no shortage of controversy among economic historians over the comparison of living standards in England and France (O'Brien and Keyder, 1978).

4. Mortality-driven low-pressure



1.3 MORTALITY

As yet, there is no comparable national evidence for France to confirm the Wrigley-Schofield supposition that the positive check was more responsive in France than in England for the period 1740-1789. It is, however, quite clear from their Figure 7.13 (WS, p. 246) that mortality levels were much higher in France even at that late date. Life expectancy was below 30 in France while it was over 35 in England. It is also possible to construct infant mortality rates for both countries. For England this involved using the model English life tables and the published life expectancy figures to obtain aggregate figures. The figures from the English family reconstitutions were considerably lower. For France the figures are directly available from the results of the aggregate survey (INED 1975,1977). The rates are shown in Table 1.

TABLE 1

Infant mortality in France and England

	FRANCE	ENGLAND	
Decade	0q1	0q1	e0
1740-9	296	195	33.5
1750-9	277	172	37.0
1760-9	282	188	34.6
1770-9	273	173	36.9
1780-9	278	183	35.3
1790-9	256	171	37.1
1800-9	213	170	37.3
1810-9	199	167	37.8
1820-9	181	156	39.6

Notes: French data from Population, 1977.
English data on life expectancy from WS, p. 230, average of quinquennial figures. Infant mortality rates interpolated from life tables, p. 714.

For most of the eighteenth century an additional infant out of every ten births died in France, with the gap narrowing rapidly after 1790.

Moreover, there is no evidence to suggest that the findings of Goubert and others on local mortality crises in the 17th C. would not also be true of national aggregates in that earlier period. As Wrigley and Schofield suggest, the evidence presented by Rebaudo for 1670-1739 shows large fluctuations in total deaths (the population base has yet to be reconstructed). Thus, although it would be premature to conclude with certainty that the positive check was more important in France, it may not be too early to begin asking what factors could produce such a difference, and how further historical research could shed light on their comparative force in the two countries.

The 'moral restraint' argument I have attributed to Wrigley and Schofield in the theoretical discussion is one possible explanation for mortality in the period prior to 1740. It rests on the assertion that English fertility was lower and more responsive than the French during that period, and that living standards were higher as a result. Nuptiality and marital fertility will be compared across countries in the next sections, but comparing living standards in notoriously difficult. Further research on both questions would be beneficial.

It is also possible that reduced overall mortality and reduced variability and sensitivity of mortality to price movements were accomplished by changes unrelated to the standard of living, i.e., by exogenous shifts in mortality itself. The most obvious would be purely health-related: improved resistance of the population to epidemic disease, improved sanitation, etc. (see McNeill, 1976 or Flinn, 1981). Other sources of change can be found in the structure of the economy; changes not necessarily related to improvements in mean income levels. Two such arguments seem worthy of discussion as lines for further work linking demographic history to the history of economy and society.

1.3.1 Economic causes of the demise of crisis mortality

1.3.1.1 Market integration

In most discussions of the positive check it is assumed that the sensitivity of mortality to fluctuations in the real wage is not constant at all levels of the real wage, but rather a decreasing function of the wage level. If this is true, then it will be possible for improvement in regional allocations of harvests to reduce aggregate national mortality responsiveness, without raising the mean standard of living. This point may seem obvious to some readers. Nonetheless, an example will prove useful in discussing the implications of such changes in the structure of economic relations for historians seeking to uncover their operation.

Imagine the following schedule of the elasticity of death rates with repect to real wage declines.

Now consider the effect of a below-average year for most of the country, with a crisis in one region representing 10%

% decline in real wages	elasticity of death rate	% increase in death rate
10%	10%	1%
20	20	4
30	30	9
40	40	16
50	50	25

of the population. Suppose living standards fall 10% in 9/10 of the country, and 50% in the remaining 1/10. The fall in the national average real wage is then .9(10%) + .1(50%) = 14%. Further suppose that there is no inter-regional trade in grain. Death rates in most of the country rise by 1%, but in the crisis region they rise by 25%. The national average rises by .9(10%) + .1(25%) = 3.4%.

Following the schedule given above, a 14% decline in living standards spread over the entire population would have produced a mortality rise of just under 2%, considerably less than that produced under autarkic regional markets.

For the nation as a whole, it would clearly be preferable to favor allocation mechanisms to eliminate regional inequalities of a transitory nature. How could we determine whether such a process advanced more quickly in England than in France? The economist thinks first of prices: the historical residue of market integration will be increasingly correlated and symmetrical price series in various regional markets. A comparative history of the development of national markets would be a welcome addition to the field. There is, however, another possible indicator that should not be overlooked: political protest.

Consumers in regions not ravaged by crisis pay a short-run price for market integration. In the example above, their wage decline is worse, 14% instead of 10%, as prices rise in their own regions. Moreover, their excess mortality doubles from 1% to 2% as a result of sharing with the crisis region. In the long run, of course, they should benefit from protection against their own regional disasters. But, as one famous English economist once said, in a context perhaps less appropriate than the present, "in the long run, we're all dead". Short-run conflicts of interest would seem inevitable unless output were expanding rapidly.

To some extent, then, the history of food riots as discussed by E.P. Thompson for England and Louise Tilly for France (Thompson, 1968, L. Tilly, 1970) may be seen as an indicator of attempted market integration. Tilly is most assertive on this point, challenging Labrousse's interpretation of the fragmentation of French grain markets through the 18th century with evidence on increasing integration of large urban markets. Given the nature of the political conflict described by Tilly, both views may be correct. What matters for protest is that grain be removed from a producing region. What matters for reduction of mortality crises is that it be delivered to regions experiencing the greatest shortage. If most transported grain goes to feed urban markets, it may well be that food riots could grow and urban grain prices become more closely-entwined, even though some outlying producing regions continue to suffer periodic subsistence crises of the older form. Thus, although it may be generally true that food riots displace subsistence crises as marketing structures improve, it may not always be possible to use political protest as an indicator that improved allocation was taking place. Still, a comparative history of the incidence of food riots in France and England might go far to improve our knowledge of the growth of national markets in all its dimensions.

1.3.1.2 Joint products and the old new husbandry

An alternative to the growing symmetry of price movements across regions as an explanation for reduced mortality crises is that suggested by Appleby, stressing the development of asymmetric price movements across grain types (Appleby, 1979). The disappearance of crisis mortality in 17th C. England is attributed to the partial shift out of winter wheat and into spring grains, especially oats. This has the effect of balancing the harvest portfolio against weather risks, because spring grains are unaffected or even improved by conditions detrimental to wheat harvests. As a consequence, oat prices do not rise in proportion to wheat prices during crises in England as they continued to do in regional markets in France. The English poor might complain of eating 'horse corn' but more of them survived to complain.

It seems likely, however, that there is more to this story than a choice of grain output mix. Appleby notes that France failed to sustain spring grain output because of fertilizer constraints, i.e., a shortage of animals for manure. This understates considerably the importance of the animal population. First of all, without an animal population (and a demand for animal products), there would likely be little demand for 'horse corn' during good years. Reduced variance will not be purchased at the price of a mean return too low to make a living in normal years. Secondly, animals themselves are storehouses for grain. Part of the asymmetry in English grain prices may well result from a declining demand for oats to feed the animal population as rising short-run food prices make early slaughter a profitable option. This suggests the need for greater attention to livestock population levels in the two countries, and to measuring the extent to which animal mortality was substituted for human in the elimination of crisis human mortality in Europe.

To conclude this discussion of factors affecting mortality, it appears quite possible that mortality was simply different in France and England, for reasons unrelated to the operation of the preventive check, but which lie at the very heart of economic history and which have important implications for social and political history. It would short-circuit the attempt to integrate demographic history with the rest of historical scholarship to ignore them by treating mortality relations as a passive responder to the preventive check.

1.4 FERTILITY

1.4.1 Nuptiality

It is nuptiality that bears the brunt of preventing the positive check in Wrigley and Schofield's English demographic history, so it is to nuptiality that one would turn in expectation of finding the failure of the preventive check in France. Crude marriage rates 1740-1859 will be analyzed along the lines used for measuring elasticities of birth and death rates. Crude rates are not as interesting as their components: age at marriage and celibacy. Rates of marital dissolution and remarriage are also important, but they are less easily-measured (Dupaquier, 1981). We are fortunate enough to have a substantial study of both age at marriage and celibacy rates for France from the INED enquetes (Henry and Houdaille, 1978, 1979), covering a considerably longer interval of time. Age at marriage is not available from the Cambridge Group's back projection procedures, but celibacy estimates were made. For age at marriage the best available source is the small collection of completed reconstitutions, reported in Wrigley and Schofield. Results by period of marriage are shown in Table 2.

The first point to be made is that age at marriage is always high in both countries, by global-historical standards.

TABLE 2

Female age at first marriage, by marriage cohort

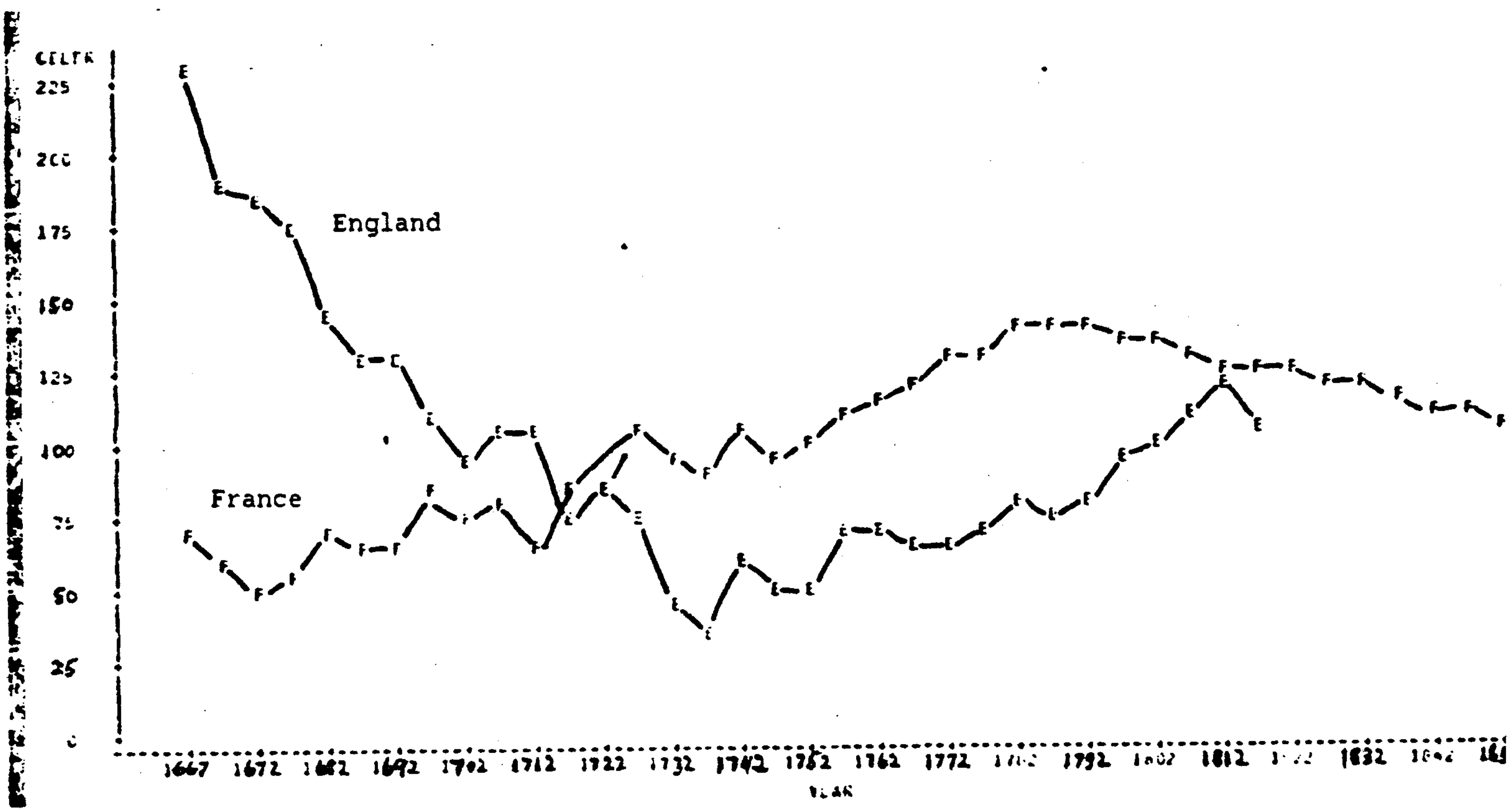
Marriages in decades beginning in	Age at first marriage in: France decades	France 50-yr avg.	England	Period
(1670-			26.5	1650-99
1680)	24.5			
(1690-				
1700-	24.9			
1710)				
(1720-	25.6	25.3	26.2	1700-49
1730)				
1740	25.5			
1750	25.8			
1760	25.8			
1770	26.2	26.1	24.9	1750-99
1780	26.5			
1790	26.1			
1800	26.3			
1819	25.6			
1820	26.0	25.8	23.4	1800-49
1830	25.8			
1840	25.4			
		24.3		1850-99

Notes: For France, data are by long cohorts 1670-1739, and thereafter by decade to 1909 (Henry and Houdaille, 1979, p. 413).
For England, data are by fifty-year period from 12 reconstitution studies (WS. p. 255).

As is well-known, this Western European marriage pattern provides substantial population control even in the absence of income-sensitivity (Hajnal, 1968). These data suggest that the period after 1740 was markedly different from the late seventeenth and early eighteenth centuries. It is difficult to be precise about timing from long aggregates, but it is clear that the French married about a year later than the English in the late eighteenth, and more than two years later in the early nineteenth centuries. In the earlier period, it seems equally apparent that the situations were roughly reversed, with age at marriage about a year later in England than in France in the early eighteenth century and perhaps two years later in the late seventeenth. A similar pattern is apparent in the course of celibacy rates, shown in Fig. 1.

The celibacy estimation techniques are vastly different for the two countries, relying in the French case on actual vital registration data, and in the English on the full statistical and logical structure of back projection. It is with some caution, then, that these numbers are to be compared. The picture they present is quite similar to that given by figures on age at marriage. The great English self-denial of the seventeenth century is seen here only in its final declining stages, meeting the French in cohorts born at the turn of the 18th century and marrying in the second quarter of the eighteenth. Once again, we see that nuptiality restraint was exercised to a greater degree in France after about 1750.

Figure 1: Celibacy rates



Notes: For France, the data are never-married women per thousand at death above age 50 (Henry and Houdaille, 1978, p. 50).
For England, rates are estimated proportions (bisexual) never-marrying before age 50 (WS, p. 260).

1.4.2 Marital fertility

In considering the middle of the eighteenth century, for which the best comparative data are available, there arises a small puzzle. Crude birth rates in England were lower than those in France, yet it appears that nuptiality was lower in France than in England at that time. (See Section 6 below). This suggests that marital fertility, presumed to be 'nautural' in both countries at this time, may be deserving of more attention. Unfortunately, there is no national English study comparable to the French national random sample of parishes. Wrigley and Schofield present results from 12 parishes to be included in the Cambridge Group's family reconstitution study, and these will be used for comparison. Table 3 provides the relevant summary statistics.

Comparing first the total marital fertility rate, our suspicion is confirmed: the lower English birth rate of the middle and late eighteenth century was produced by lower overall levels of marital fertility. Only after the Revolution when fertility control became widespread in rural France did French marital fertility fall to the levels of the English. To my knowledge, this has gone unnoticed, not to mention unexplained, in writings on demographic history.

The Coale-Trussell parameters provide a summary description of the pattern of marital fertility by age. High values of m indicate relatively greater reductions of fertility at older age groups. Changes in M indicate equiproportional

TABLE 3

Marital fertility in France and England

FRANCE				ENGLAND			
Cohort of Marriage	TMFR	M	m	TMFR	M	m	Period
				7.03	.82	.07	1600-49
				6.92	.81	.07	1650-99
1690-1719	8.36	.96	.03	6.77	.84	.19	1700-49
1720-1739	8.46	.96	.01				
1740-1769	8.35	.95	.03	6.92	.84	.15	1750-99
1770-1789	7.88	.96	.14				
1790-1819	6.94	.90	.27				

Notes: TMFR=5 times sum of age-specific marital fertility rates, 20-44.
M, m are Coale-Trussell parameters.
French data is described in Weir, 1980, original source is INED enquete nominative.
English data from 12 reconstitutions taken from WS, p. 254.

movements at at all ages. Consider first the implication of the lower values of M in England.

Longer birth intervals at all parities are what is normally implied by a lower M. Could this have been due simply to lower infant mortality in England, given that intervals following infant death are typically shorter? Evidence from the INED reconstitutions suggests that the average effect of infant survival could have been on the order of 10-12 months for rural France before 1789, implying rather extensive breastfeeding (Weir, 1981). Infant mortality rates by decade were constructed for both countries. For most of the eighteenth century an additional infant out of every ten births died in France. If we suppose that infant survival implied an interval 12 months longer on average, then the overall English mean birth interval would have been .1(12)= 1.2 months longer, all else being equal. But the estimated levels of M imply that the average birth interval in England over the peak childbearing years 25-34 would have been over 4 months longer than that in France. Something else must have been different. Perhaps breastfeeding practices differed. This deserves exploration. Perhaps, too, there was some fertility control among some social or regional groups. This control may have taken the form of spacing between births as well as the more commonly-assumed parity-specific 'stopping' behavior. Perhaps the low levels of English cohort marital fertility reflect a greater use of fertility control in response to cyclical fluctuations at all stages of the family life cycle. Ron Lee's analysis of short-run fluctuations in birth rates suggsts quite strongly that this is the case (WS, pp. 369-370), although the matter is not considered seriously in the discussion of Wrigley and Schofield. This sort of behavior would have the effect of reducing completed family size without the appearance of what are usually interpreted as deliberate attempts at limitation of final family size by increasing this control later in marriage. This question can only properly be addressed using parity-specific birth interval data not yet available for England. Future work with the French family reconstitution sample will address this issue.

It is possible to interpret the other Coale-Trussell parameter as an index of marital fertility control related to parity (family limitation), although this interpretation is not always straightforward (Weir, 1980), and direct evidence on fertility by parity is obviously preferable. The values for 18th C. England are not conclusive evidence of control on a wide scale, but they make the question interesting. Could family limitation have been practiced by a few social and regional groups? Could a nascent fertility transition have been aborted by industrialization? More detailed analyses of family histories may provide some important insights.

David Levine devotes considerable effort to a discussion of fertility control in Shepshed during its declining phase. The evidence appears to be less than convincing. Consider the following comparison with Cabris, a rural village not far from Nice in the south of France which is part of the INED sample and has been covered by family reconstitution for the years 1830-69 by my own efforts. Table 4 gives some of the relevant data.

Two points can be made about the comparison. First, that the degree of fertility control established in an agricultural community in southern France by the middle of the 19th C. was far greater than any that occurred in Shepshed. Secondly, the data for Shepshed after 1825 look very little different from those for all of England in the eighteenth

TABLE 4

Cabris and Shepshed

CABRIS				SHEPSHED			
Cohort of Marriage	TMFR	M	m	TMFR	M	m	Period
				7.13	.83	.07	1600-99
1690-1719	6.41	.74	.03	7.14	.87	.16	1700-49
1720-1739	6.70	.76	.05				
1740-1769	7.11	.81	.01				
1770-1789	6.95	.84	.13	7.49	.89	.10	1750-1824
1790-1819	5.69	.79	.43				
1820-1839	4.92	.71	.53	7.22	.89	.17	1825-1851
1840-1859	3.81	.55	.52				

Notes: TMFR=5 times sum of age-specific marital fertility rates, 20-44.
M, m are Coale-Trussell parameters.

century. Therefore, if Levine is correct in his finding that some fertility control was important in Shepshed, it may equally well have been true for England as a whole in an earlier period.

1.5 COMPARATIVE VITAL HISTORIES, 1740-1829

1.5.1 The sources

The first rule of comparative analysis must be the use of comparable data and methods. To some extent this is already compromised by the choice of units of analysis. England without Ireland, Scotland or Wales and France inclusive of Brittany, Languedoc and the Massif Central are arguably in-comparable entities. Such a match is surely preferable, however, to comparisons of England in the aggregate with a small region of France (e.g., WS, pg. 328). As Goubert himself concluded his remarkable study: "Mais il est seulement le Beauvaisis" (Goubert, 1960, pg. 624). The difficulty posed by this rule is that one is reduced to making comparisons on the basis of the least common denominator of available information. With some effort, this restriction need not preclude valuable insight.

The period 1740-1829 is the period of the fertility transition in France and is also the period for which the most directly comparable national data are available. English data are borrowed directly from the Cambridge Group results , while the French data were obtained, after some manipulation, from the <u>enquete</u> <u>anonyme</u> of INED (INED, 1975,1977). A summary of the sources and a table of the basic data series can be found in the appendix.

Both studies rely on a combination of parish register samples and some form of 'back projection' of the population from nineteenth-century censuses. A complete comparison of methodology would be valuable, but is beyond the scope of this paper. Suffice it to say that the English techniques are considerably more sophisticated and that that sophistication was induced in large part by the poorer quality of registration and the unavoidable complication of migration. Applying the Cambridge Group techniques to the French data would seem an obvious step toward a truly comparative history. It may even be possible thereby to extend the range of the French series backward from 1740; certainly to 1670 where the INED registration sample begins, and possibly even earlier.

Extending the coverage to 1830-1869 is not difficult; Wrigley and Schofield provide data to 1871, while French national vital statistics are available in Mitchell (1975). This permits the comparison of industrial England before its fertility transition with an industrializing France already practicing family limitation on a wide scale.

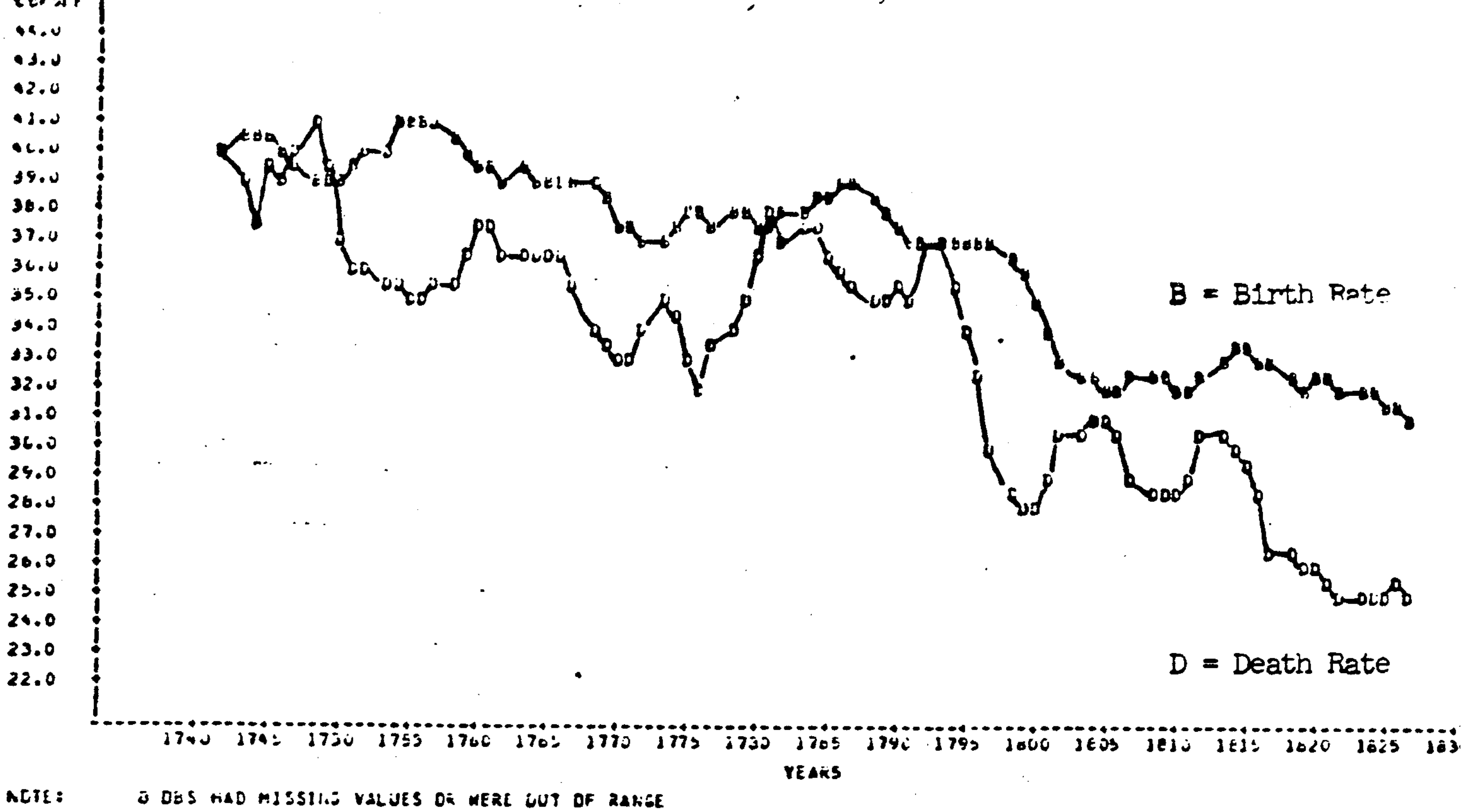
1.5.2 Historical trends and summary statistics

It is instructive to compare directly the vital histories in the two countries over this period, as is done in Fig. 2, using five-year moving averages of birth and death rates for France and England from 1740 to 1829. Certainly there is something different about the two countries. As suggested by Wrigley and Schofield (WS, Figure 7.3, pg. 214, and Figure 7.13, pg. 246), France maintained a small rate of natural increase throughout the period as fertility fell in step with mortality declines, while in England the two paths diverged, creating historically unprecedented rates of sustained population growth.

Another perspective on the same data is given in Fig. 3, where the course of each vital rate separately is compared across countries. For births, the periodization has provid-

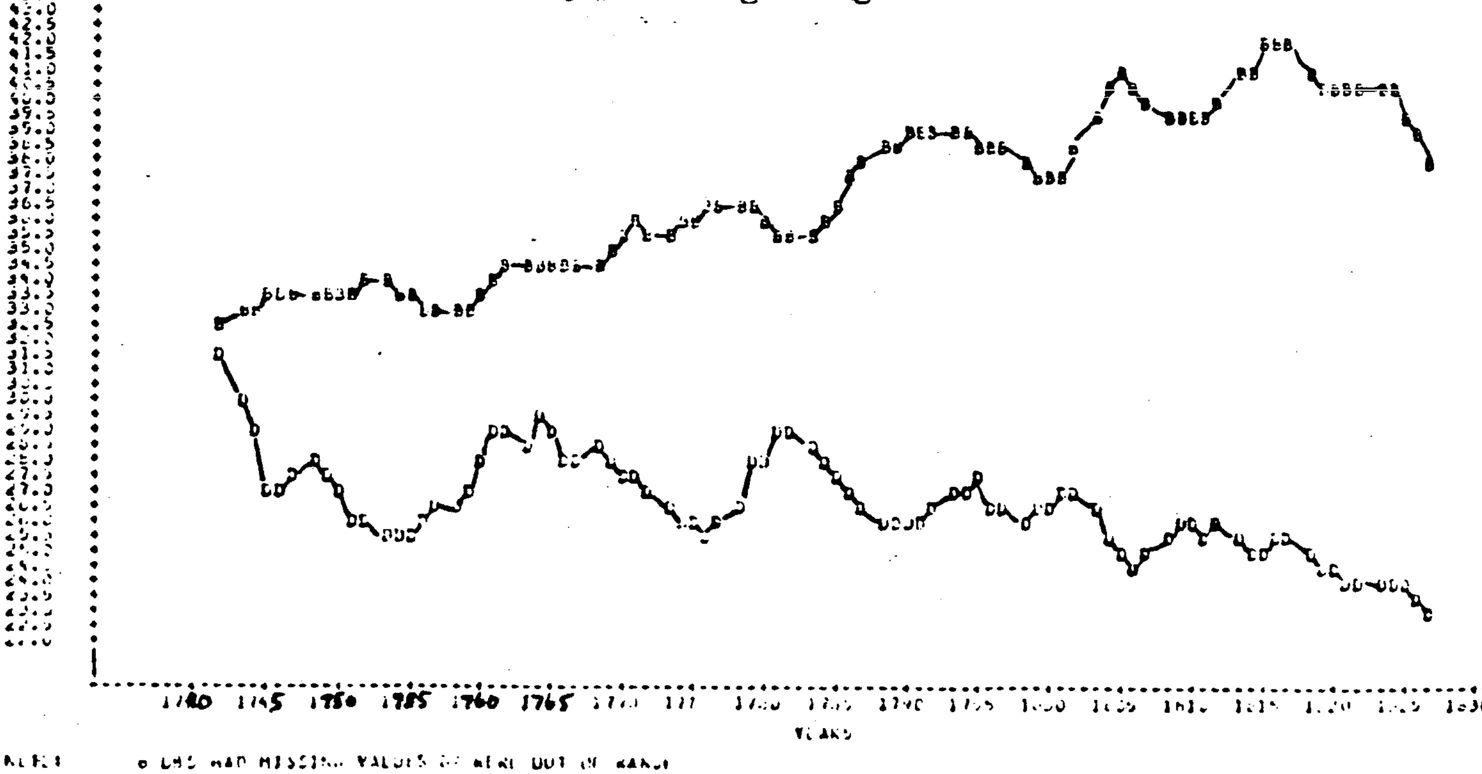
Vital Rates in France, 1740-1829

5-yr. moving averages



Vital Rates in England, 1740-1829

5-yr. moving averages

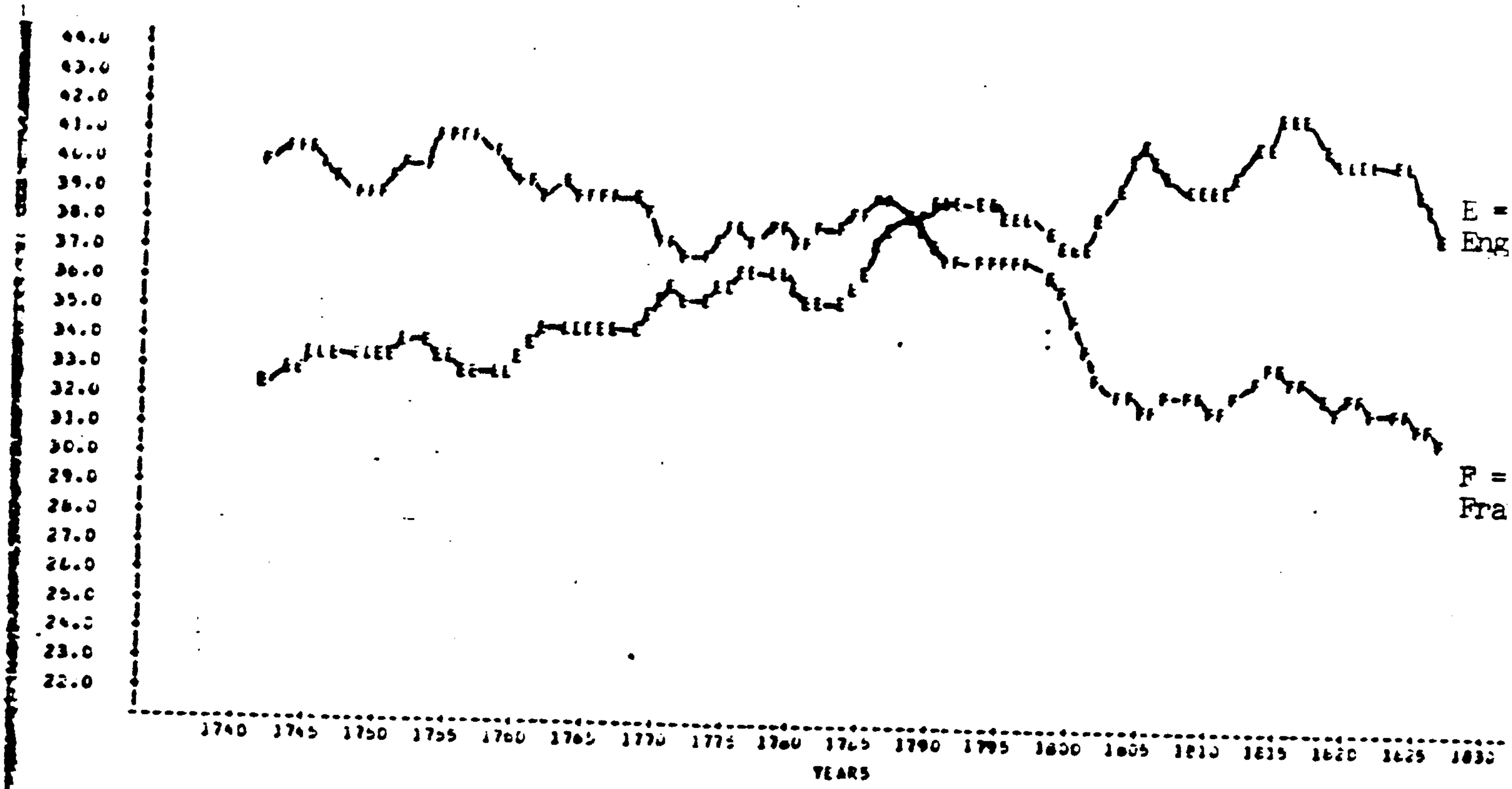


ed a striking picture of the inverse symmetry of the two national fertility histories. France and England exchanged their positions of the mid-18th C. by the middle of the next. How this was accomplished is one of the pre-eminent questions for a comparative demographic history.

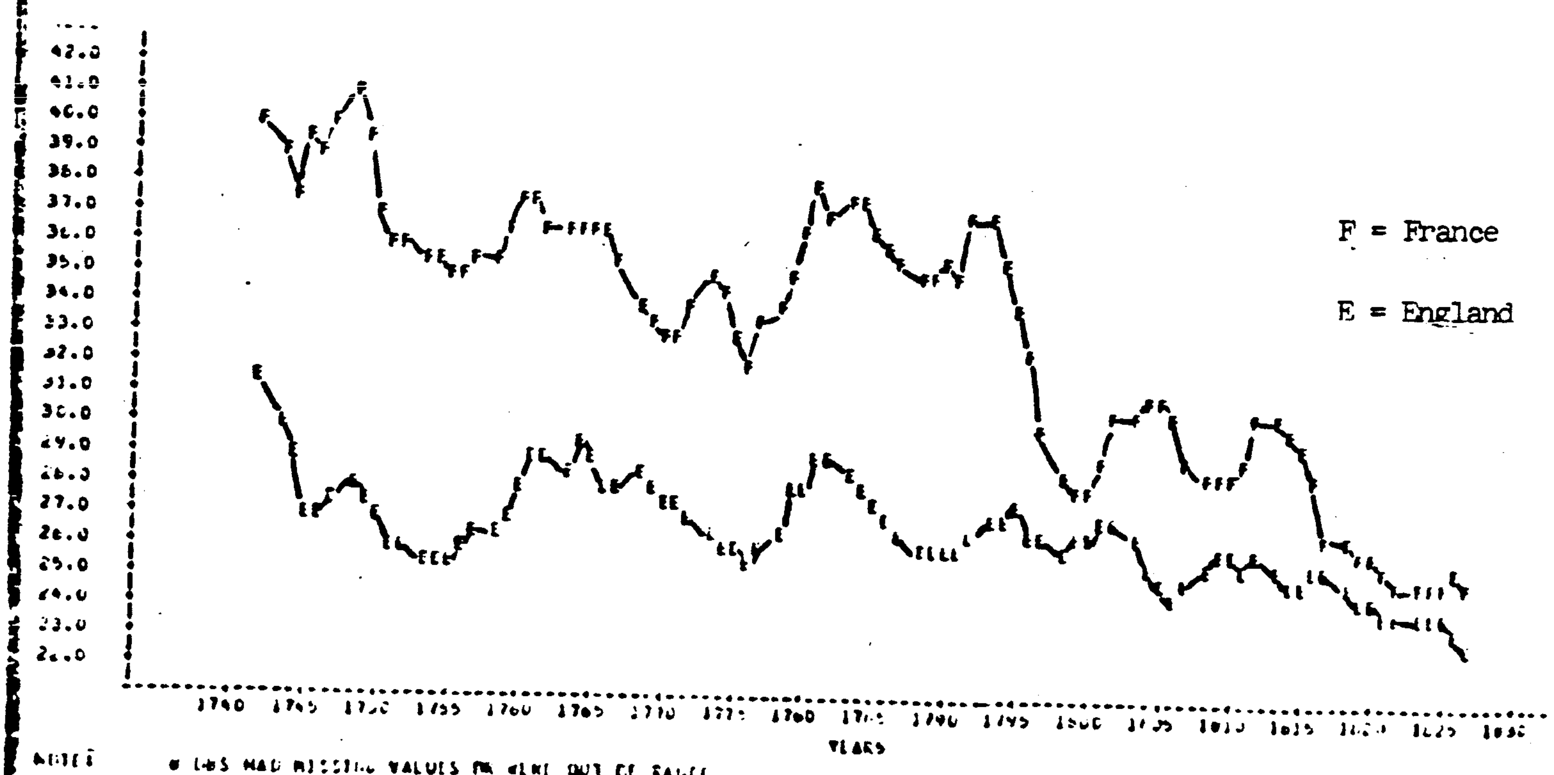
Death rates show a very different course. French rates are markedly higher in the 18th C., but converge rapidly to near-equality with the English by 1830. There appears to be a sympathetic pattern to cyclical movements in the two countries down to 1790.

Birth rates in France and England.

5-yr. moving averages



Death Rates in France and England, 5-yr. moving averages



1.6 SHORT-RUN ANALYSIS, 1740-1869

1.6.1 Methods

In this section, short-run fluctuations in demographic and economic variables will be analyzed to measure the stability and the elasticities of the functional relationships making up the Malthusian system described earlier. The analysis will follow as closely as possible the principles of the analysis described by Ron Lee in chapter 9 of Wrigley and Schofield. Minor differences in actual practice will be necessary in order to achieve comparability between French and English results. First among these is the conversion to calendar year data in place of harvest year data. It is necessary because French data on most variables are only available by calendar year. For this reason it will also not be possible to replicate the monthly analysis performed by Lee.

The analysis of short-run fluctuations may not provide insights into the century-long adjustments to equilibrium that Wrigley and Schofield appear to find in England, 1541-1871. It will, however, reveal how sensitive the demographic system was to alternations between good and bad years. Were grain prices a barometer of mortality in France, as asserted by Goubert for the long seventeenth century ending in 1730? More so than in England? And is this matched, as Wrigley and Schofield imply, by a lack of responsiveness on the part of the behavioral variables determining fertility?

One of the great advantages of the short-run analysis pioneered by Lee is that it eliminates many of the thorny practical problems facing economic and demographic historians when trying to measure the levels of important variables. The variables analyzed are simple transformations of the observed variables; divided through by eleven-year moving averages of the variable centered on that year. A second transformation to adjust mortality for the influence of births is described in detail in the appendix. The main transformation is particularly important when only the absolute numbers of births, deaths, and marriages are available because it eliminates the need to standardize for (long-run) changes in population size. This is not an issue here, because population size has been determined in both studies used, making vital rates available. The transformation is important, however, for the use of wheat prices as an exogenous variable. Changes in the purchasing power of money, the level of nominal wages, and the international exchange rate will all affect the meaning of a nominal price series in real terms. They are also all likely to vary slowly relative to price fluctuations, making transformed prices a good index of short-run fluctuations in real wages or living standards. The alternative of constructing a real wage series would obviously entail far more effort and contoversy. One would probably wish to make the transformation at the end anyway, to eliminate trends and long cycles. To some readers untrained in econometric technique, these methods may seem complex. Their true beauty is their simplicity.

1.6.2 Summary statistics

As a first step, we will want to examine some simple summary statistics on the variables by country and time period, as presented in Table 5.

TABLE 5

Summary statistics

	Mean		Volatility	
Death rates				
	England	France	England	France
1740-1789	27.54	36.37	.052	.093
1790-1829	24.84	27.76	.053	.101
1830-1869	22.46	23.65	.046	.070
Birth rates				
	England	France	England	France
1740-1789	35.13	38.77	.026	.026
1790-1829	39.24	32.57	.037	.029
1830-1869	35.82	27.19	.018	.025
Marriage rates				
	England	France	England	France
1740-1789	8.69	8.65	.047	.078
1790-1829	8.20	8.03	.072	.150
1830-1869	8.21	8.02	.041	.038
Prices				
	England	France	England	France
1740-1789			.150	.168
1790-1829			.185	.204
1830-1869			.216	.197

Notes: Volatility is the standard deviation of the transformed variable, and can be read as the average annual percentage fluctuation.

The mean levels of the vital rates merely summarize the visual impressions of the earlier graphs. For the later period, one can readily see that the convergence of death rates continues, while birth rates return to their 18th C. level in Britain and fall to record lows in France. Crude marriage rates fall in both countries after 1790, but stay constant after 1830.

More interesting are the measures of volatility in the variables. For deaths, France shows nearly twice the volatility of the English through 1829, with a more pronounced decline after that date, though remaining well above the English rate. It seems unlikely that this could be due simply to the effects of sample size (the two surveys are of comparable size), if only because the volatility of birth rates is nearly identical in the two, showing increased movement during the Napoleonic era in both countries. In general, however, birth rate fluctuations on the order of two and a half percent in a year are far below those of the other series. Marriage rates in France are initially more volatile than those across the Channel, but stabilize dramatically after 1830. Finally, wheat prices are slightly more volatile in France, but certainly not enough to explain the greater volatility of death or marriage rates as the result of a response system identical to the English that simply experienced bigger price shocks. Prices become increasingly volatile in the short run in both countries as they undergo industrialization.

1.6.3 Elasticities of response

Given these transformed series of prices, birth rates, marriage rates, and adjusted death rates, it is possible to proceed to the specification of the regression analyses. Here again, the procedures adhere as closely as possible to those of Lee, altering the specification only by the direct inclusion of two lagged values of the dependent variable in each equation in place of his correction for second-order autoregression in the disturbances. By so doing, it is possible to trace the effects of a change in prices on current and future demographic rates both directly and indirectly through the lag structure of the rates themselves. This makes the interpretation of the estimated coefficients a bit more difficult by making explicit the need to use the regression estimates as parameters of a simulation model of a system. The equations to be estimated in each of the three periods are as in Table 6.

These specifications economize on the limited degrees of freedom available in the short (by econometric, not historical standards) periods studied here by not including the fourth lagged value of independent variables as Lee does. He consistently finds small and insignificant values for the coefficients on these terms (WS. p. 375).

In Table 7 the results for the two parts of the preventive check are presented. A full presentation of the estimated equations, with all coefficients and standard errors, is given in the appendix.

TABLE 6

Regression equations

Deaths:

$$CDR^*_t = a_0 + a_1 CDR^*_{t-1} + a_2 CDR^*_{t-2} + b_0 P_t + b_1 P_{t-1} + b_2 P_{t-2} + b_3 P_{t-3} + e_t$$

Births:

$$CBR_t = a_0 + a_1 CBR_{t-1} + a_2 CBR_{t-2} + b_0 P_t + b_1 P_{t-1} + b_2 P_{t-2} + b_3 P_{t-3} + c_0 CDR^*_t + c_1 CDR^*_{t-1} + c_2 CDR^*_{t-2} + c_3 CDR^*_{t-3} + e_t$$

Marriages:

$$CMR_t = a_0 + a_1 CMR_{t-1} + a_2 CMR_{t-2} + b_0 P_t + b_1 P_{t-1} + b_2 P_{t-2} + b_3 P_{t-3} + c_0 CDR^*_t + c_1 CDR^*_{t-1} + c_2 CDR^*_{t-2} + c_3 CDR^*_{t-3} + e_t$$

where all variables are defined as the current value of the variable divided by an eleven-year moving average centered on the current year.

Consider first the comparison most relevant to Wrigley and Schofield's hypothesis that France suffered a failure of marriage restraint prior to its fertility transition: the impact of prices on marriage rates 1740-1789. It would appear that the discussion ought to be reversed; why is there such a comparative failure of marriage responsiveness to short-run price movements in England in the eighteenth century? Marriage rates were twice as responsive in France im-

TABLE 7

Preventive check, 1740-1869

The cumulative effect of prices,
net of adjusted mortality.

1740-1789

elapsed years	Births England	Births France	Marriages England	Marriages France
0	-.069	-.084	-.193	-.485
1	-.173	-.171	-.216	-.471
2	-.123	-.093	-.213	-.378
3	-.165	-.183	-.109	-.532
4	-.164	-.170	-.113	-.608

1790-1829

elapsed years	England	France	England	France
0	-.128	-.047	-.220	-.476
1	-.167	-.116	-.246	-.059
2	-.190	-.060	-.164	-.435
3	-.203	-.082	-.162	-.411
4	-.208	-.077	-.175	-.306

1830-1869

elapsed years	England	France	England	France
0	-.041	-.021	-.090	-.126
1	-.062	-.122	-.193	-.079
2	-.026	-.031	-.143	-.074
3	-.063	-.054	-.161	-.098
4	-.068	-.053	-.187	-.092

Notes: The figures in the table were obtained by simulating the effect of a one percent increase in prices in a single year through a system of coefficents estimated with two lagged values of the dependent variable, current and three lagged values of adjusted mortality, and current and three lagged values of prices as independent variables. Because all variables are measured as percentage deviations, the coefficients should be interpreted as elasticities.

mediately following a price shock, and the cumulative effect after five years was even greater.

Because of the transformation of birth rates by dividing through by a moving average, any variations due to changes in the stock of marriages will be largely removed. Variations in current marriage rates can only have a small influence on birth rates, so any significant responsiveness of births to prices must be interpreted as a marital fertility response (Lee, 1975, Lee in WS, p. 369). Is there any evidence of a stronger English preventive check here? With all due respect for the shortness of the sample and the difficulties of comparability, the results appear identical in the two countries. This would seem to refute the earlier suggestion that greater marital fertility responsiveness to prices in England had produced its lower cohort marital fertility. The elasticity of response was little different from that in France, and English prices were less volatile, so there is no reason to suspect that this was the mechanism behind the smaller completed family sizes.

How is the strength of the marital fertility response to prices influenced by the fertility transition? It appears to be weakened considerably in France after 1790. England appears to have a slight increase in the responsiveness of births in 1790-1829, but the two countries are once again quite similar after 1830 with weaker marital fertility mechanisms than a century earlier. So the dramatic transformation of marital fertility behavior in France after 1790 that distinguished it all through the 19th C. from the 'natural' fertility of the rest of Europe actually appears to have reduced the extent to which marital fertility was responsive to short-run changes in the standard of living.

It is also worth noting that the responsiveness of marriages to prices also declines in France after 1790, and particularly after 1830 when it finally falls below the elasticity of English marriages.

It is against the background of similar or stronger behavioral patterns of response to price shocks via marital fertility and nuptiality restraint that we may now evaluate the evidence on the comparative strength of the positive check, presented in Table 8. The results are disappointing in their instability; both countries reveal a cumulatively negative impact of price changes on death rates after five years in the earliest period. In the subsequent period the results seem more plausible a priori, with net increases in mortality up to two years after the price shock, then declining somewhat but remaining positive after five years. France appears to have a much more responsive death rate in this period than England. One would need to ask, however, whether this represents a 'famine' effect, or the joint correlation of deaths and prices with increases in the level of mobilization for war. During the mid-19th century France appears to retain a positive check response, while England's is reduced to a small oscillation returning to zero in a few years.

TABLE 8

Positive check, 1740-1869

Cumulative effect of prices on adjusted mortality

elapsed years	1740-1789 England	1740-1789 France	1790-1829 England	1790-1829 France	1830-1869 England	1830-1869 France
0	-.022	-.180	.138	.148	.058	.141
1	-.053	-.056	.019	.164	-.067	-.052
2	-.074	.234	.210	.501	.133	.260
3	-.163	-.208	.082	.498	.015	.238
4	-.189	-.452	.037	.424	-.045	.190

Notes: The estimated elasticities were obtained by simulating the effect of a one percent increase in prices in a single year..

It would be premature, on the basis of this evidence, to conclude that Wrigley and Schofield's comparative history is wrong. First and foremost, the possibility of a major contrast in the 17th century remains a perfectly open question at the national level. For the period after 1740 when comparable data are available, the comparison using short-run techniques does not support their view of the pre-industrial regimes nor their interpretation of the French marital fertility decline.

1.7 THE BLACK SEVENTEENTH CENTURY

French demographic historians with great experience in the study of local mortality crises have often advanced the hypothesis that a major break in the sensitivity of mortality to grain prices occurred shortly after the death of Louis XIV (Goubert, 1974, Meuvret, 1956). In their view the seventeenth century was disastrous and that economic-demographic system extended into the first decades of the eighteenth century (at least until after the last great crisis in 1709-10). If this is true, one might expect to find greater confirmation of Wrigley and Schofield's assertions in this earlier period than in the post-1740 period for which the aggregate INED data are available. Because of the obvious interest of such an extension, it will be attempted despite some rather formidable empirical obstacles.

The first empirical hurdle is to find data on vital rates, or, since Ron Lee has shown that short-run analysis can be done with numbers of events, a national series of births, deaths, and marriages. This has been attempted by Daniele Rebaudo, using the smaller sample of 40 French parishes taken for the family reconstitution study, supplemented with a few additional local studies to improve the regional representation (Rebaudo, 1979). These data are then weighted to create a national series. They differ from the main aggregate sample not only in the smaller base, but also in being restricted to rural communities; urban events are excluded. This should not be a matter of great importance in a country so little urbanized as France in 1700, but the distinction should be kept in mind. A further limitation, actually an advantage in the present context, is that only deaths (actually, burials) of persons above age 5 are reported. This eliminates the need to transform the mortality variable for the influence of births; a fortunate choice considering the lack of data on infant mortality rates in that era.

A far more difficult problem is posed by the absence of any national price series for wheat prior to 1700. Even the period 1700-26 is to be treated with caution, according to the creator of the only extant series (Labrousse, 1932). In the years since Labrousse first wrote, a number of local markets have been studied and long series of prices produced (reproductions of the mercuriales). Weaving these diverse strands into a national pattern is no mean task, but the task is made considerably easier by the fact that only a national series of short-run fluctuations is needed. Converting each local series to a common monetary unit and a common measure of volume or weight is therefore unnecessary. Short-run fluctuations in the local series were averaged using weights determined by the best linear fit to fluctuations in the national series 1740-1789 to produce a national series of short-run fluctuations 1670-1739. Further details of the construction of this price index are described in the appendix.

With the resulting transformed variables, the models presented earlier can be estimated for 1670-1739. The data show a higher degree of inherent volatility in this period, some of which may be due to the weaker sampling base. Volatility measures comparable to those of Table 5 are .229 for deaths, .067 for births, .155 for marriages, and .235 for prices. It is important to stress, however, that any increase in volatility due only to sampling error will bias downward the strength of the various relationships as estimated by elasticities of response. If the estimated elasticities are higher, when price volatility is greater, then the system must be both more sensitive and subject to greater external shocks. Results for all three equations are in Table 9, accompanied by figures given by Lee for England in the most nearly comparable period (WS, p. 375). Once again, the full set of estimated coefficients can be found in the appendix.

It appears with striking clarity that French mortality was indeed far more sensitive to grain prices under Louis XIV than in subsequent years. The elasticities are also far above those found by Lee for England 1641-1745, or even 1548-1644. Another set of estimates of mortality responsiveness presented by Lee (WS, p. 393) for the period 1665-1745 suggests that the mildness of the positive check in England 1641-1745 is largely due to the influence of the earliest years, before 1670. For the more strictly compara-

TABLE 9

Cumulative effects of prices, net of mortality, 1670-1739

	France, 1678-1735			England, 1641-1745		
elapsed years	deaths	births	marriages	deaths	births	marriages
0	.452	-.073	-.207	.037	-.066	-.079
1	.629	-.193	-.340	.110	-.143	-.168
2	.604	-.142	-.276	.169	-.119	-.238
3	.532	-.199	-.150	.169	-.130	-.237
4	.502	-.190	-.133	.103	-.131	-.206

Notes: Cumulative elasticities for France obtained by simulation of a one-percent price increase in a single year. Figures for England are sums of reported elasticities at lags 0-4 (WS, p. 375).

ble period, English deaths increase over five years by 30% for a 100% increase in prices, nearly three times the rate estimated for the longer period, but still only three-fifths as great as the French. The positive check was strong in France, and stronger than in England, but the period 1670-1739 appears to have been hard on both sides of the Channel, perhaps even harder than in the half-century preceeding it.

So, demographic historians arguing for a clear change in the mortality regime in France by the mid-18th C. seem confirmed. Is there a parallel transformation of the preventive check? Births show a pattern of responsiveness nearly identical to that of 1740-1789 in France and stronger than in the years after 1790. Marriages, on the other hand, respond rather less initially, and the rebound after three years is stronger in this period than in the final years of the Ancien Regime. As a result, the cumulative response of marriages over five years is far below its level in the next period, though slightly higher than the rates for the mid-19th C.

Comparisons with England in this period are more supportive of the Wrigley-Schofield view of the comparative efficacy of the preventive check. Births were slightly more responsive to prices in the short run in France and their recovery after five years was less complete there than in England. Marriages were more responsive initially in France, but the effects were more persistent in England. If nuptiality is the principal motor of the long-run preventive check, then it may well have been weaker in France than in England from 1670 to 1740. Whether this is cause or effect of the greater sensitivity of mortality is not a question to be answered by this kind of analysis.

1.8 CONCLUSIONS

1.8.1 Summing up the aggregate evidence

Can this welter of elastic checks and volatile fluctuations be condensed into a meaningful statement about the economic-demographic histories of France and England? It seems fair to say that France was substantially more affected by a short-run positive check in the late seventeenth century than England ever was since at least the 14th C., and far more than France herself was ever to be again. But the source of this radical transformation of the mortality regime in France during the second quarter of the 18th C. must be sought in the determinants of mortality itself and not in a failure of the preventive check.

Nuptiality in France was only slightly less responsive than in England before 1740 and became much more responsive in the next period while English marriage restraint loosened considerably. French marital fertility was easily as responsive as the English up to 1790. It seems more plausible to interpret the rise in age at marriage and accompanying increase in nuptiality responsiveness after 1740 as being a consequence of an exogenous mortality change increasing population pressure while stifling the positive check than to treat mortality change as the result of a behavioral shift in marriage.

So much for the French mortality 'transition' of the early 18th C. What of the fertility transition at its close? We discover that the adoption of marital fertility control and the sustained secular decline in fertility initiated at the end of the eighteenth century did nothing to improve the cyclical responsiveness of fertility in France as compared with England or with her own historical record. This would seem to be a strong refutation of the Wrigley-Schofield interpretation of the French fertility transition.

Aggregate data of this sort offer no insights into the behavioral mechanisms promoting the observed responses to price shocks. Were they the outcomes of complicated social processes in which no one consciously thought to delay her marriage or to postpone a birth because prices were high, but in which the result was nonetheless built into the system (see, e.g., Lesthaeghe, 1980) ? Or does the aggregate simply reflect the sum of identical individual responses to economic change? These are questions whose answers require very different data and research strategies.

1.8.2 Less-aggregated studies of nuptiality responses

In the discussion of mortality it was asserted that changes in the structure of the economy, not necessarily related to the standard of living, might alter the relationship of mortality to real wages. This is even more true of nuptiality. It is becoming increasingly evident that the spread of rural industry affects marriage behavior (Braun, Mendels, Levine). In light of the increasing importance now being attached to proto-industrialization as an integral part of the process of industrialization (cf. Tilly, 1981), it would be useful to distinguish the influence of rising wages from structural transformation in producing earlier marriage. Did the same behavioral rules produce earlier marriage because earnings rose with rural industry? Or did the rules change, with the new proletariat no longer subject to social control of marriage?

Answering these questions requires a combination of family reconstitution data on individual families and a battery of social and economic information about families and communities. One interesting example of such a study for France is that of Derouet (Derouet, 1980). In examining a largely agricultural village under the Ancien Regime, he finds that it was the journaliers who were most responsive to economic conditions, both in marriage behavior and in mortality rates. The Malthusian system was class-specific. Further studies of this sort, comparing protoindustrial and agricultural communities, would be invaluable.

Without economic data it is still possible to use family reconstitution results to examine some hypotheses about demographic response. For example, one 'story' about the nuptiality valve for agricultural societies is built on the idea of 'ecological niches' (see WS, p.461). This might operate through direct family inheritance or through a social allocation mechanism at the village level. In either case, prospective spouses must await a 'niche' in which to settle. Using a subsample of the INED family reconstitutions, it was possible to examine this mechanism in two ways. First, a regression of son's age at marriage on son's age at death of the father should reveal a positive relationship if private patrilineal inheritance influenced marriage. No such relationship was found among sons in any birth cohort after 1740. Data for the earlier period are not available for this analysis. Secondly, the level of adult mortality in the community ought to influence age at marriage through the rate of niche evacuation. Various village cross-section and cross-section time-series regressions using village aggregates of age at marriage and adult survival rates found no influence of the level or the change in level of adult survival on age at marriage or change in age at marriage for the long marriage cohorts in which the INED village-level data are grouped. The mechanisms by which the observed aggregate responsiveness of nuptiality was obtained are thus still unknown.

1.8.3 Understanding the fertility transition

This paper has been largely concerned with characterizations of the pre-modern demographic regimes in France and England. To some extent this gives a distorted picture of the relative importance of the various questions open to a comparative history of economy and demography. By far the most important single question is why did France have a fertility transition after 1790 and England not until nearly a century later? As with most complex and important historical phenomena, it is often easier to say what the French transition was not than to say what it was. By all the evidence given here, it was not, as suggested by Wrigley and Schofield, a substitution of an effective and direct form of preventive check for an ineffective, indirect one. More research into 19th C. time-series data may reveal some cyclical responsiveness of marital fertility, but such responsiveness is quite beside the point after 1790. The secular decline in fertility that accompanies modernization (with seemingly inexplicable leads and lags) represents a clear break of the Malthusian link between wages and birth rates, just as modern economic growth represents a clear break of the classical link between population and real wages. Family reconstitution provides the opportunity to see this quite clearly. In Fig. 4 the proportion of women having a birth of the indicated order within five years of starting the interval is shown for 1750-1829.

The cycle in birth rates just before the Revolution is replicated at all parities, indicating that cyclical responsiveness does not involve parity-specific control. After 1790, however, the dominant source of fertility variation is attained parity.

It is possible, however, to reject the 'unconscious rationality' model implicit in the Wrigley-Schofield interpretation of France (explicit in Wrigley, 1978 and criticized on theoretical grounds by Lesthaeghe, 1980) without completely rejecting the idea that marital fertility control was substituted for delayed marriage. Van de Walle has made such an argument based on the negative cross-departmental correlation of nuptiality and marital fertility (Van de Walle, 1974). The aggregate time-series evidence for most

Figure 4: Parity-specific fertility in France, 1760-1829

other European countries, particularly England, suggests just the opposite--that delayed marriage and fertility control were complementary strategies in the later declines (Watkins, 1981). Similarly, fertility control in the U.S. seems to have been more effective among later-marriers (David and Sanderson, 1976). Was France unique in this regard, or has the level of aggregation confused the issue? Could the fertility controllers and the early marriers have been different people in the same departments? Ecological data cannot resolve some important issues.

Nor are monolithic models based on a single 'representative individual' appropriate to the task. Not everyone controlled fertility and not in all regions. Every individual may have been 'rational', but they certainly were not all alike. Some had land or capital, others did not. More difficult for the economist, some had aspirations and others did not. And individual behavior is not independent of the behavior of others in society. Elsewhere I have argued that the early French decline can be seen as the demographic aspect of the evolution of a class of proprietors and potential proprietors who become more 'bourgeois' than 'peasant', to use the crudest possible terms, as a consequence of the simultaneous development of a landless class; a proletariat, if you will. This proves to be consistent with much of what is already known and written on the subject, but it is far from proven. Place it first on the agenda for the comparative history of economy and demography in France and England.

Appendix A

CONSTRUCTION OF BASIC DATA SERIES, 1740-1869

A.1 VITAL RATES

For England, the annual data for birth,death, and marriage rates are available in Appendix A3:3, pp. 531-535 of Wrigley and Schofield. Five-year moving averages were constructed directly from the annual figures without weighting. They will, therefore, differ slightly from five-year birth,death, and marriage rates centered on the same year.

For France the procedure involved several additional steps. Annual totals of births deaths, and marriages are given in INED 1975, pp. 52-57. The series corresponding to France in its territory of 1861 were used, for compatibility with the reconstructed population figures at five-year intervals given in pp. 92-93. Published death totals are not corrected for underregistration, and are inappropriate in the given form. Corrected figures are given in INED, 1977, along with vital rates calculated on mean population over each year. These figures were ultimately adopted in place of the 1975 figures for all vital rates. Mitchell(1975) provides vital rates for France that were adopted for the period 1830-1869, after the INED survey data end.

A.2 ADJUSTING DEATHS FOR FLUCTUATIONS IN BIRTHS

Given the high levels of infant mortality relative to adult mortality, an important source of variation in observed death rates will be a structural result of variation in birth rates in current and past years. It will simplify matters to adjust the observed death rates for observed birth rates to eliminate this source of variation. The adjustment formula adopted here is:

$$CDR^*(t) = CDRt - (IMRt * (S*CBRt + (1-S)*CBRt-1))$$

where CDR*(t) = adjusted crude death rate in year t,

CDRt = crude death rate in year t,

CBRt = crude birth rate in year t,

IMRt = infant mortality rate applicable to decade in which year t falls,

S = the separation factor; the proportion of infant deaths occurring within the calendar year of birth.

This specification differs from that used by Lee (WS, ch.9, fn. 7, pp. 357-358) in several respects. The only modification that might not improve the accuracy of the adjustment is that only infant mortality is adjusted for here, while Lee also adjusts for mortality at ages 1-5. He assumes a constant mortality level for these ages throughout the three centuries he studies. Building in changes in child mortality rates would be possible, but would in any case reduce the size of the sample by requiring longer lags in the birth series to construct the adjusted mortality variable. Since most of the structural relationship between births and deaths consists of deaths in the first year of life, this should be an adequate correction.

Saving sample size is a motivation for another, costless modification to Lee's technique. The above formula subtracts the expected volume of infant deaths from observed deaths, to produce an adjusted mortality variable with a mean level equal to that of the non-infant death rate, but retaining variations due to annual deviations of the infant death rate from its trend (decadal average). Lee subtracts only the deviation in death rates due to deviations in birth rates, leaving the level of adjusted death rates equal to that of observed rates on average. Leaving aside the issue of child mortality, the two approaches are identical except that Lee adds back in an eleven-year moving average of infant deaths centered on year t (IMR times an eleven-year moving average of births). For the analysis of short-run fluctuations around eleven-year moving averages, this will have no effect except to shorten the sample.

Lee uses fifty-year averages of the infant mortality rate, based on a limited and unrepresentative sample of parish reconstitutions. But a more flexible and representative estimate of infant mortality is directly available (WS, p.230,714). Back projection provides a life table for each quinquennial period from which infant mortality rates can be inferred. This was done by decade for comparability with the available INED decadal life tables for France, 1740-1829 (INED, 1975). Two advantages result. Trend changes in infant mortality have a smoother effect on adjusted deaths when changes occur every ten years instead of every fifty. And the English adjustments are made consistent with the aggregate results of Wrigley and Schofield's reconstruction, which suggest higher levels of infant mortality than is revealed by family reconstitutions uncorrected for underregistration (WS, pp. 248-253). In order to estimate infant mortality for France in decades after 1829, when only crude death rates are available, an estimate of the elasticity of infant mortality with respect to changes in the CDR was obtained for 1780-1829 and then used to project the rates for 1830-1869. Because crude death rates do not change much in that period, this is little different from assuming infant mortality constant as Lee does. The estimates are:

1830-39	.179
1840-49	.165
1850-59	.169
1860-69	.160

Finally, Lee uses a separation factor based on ad hoc assumptions about the proportion of infant deaths in the first month of life (50% up to 1700, then declining linearly to 33% in 1850). using Bourgeois-Pichat's biometric formula, the remaining deaths can be distributed over the remaining eleven months. This results in separation factors from .735 to .675. But an examination of the INED family reconstitutions (Weir, 1981) and English parish registers (Wrigley, 1977) suggests that a figure of 50% in the first month is appropriate even at the end of the 18th century for recorded deaths in both countries. Since underregistration is likely to be more severe in the first month, this is probably an underestimate. Calculations from the INED sample (yielding a life table quite close to that of Wrigley, 1977 for the 1780's. i.e., about half the deaths in the first month and three quarters after five months) suggest a separation factor of .74 as an average of the whole period 1740-1829. This figure was adopted as a constant for the whole of this study. More precise intertemporal and international variants will require substantial new efforts at studying infantile mortality, while the changes are not likely to be of great consequence to the analysis at issue here.

A.3 FRENCH WHEAT PRICES, 1670-1739

The starting point for any study of national wheat prices in France remains Labrousse's classic *Esquisse du Mouvement des Prix et des Revenus* (Labrousse, 1932). From 1756 to 1790 he was able to construct a truly representative national series based on reports from each of the 32 generalites of France and the city of Paris. From the monetary reform of

1726 to 1755 he constructed a series based on partial coverage of less than half the generalites, but was careful to check this limited sample against the national results 1756-1790 and found that the agreement was quite close. He also offered figures going back to 1700, with considerably less confidence in their real value during a turbulent financial period. Since that time, several important new local price series have been published, making up for the unavailability, to this American researcher, of some of the series used by Labrousse. If the data are different, the method is intuitively similar to that of Labrousse, but brought into the modern era of computerized statistical analysis. Instead of guessing at the proper weights for the various local series and then checking the results against the standard 1756-1790, it was possible to estimate the weights in a linear regression in which short-run fluctuations in Labrousse's national series 1740-1790 were the dependent variable, and short-run fluctuations in each of the local series were entered as independent variables. The coefficients were then used to 'predict' fluctuations in national prices 1670-1739 from the local series. The equation predicting national fluctuations 1740-1789 from the ten local series available fit quite well; R2=.90. It is not possible to produce from this procedure a national price series indicating levels, trends, or real values of wheat prices. From the standpoint of many traditional historians of prices, then, all the interesting features have been removed. What remains is only that which is relevant to the study of short run fluctuations.

In order to implement the procedure, it was necessary to restrict the sample of local price series to those for which data were continuously available between 1670 and 1790. This eliminated, for example, the important study by Baulant and Meuvret (1962) of the Paris market, because the mercuriale they report ended in 1698. Fortunately, the focus on short run fluctuations makes it possible to exploit what has been the most consistent strength of local price studies: direct reporting of prices in local currencies and measures. In this way, many of the critical debates centering on conversions to metallic currencies can be avoided (see, e.g., Bloch, 1937, Meuvret, 1944). The local price series used were:

Locality	Source
Toulouse	Freche, 1967, pp. 85-91 Units: livres per setier Modifications: none.
Pontoise	Dupaquier, et. al., 1968, pp. 40-99 Units: livres per setier Modifications: Simple annual mean of the reported quarterly data. Missing data for 1670-1676 were replaced with data for Chaumont, a very close series.
Strasbourg	Hanauer, 1878, pp. 94-101 Units: rezals Modifications: none.
Poitiers	Raveau, 1930, pp. 360-365. Units: livres Modifications: none.

St. Etienne	Gras, 1910, pp. 230-270. Units: sols per boisseau. Modifications: Data from 1726 in livres and sous re-expressed in sols.
Paris	Hauser, 1936, pp. 107-112. Units: livres per setier. Modifications: Extended from 1774 to 1789 with data for the city of Paris in Labrousse (1932).
Angers	Hauser, 1936, pp. 258-262. Units: sous per boisseau. Modifications: none.
Grenoble	Hauser, 1936, pp. 365-371. Units: sous per quartal. Modifications: Extended from 1780 to 1789 with data for the generalite of Grenoble in Labrousse (1932).
Buis-les-Baronnies	Hauser, 1936, pp. 337-342. Units: sous per eymine. Modifications: none.
Romans	Hauser, 1936, pp. 419-424. Units: livres per setier. Modifications: none.

A.4 REFERENCE TABLES

TABLE 10

Basic data series: France, 1740-1869

Year	CBR	CMR	CDR	CDR*	Price
1740	39.5	8.6	38.7	27.00	12.25
1741	40.3	8.1	43.8	31.93	14.18
1742	37.8	9.3	40.1	28.71	10.69
1743	40.6	10.8	43.9	32.09	7.82
1744	41.5	9.9	34.4	22.18	7.57
1745	41.0	8.8	32.3	20.12	7.62
1746	40.5	8.4	37.2	25.17	9.39
1747	38.6	8.2	48.8	37.22	12.04
1748	37.4	7.8	42.8	31.63	13.72
1749	39.6	8.7	38.6	27.04	12.46
1750	39.0	8.9	36.7	25.85	11.49
1751	39.7	9.5	31.7	20.75	11.67
1752	39.0	8.1	34.4	23.54	13.25
1753	40.4	9.4	38.2	27.11	11.85
1754	40.7	9.1	37.8	26.54	11.17
1755	40.6	9.4	34.2	22.94	8.54
1756	43.1	9.3	33.3	21.54	9.58
1757	40.4	7.9	32.1	20.71	11.89
1758	40.4	8.8	36.8	25.60	11.27
1759	39.9	8.3	40.6	29.51	11.76
1760	39.2	8.1	35.0	23.89	11.77
1761	40.7	7.4	37.6	26.23	10.00
1762	38.2	7.6	37.6	26.64	9.91
1763	38.7	7.8	36.6	25.72	9.53
1764	38.6	8.9	34.5	23.60	10.01
1765	39.9	8.7	36.7	25.54	11.16
1766	39.0	9.2	36.9	25.83	13.27
1767	39.5	9.0	38.8	27.69	14.32
1768	37.4	7.7	35.3	24.59	15.51
1769	39.8	8.8	29.5	18.45	15.38
1770	37.8	7.2	29.8	19.33	18.82
1771	36.5	6.5	33.1	23.04	18.16
1772	36.8	7.6	37.2	27.17	16.65
1773	36.8	7.9	35.7	25.65	16.44
1774	37.8	8.2	34.4	24.15	14.57
1775	37.8	8.2	34.6	24.28	15.89
1776	37.3	9.2	30.1	19.88	12.91
1777	39.5	8.8	30.8	20.17	13.36
1778	36.3	7.7	30.6	20.46	14.67
1779	37.3	8.6	41.3	31.18	13.59
1780	38.2	9.3	36.4	25.84	12.59
1781	38.1	9.1	36.5	25.90	13.45
1782	37.8	8.2	38.7	28.16	15.26
1783	37.2	8.2	38.0	27.61	15.02
1784	37.6	8.9	35.7	25.27	15.33
1785	38.9	9.2	37.7	26.97	14.83
1786	39.8	9.2	36.7	25.70	14.13

1787	39.2	8.7	35.0	24.05	14.16
1788	38.7	8.3	34.9	24.10	16.09
1789	37.5	7.7	33.4	22.88	21.92
1790	37.4	7.8	32.3	22.71	19.45
1791	35.9	8.70	34.7	25.40	16.22
1792	36.7	8.90	36.2	26.85	22.09
1793	36.2	11.60	36.5	27.19	19.14
1794	38.3	11.50	45.2	35.53	19.14
1795	36.7	8.50	34.2	24.69	19.14
1796	35.8	8.70	29.9	20.67	19.14
1797	37.7	9.50	28.4	18.87	19.48
1798	37.2	10.70	27.1	17.54	17.07
1799	36.3	9.00	28.0	18.64	16.20
1800	34.4	6.50	29.4	21.96	20.30
1801	32.9	7.20	27.0	19.90	22.61
1802	32.9	8.00	28.9	21.89	25.19
1803	32.2	7.00	32.9	26.00	23.38
1804	31.7	7.50	34.4	27.62	18.72
1805	33.0	7.80	28.5	21.54	19.49
1806	31.8	7.20	28.3	21.46	19.28
1807	31.9	7.70	30.1	23.31	18.85
1808	32.4	8.00	28.6	21.72	16.50
1809	32.7	9.00	28.2	21.25	14.86
1810	32.0	8.20	26.0	19.59	19.68
1811	32.0	7.00	26.4	20.03	26.17
1812	30.7	7.80	32.7	26.52	34.41
1813	32.7	13.70	34.3	27.89	22.51
1814	35.1	6.50	33.6	26.73	17.73
1815	33.4	9.20	28.5	21.76	19.53
1816	34.3	8.70	25.8	19.02	28.31
1817	31.9	6.60	26.3	19.82	36.16
1818	31.2	7.30	25.5	19.25	24.65
1819	33.4	7.20	27.1	20.56	18.42
1820	32.4	7.20	25.6	19.68	19.13
1821	31.8	7.20	24.4	18.61	17.79
1822	32.1	7.50	25.6	19.80	15.49
1823	31.2	8.50	24.0	18.31	17.52
1824	31.9	7.70	25.1	19.35	16.22
1825	31.3	7.60	25.1	19.40	15.74
1826	31.8	7.90	25.6	19.86	15.85
1827	31.0	8.10	24.8	19.15	18.21
1828	30.6	7.80	25.6	20.04	22.03
1829	30.3	7.40	24.8	19.30	22.59
1830	30.2	8.40	24.8	19.38	22.39
1831	30.6	7.60	24.4	18.94	22.10
1832	28.9	7.50	28.4	23.14	21.85
1833	29.9	8.10	24.6	19.29	16.62
1834	30.2	8.30	27.7	22.30	15.25
1835	30.2	8.40	24.6	19.19	15.25
1836	29.6	8.30	22.4	17.07	17.32
1837	28.3	8.00	25.4	20.27	18.53
1838	28.8	8.20	24.2	19.06	19.51
1839	28.5	8.00	22.8	17.68	22.14
1840	27.9	8.30	23.7	19.07	21.84

1841	28.5	8.25	23.2	18.52	18.54
1842	28.5	8.15	24.0	19.29	19.55
1843	28.2	8.25	23.1	18.43	20.46
1844	27.5	8.00	22.0	17.43	19.75
1845	27.9	8.05	21.1	16.51	19.75
1846	27.3	7.60	23.2	18.66	24.05
1847	25.4	7.05	23.9	19.62	29.01
1848	26.5	8.25	23.6	19.27	16.65
1849	27.7	7.85	27.4	22.88	15.37
1850	26.8	8.35	21.4	16.83	14.32
1851	27.1	8.00	22.3	17.73	14.48
1852	26.8	7.85	22.6	18.05	17.23
1853	26.0	7.80	22.0	17.57	22.39
1854	25.5	7.50	27.4	23.06	28.82
1855	25.0	7.85	26.0	21.75	29.32
1856	26.3	7.85	23.1	18.71	30.75
1857	25.9	8.15	23.7	19.30	24.37
1858	26.7	8.45	24.1	19.62	16.75
1859	27.9	8.15	26.8	22.13	16.74
1860	26.2	7.90	21.4	17.13	20.24
1861	26.9	8.15	23.2	18.92	24.55
1862	26.5	8.10	21.7	17.44	23.24
1863	26.9	8.00	22.5	18.21	19.78
1864	26.6	7.90	22.7	18.43	17.58
1865	26.5	7.85	24.7	20.45	16.41
1866	26.4	8.00	23.2	18.97	19.61
1867	26.2	7.85	22.7	18.49	26.19
1868	25.7	7.85	24.1	19.96	26.64
1869	26.0	8.25	23.6	19.45	20.33

TABLE 11

Basic data series: England, 1740-1869

Year	CBR	CMR	CDR	CDR*	Price
1740	33.7	8.2	31.1	24.52	45.1
1741	31.2	7.3	34.7	28.48	41.5
1742	30.8	8.2	36.7	30.67	30.2
1743	33.9	9.0	29.0	22.54	22.1
1744	34.0	8.9	25.0	18.37	22.1
1745	34.1	8.2	25.2	18.55	34.4
1746	33.2	8.0	27.9	21.38	34.7
1747	32.8	8.7	28.6	22.18	31.0
1748	33.7	8.5	28.6	22.07	32.9
1749	32.8	8.3	26.8	20.35	32.9
1750	34.8	8.4	27.5	21.60	28.9
1751	34.2	8.1	26.3	20.39	34.2
1752	33.0	8.1	25.4	19.67	37.2
1753	33.9	8.3	24.8	19.00	39.7
1754	33.7	7.9	25.4	19.59	30.8
1755	34.2	8.4	25.2	19.34	30.1
1756	33.6	8.6	25.7	19.89	40.1
1757	31.7	7.4	26.2	20.66	53.3
1758	31.4	8.1	27.4	21.98	44.4
1759	33.7	9.2	27.3	21.60	35.2
1760	33.6	9.8	26.4	20.07	32.4
1761	34.8	9.8	26.5	20.01	26.8
1762	34.4	8.8	31.3	24.81	34.7
1763	33.4	9.4	32.4	26.07	36.1
1764	35.1	9.5	27.2	20.68	41.5
1765	35.4	9.0	26.1	19.45	48.0
1766	33.6	8.8	30.0	23.59	43.1
1767	33.9	8.3	29.5	23.14	57.3
1768	33.8	9.0	27.8	21.44	53.8
1769	35.5	9.5	27.2	20.60	40.6
1770	36.7	9.4	28.6	22.30	43.6
1771	35.2	9.0	27.2	21.04	50.5
1772	35.7	9.0	27.3	21.14	58.3
1773	36.1	8.7	27.6	21.37	59.0
1774	34.9	8.8	24.8	18.70	55.5
1775	36.5	8.6	25.9	19.65	51.2
1776	36.1	8.8	24.6	18.33	42.7
1777	37.0	9.0	26.2	19.83	49.1
1778	36.9	8.9	25.9	19.51	44.1
1779	36.9	8.5	28.0	21.61	36.3
1780	36.1	9.0	29.0	22.35	43.4
1781	35.5	8.5	29.7	23.17	52.6
1782	34.9	8.3	28.4	21.98	54.0
1783	34.8	8.7	29.3	22.92	54.0
1784	35.3	8.7	28.5	22.06	54.0
1785	37.5	9.8	27.3	20.54	48.3
1786	38.5	9.0	26.7	19.70	41.9

1787	37.3	8.8	25.8	18.91	45.5
1788	39.1	8.8	26.8	19.73	49.1
1789	37.9	8.4	25.6	18.60	56.2
1790	39.4	8.8	25.8	19.12	56.5
1791	38.4	8.6	25.4	18.78	50.2
1792	40.4	9.1	25.9	19.08	44.4
1793	39.2	8.9	28.4	21.64	50.9
1794	38.2	8.3	26.9	20.32	54.0
1795	38.4	7.5	29.1	22.54	77.6
1796	37.9	8.5	25.1	18.59	81.1
1797	39.8	8.7	27.2	20.47	55.4
1798	39.3	9.1	24.9	18.15	53.5
1799	37.6	8.2	25.1	18.59	71.2
1800	36.6	7.4	26.7	20.43	116.6
1801	33.9	6.9	28.1	22.21	123.3
1802	39.0	9.7	27.0	20.59	72.0
1803	41.3	10.0	28.4	21.48	60.7
1804	41.6	9.1	24.6	17.54	64.3
1805	40.9	8.3	23.9	16.91	92.6
1806	40.4	8.0	23.2	16.30	81.6
1807	40.1	8.6	26.1	19.26	77.7
1808	39.8	8.0	25.9	19.12	83.9
1809	38.6	7.7	24.7	18.08	100.4
1810	39.5	7.7	27.9	21.34	109.8
1811	40.0	8.4	26.5	19.84	98.3
1812	39.1	8.0	24.8	18.23	130.5
1813	40.1	7.7	23.8	17.14	113.2
1814	40.5	8.7	26.1	19.35	76.7
1815	44.3	9.0	25.1	17.86	67.7
1816	42.2	8.4	26.0	18.86	81.0
1817	41.9	7.7	24.8	17.78	100.0
1818	40.8	8.1	25.7	18.83	89.1
1819	40.1	7.7	24.9	18.17	76.9
1820	39.8	8.3	24.0	17.77	70.0
1821	40.9	8.1	23.4	17.06	57.9
1822	41.9	8.4	23.6	17.10	46.0
1823	40.8	8.3	24.6	18.19	55.0
1824	39.9	8.1	24.2	17.93	65.9
1825	39.6	8.7	24.3	18.11	70.7
1826	39.5	7.9	24.2	18.03	60.6
1827	37.3	7.4	22.8	16.89	60.4
1828	38.5	8.5	21.8	15.84	62.3
1829	35.7	7.3	22.1	16.41	68.3
1830	35.6	7.3	20.7	15.32	66.2
1831	35.2	7.9	22.5	17.16	68.4
1832	35.2	8.1	23.0	17.68	60.6
1833	36.8	8.4	21.8	16.30	54.6
1834	36.0	8.1	22.3	16.83	47.7
1835	35.6	7.9	22.0	16.60	40.5
1836	35.8	8.1	21.7	16.30	50.0
1837	35.3	7.5	22.8	17.45	57.6
1838	35.2	7.7	22.7	17.38	66.6
1839	36.3	7.9	22.3	16.86	72.9
1840	36.1	7.8	23.3	17.69	68.4

1841	36.0	7.7	22.0	16.41	66.3
1842	35.6	7.4	22.1	16.56	59.0
1843	35.5	7.6	21.6	16.09	51.7
1844	35.6	8.0	22.0	16.48	52.8
1845	35.0	8.6	21.3	15.85	52.4
1846	36.1	8.6	23.4	17.84	56.4
1847	33.7	7.9	25.0	19.67	72.0
1848	34.7	8.1	23.4	18.06	52.1
1849	35.2	8.1	25.4	19.96	45.6
1850	35.7	8.7	21.0	15.48	41.5
1851	36.4	8.7	22.1	16.48	39.7
1852	36.4	8.7	22.1	16.45	42.1
1853	35.2	9.0	23.0	17.49	54.9
1854	36.0	8.6	23.6	18.05	74.7
1855	35.7	8.1	22.8	17.25	77.1
1856	36.4	8.4	20.6	14.98	71.4
1857	36.1	8.3	21.8	16.19	58.1
1858	35.3	8.0	23.1	17.59	45.6
1859	36.6	8.5	22.4	16.77	45.2
1860	35.8	8.6	21.2	15.83	54.9
1861	35.9	8.1	21.6	16.25	57.1
1862	36.2	8.0	21.3	15.91	57.2
1863	36.4	8.4	22.9	17.48	46.2
1864	36.5	8.6	23.6	18.16	41.5
1865	36.4	8.7	23.1	17.67	43.1
1866	36.2	8.8	23.3	17.89	51.5
1867	36.4	8.3	21.7	16.28	66.4
1868	36.6	8.0	21.8	16.35	65.8
1869	35.5	7.9	22.1	16.76	49.7

TABLE 12

Basic data series: France, 1670-1739

Year	Births	Marriages	Deaths	Prices
1670	1448	291	914	.
1671	1680	387	727	.
1672	1566	340	678	.
1673	1675	296	738	.
1674	1594	300	822	.
1675	1593	317	795	1.165
1676	1553	334	1298	1.040
1677	1669	391	679	1.070
1678	1466	290	752	1.123
1679	1435	325	965	1.141
1680	1598	370	1003	1.036
1681	1483	383	978	1.078
1682	1583	330	767	0.996
1683	1597	347	755	0.899
1684	1531	334	913	1.040
1685	1499	354	909	1.025
1686	1500	321	821	0.872
1687	1462	333	747	0.808
1688	1554	364	869	0.631
1689	1452	317	820	0.664
1690	1656	340	885	0.841
1691	1452	326	953	1.049
1692	1462	300	983	1.141
1693	1403	263	1315	1.590
1694	1081	304	1724	1.580
1695	1547	460	881	0.716
1696	1587	404	706	0.654
1697	1545	288	501	0.785
1698	1619	312	525	1.124
1699	1455	247	688	1.485
1700	1603	348	718	1.167
1701	1676	395	785	0.879
1702	1632	420	754	0.888
1703	1646	404	702	0.894
1704	1651	419	747	0.827
1705	1696	408	1022	0.806
1706	1686	419	768	0.727
1707	1793	367	954	0.638
1708	1695	322	837	0.834
1709	1469	175	1415	1.796
1710	1132	242	1430	1.242
1711	1543	417	795	0.852
1712	1510	375	886	1.087
1713	1381	305	793	1.368
1714	1371	332	666	1.242
1715	1617	314	634	0.775
1716	1574	342	561	0.706
1717	1567	320	562	0.642

1718	1639	327	724	0.715
1719	1592	420	1082	1.016
1720	1576	400	892	1.391
1721	1661	323	807	0.861
1722	1623	309	708	0.934
1723	1634	384	769	1.123
1724	1712	402	979	1.137
1725	1701	324	720	1.134
1726	1667	374	754	1.009
1727	1686	446	776	0.960
1728	1732	375	833	0.868
1729	1647	382	1007	0.986
1730	1748	367	891	0.954
1731	1715	346	953	1.100
1732	1829	291	960	0.844
1733	1722	379	978	0.929
1734	1732	463	790	0.945
1735	1741	361	878	0.982
1736	1879	254	709	0.986
1737	1799	252	734	0.948
1738	1667	294	849	1.030
1739	1662	290	979	1.036

Notes: Sources and methods of construction are described in the text and the appendix. Deaths refer to deaths of persons age 5 and above, prices refer to an index of short-run fluctuations in wheat prices.

TABLE 13

Estimated equations: French CBR, 1747-1865

Fertility

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		.913	.642	1.620
		(.309)	(.264)	(.388)
CBR	1	.043	.165	-.403
		(.180)	(.181)	(.220)
	2	.219	.157	-.089
		(.180)	(.180)	(.182)
CDR*	0	-.033	.014	-.074
		(.040)	(.041)	(.035)
	1	-.040	.011	-.024
		(.034)	(.043)	(.038)
	2	.055	.011	.024
		(.033)	(.039)	(.031)
	3	-.015	.053	.021
		(.032)	(.035)	(.033)
Prices	0	-.085	-.047	-.021
		(.040)	(.028)	(.021)
	1	-.083	-.061	-.109
		(.055)	(.033)	(.027)
	2	.100	.074	.048
		(.054)	(.035)	(.035)
	3	-.075	-.020	.005
		(.042)	(.032)	(.025)
R-square		.47	.51	.76

TABLE 14

Estimated equations: French CMR, 1747-1865

Nuptiality

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		1.107 (.385)	1.186 (.397)	1.230 (.393)
CMR	1	.428 (.178)	-.161 (.178)	-.290 (.211)
	2	-.117 (.193)	-.290 (.169)	-.091 (.195)
CDR*	0	-.077 (.121)	.444 (.227)	-.062 (.064)
	1	.079 (.101)	.141 (.256)	.054 (.066)
	2	-.024 (.099)	-.047 (.225)	.130 (.058)
	3	.025 (.095)	.222 (.198)	.088 (.064)
Prices	0	-.485 (.122)	-.476 (.161)	-.126 (.036)
	1	.222 (.181)	.340 (.202)	.010 (.059)
	2	.030 (.169)	-.447 (.211)	.007 (.059)
	3	-.192 (.127)	.085 (.184)	-.018 (.041)
R-square		.47	.38	.66

TABLE 15

Estimated equations: English CBR, 1747-1865

Fertility

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		1.720	.677	.763
		(.384)	(.366)	(.283)
CBR	1	-.185	r.044	r.205
		(.183)	(.184)	(.204)
	2	-.136	.193	.098
		(..175)	(.211)	(.188)
CDR*	0	-.103	.015	-.092
		(.050)	(.0810	(.060)
	1	-.123	.039	.043
		(.054)	(.061)	(.055)
	2	.068	.108	.078
		(.057)	(.061)	(.057)
	3	-.031	.088	-.045
		(.047)	(.0670	(.062)
Prices	0	=.069	=.128	=.041
		(.024)	(.031)	(.030)
	1	-.117	-.033	-.013
		(.030)	(.042)	(.037)
	2	.022	.003	.045
		(.034)	(.040)	(.038)
	3	-.046	-.004	-.043
		(.027)	(.036)	(.031)
R-square		.69	.69	.35

TABLE 16

Estimated equations: English CMR, 1747-1865

Nuptiality

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		1.001	1.117	1.451
		(.289)	(.358)	(.266)
CMR	1	-.030	-.033	.508
		(.152)	(.200)	(.158)
	2	-.165	-.157	-.346
		(.152)	(.200)	(.158)
CDR*	0	-.013	-.059	-.267
		(.085)	(.152)	(.121)
	1	.144	.161	.216
		(.092)	(.126)	(.111)
	2	.209	.154	-.070
		(.095)	(.128)	(.105)
	3	.003	.024	-.341
		(.083)	(.042)	(.110)
Prices	0	-.193	-.220	-.090
		(.044)	(.064)	(.056)
	1	-.029	-.033	-.057
		(.057)	(.085)	(.067)
	2	-.029	.046	.071
		(.059)	(.088)	(.074).
	3	.100	.001	-.079
		(.044)	(.069)	(.061)
R-square		.69	.65	.54

TABLE 17

Estimated equations: French CDR, 1747-1865

Adjusted Mortality

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		1.369 (.288)	.377 (.228)	.982 (.262)
CDR*	1	.306 (.143)	.616 (.164)	-.077 (.184)
	2	-.373 (.137)	-.212 (.151)	-.161 (.166)
Prices	0	-.180 (.186)	.148 (.126)	.141 (.100)
	1	.179 (.232)	-.075 (.146)	-.182 (.128)
	2	.185 (.238)	.358 (.143)	.320 (.128)
	3	-.485 (.190)	-.207 (.134)	-.029 (.112)
R-square		.41	.48	.29

TABLE 18

Estimated equations: English CDR, 1747-1865

Adjusted Mortality

Explanatory variable	lag	1747-1789	1790-1829	1830-1865
Constant		1.053	.769	.983
		(.201)	(.194)	(.246)
CDR*	1	.358	.265	.213
		(.161)	(.165)	(.177)
	2	-.261	-.060	-.173
		(.146)	(.163)	(.179)
Prices	0	-.022	.138	.058
		(.083)	(.084)	(.097)
	1	-.023	-.156	-.137
		(.098)	(.097)	(.119)
	2	-.016	.231	.236
		(.094)	(.096)	(.120)
	3	-.089	-.185	-.182
		(.076)	(.084)	(.099)
R-square		.23	.30	.22

TABLE 19

Estimated equations: France, 1678-1734

Explanatory variable	lag	Dependent variable: Deaths	Births	Marriages
Constant		.323 (.183)	1.569 (.261)	1.057 (.258)
Lag of dep. variable	1	.444 (.135)	-.179 (.142)	.307 (.151)
	2	-.072 (.127)	-.028 (.142)	-.345 (.148)
Deaths	0		-.084 (.040)	-.061 (.105)
	1		-.037 (.043)	.310 (.107)
	2		.029 (.038)	-.080 (.102)
	3		-.044 (.034)	-.001 (.099)
Prices	0	.452 (.109)	-.073 (.036)	-.207 (.091)
	1	-.023 (.142)	-.133 (.043)	-.069 (.105)
	2	-.071 (.138)	.027 (.046)	.033 (.111)
	3	-.048 (.112)	-.051 (.036)	.061 (.099)
R-square		.50	.63	.54

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