The Economic History of Britain since 1700

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In sum, then, the possible reasons for economic growth in the eighteenth century are many. The acceleration of productivity change (calculated in section 2) appears to have been more important than the acceleration of saving and investment. Yet productivity change does not fall from heaven. It can itself be, as argued here, a consequence of economic growth, especially of (if it were known for sure that the economy was at less-than-full employment) demand. And demand had many sources. With this array of possibilities in mind, we turn in the chapters following to the details of the story.

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British population in the eighteenth century

R. D. LEE & R. S. SCHOFIELD

The evidence

At the beginning of the eighteenth century the economy of Britain, still predominantly agricultural, was subject to sharply diminishing returns to labour. Population increase at more than a modest pace would send real wages tumbling, as it had in the sixteenth and seventeenth centuries. A doubling of population had then depressed real wages to perhaps 40 per cent of their previous level (Phelps-Brown and Hopkins 1956; Lee 1973 and forthcoming). By the early nineteenth century, however, British population was growing at an unprecedented rate, and the economy was able to absorb the expanding labour force with little change in living standards. Were these accelerations in the growth of population and the demand for labour coincidental? Did population grow in response to the demands of an expanding economy, or was the economy stimulated by the demands of increasing populations? After more than a century of research, these still remain the major interpretive issues of eighteenth-century British population history.

Part of the difficulty in resolving the issues stems from the shakiness of the available data; the first task, therefore, must be a review of the facts and their sources. The sources, and the information which they give, relate either to England and Wales or to Scotland. We shall concentrate in this chapter on England and Wales, since Scotland has been fully discussed in Flinn et al. *Scottish Population History* (1978). For comparison, however, the first British census in 1801 after some adjustment gives a population size for England and Wales of 9.16 million, and for Scotland 1.60 million. For the beginning of the eighteenth century we are on less solid ground. For Scotland, Deane and Cole (1967: 6) give figures of 1.04 million in 1701 and 1.25 million in 1751, but these are based on a venerable source, Sir John Sinclair, *Analysis of the Statistical*

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Account of Scotland (1825: 149); Flinn et al. discuss their accuracy but do not provide alternatives. For England and Wales, Gregory King estimated the population of 1695 to be 5.5 million, based on hearth tax returns. Glass reanalysed the available portions of King's data and arrived at the lower figure of 4.9 million (Glass 1965a: 203). Taking this as a lower bound, he then suggested 5.2 million as a plausible revision of King's estimate. Hollingsworth (1969) and Chambers (1972) have concurred that 5.2 million, or perhaps less, is a reasonable figure.

These enumerations provide benchmarks for the beginning and end of the eighteenth century. For the intervening period, historians have had to rely principally on the 'parish registers', which are lists of baptisms, burials and marriages maintained by the clergy. The way these have been used, and the attendant difficulties, have been the subject of detailed scholarship, but the main outlines are as follows.

John Rickman, director of the British censuses from 1801 to 1841, arranged for all parishes in England and Wales to report to him the numbers of baptisms, burials and marriages recorded in their registers for certain dates: for baptisms and burials, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780 and every year thereafter; for marriages, every decade as above, but annually from 1754 on. If net migration in or out of England and Wales was negligible, if Rickman's count of baptisms and burials accurately reflected the numbers of births and deaths, and if the decadal years were demographically representative, one could (as many have) estimate eighteenth-century population by counting back from the census of 1801: to find the population in 1800, subtract births and add deaths occurring in 1800; to find the population in 1799, subtract the births and add the deaths from 1799 to the estimate for 1800; and so on. Earlier in the century, one multiplies each isolated figure of births and deaths by ten. All estimates of population in the eighteenth-century have been obtained in essentially this way, but only after some adjustment to overcome the deficiencies of Rickman's raw numbers.

There are four possible deficiencies: (1) the decadal years chosen by Rickman may be atypical; (2) baptisms and burials may have gone unregistered; (3) parishes may have failed to respond, or their records may have been lost or inaccurately summed by Rickman's clerks; (4) the growth of nonconformity at the end of the eighteenth century may have led to an increasing amount of under-registration of deaths by the Anglican registers (see Krause 1965). Recent work by Razzell (1972) and Wrigley (1975 and 1976a) goes far towards resolving points (2) and (3). Points (1) and (4) will be dealt with below.

For the past 175 years the study of eighteenth-century population at the national level has depended on Rickman's evidence, deficiencies and all. In recent years, the reworking of it by Brownlee has been most widely accepted. For informative surveys of work on eighteenth-century population based on Rickman's series, the reader is referred to Glass (1965b), Tranter (1973a), Flinn (1970), Wrigley (1976a), Ohlin (1955), and several articles in Drake (1969). Brownlee's work provides estimates of population size and crude vital rates (numbers of births, deaths and marriages per 1000 population). Yet the most useful demographic estimates have remained unavailable: the size of each age group, the age-specific fertility rates and mortality rates, and summary measures such as total fertility rates and life expectancy.

New evidence, fortunately, is at hand, assembled since 1964 by the Cambridge Group for the History of Population and Social Structure with the help of hundreds of local volunteers. Their efforts have led to the collection of data from 404 parishes with registers of good quality, representing about one sixteenth of the total population. Some of the registers span the entire period from 1538 (when Thomas Cromwell ordered their compilation) to 1840 (when civil registration of vital events became effective). Most of the parishes covered began registration by 1560, 90 per cent by 1610, and all by 1662. The work which has been done with this material is important in itself and as an example of demographic study, and it is therefore worth recounting in detail.

Each parish register was first scanned for obvious short-term gaps and registration deficiencies, and these were made good by interpolation. Since the 404 parishes were not drawn as a strictly random sample, their distributions across a number of standard social and economic characteristics were compared to the distributions obtained from a stricly random sample of parishes. The 404 parishes turned out to be representative of most characteristics – for example geographical spread and the proportions of the populations employed in agriculture, manufacturing and commerce as defined in the 1831 census. However, they were found to include too many parishes with large populations and too few with small ones. In order to avoid any consequent bias from this source, the parishes were divided into a number of population size-groups and the total numbers of baptisms, burials and marriages ('vital events' or simply 'events') recorded in each size-group were re-weighted to correct for the biased size-distributions of the parishes before being aggregated together to form an overall total. These overall totals were then corrected for under-registration in two ways. First the numbers of baptisms and burials that were missing because children died very young (before they could be baptised) were estimated from studies of infant mortality and from the results of 'family reconstitution' by which all possible family trees in a single community are reconstructed from the parish registers. Second, the numbers of events missing for other reasons, for example because of nonconformity or poor registration, were estimated for the early nineteenth century by adjusting the national totals of births, marriages and deaths as recorded in Rickman's survey of all parish registers using the totals implied by the age information contained in the early nineteenth-century censuses. While the under-registration due to late baptism can be estimated

independently at all dates, this second catch-all category of under-registration can only be estimated directly for the early nineteenth century. For earlier periods the levels estimated for around 1800 were tapered off back through the eighteenth century following the curve described by the numbers of events recorded in nonconformist registers during this period. Finally the vital events recorded in the set of 404 parishes, adjusted in the ways just described, could be inflated to produce 'national' totals because they were found to comprise a constant proportion of the national totals of events collected by Rickman for sample years in the eighteenth century, producing a ratio which matched the ratio between the total population of the 404 parishes and the national population enumerated in the 1811 Census. A further adjustment was made to take account of changes in the proportion of the national total of events contributed by London, which was not represented in the set of 404 parishes and which had a very different ratio between baptisms and burials.

Thus the frequencies of baptisms, burials and marriages as originally recorded in the parish registers have passed through several stages of correction, each of which involves a risk of error. Nonetheless, the new estimates enable us to push our knowledge of population back on a continuous basis about two centuries further than is currently possible for any other country.

The dimensions

Population size

Because the new data give baptisms and burials for every year while Rickman's series gave them for only one year in each decade, the new data series can be used to check the representativeness of the years for which Rickman's data are available. Let us suppose, for the moment, that the new series provided data only for the Rickman years (1700, 1710, etc.), and that we based a population estimate upon it. Assuming these years were typical, we would conclude that between 1700 and 1740 population actually *declined* by about 215000. If we now calculate the population change using *all* the available years, we find a population increase of about 660000 people over this same forty year period, 1700 to 1740. The years chosen by Rickman, in other words, had atypically low growth, and treating them as representative leads to a very substantial underestimate of population growth for the first half of the eighteenth century

Figure 2.1 plots estimates of population size based on the new data (with the older estimates by Brownlee) for the years 1695 to 1801. The actual estimates are given in table 2.1. Clearly the agreement is very close from 1740 to 1840, but as indicated above, the Brownlee estimates show stagnation while the new estimates show growth for 1701 to 1740. Thus, while Brownlee puts the figure for 1701 at 5.83 million, the new estimate has it as 5.29 million. For 1695, the new data suggest a figure of 5.18 million, which agrees very well with the contemporary reappraisals discussed above of Gregory King's estimate.

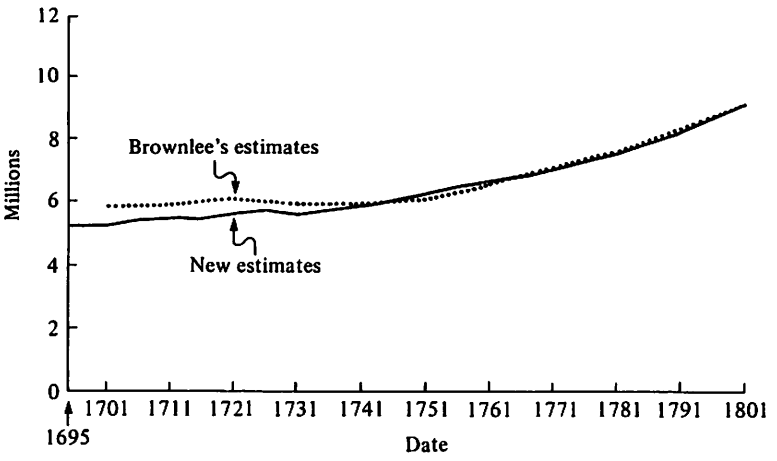

Figure 2.1 Population size in eighteenth-century England and Wales. Source: See text.

Table 2.1. *Estimates of population size and growth for England and Wales* 1695–1801

	Population size (millions)		Growth rate since preceding date (% year)	
Date	Brownlee	New estimates	Brownlee	New estimates
1695	—	5.18	—	—
1701	5.826	5.29	—	0.35
1711	5.981	5.51	0.26	0.41
1721	6.001	5.66	0.03	0.27
1731	5.947	5.59	−0.09	−0.13
1741	5.926	5.94	−0.04	0.62
1751	6.140	6.20	0.35	0.42
1761	6.569	6.62	0.68	0.66
1771	7.052	6.97	0.71	0.51
1781	7.531	7.57	0.66	0.83
1791	8.247	8.21	0.91	0.82
1801	9.156	9.16	1.05	1.08

Source: For Brownlee's estimates, Deane and Cole (1967: 6). The new estimates are derived from a preliminary version of the Cambridge Group's aggregate data, and are subject to revision; for details, see text.

The revision of the population estimates for the first half of the eighteenth century may seem inconsequential, but it is not. The widely accepted view that population stagnated during this period has played an important role in the construction of other statistics and in the interpretation of economic changes

in the eighteenth century. Brownlee's estimates suggested an average growth of population of 0.05 per cent/year for 1701 to 1740, contrasted with 0.73 per cent/year for 1741 to 1800. The new estimates suggest 0.30 per cent/year for the first period, and 0.71 per cent/year for the second. Thus, while the growth rate did more than double between periods, the contrast is considerably less striking than was previously believed. Both the new estimates and the old assume that net migration from England and Wales was negligible over the century. Current research by the Cambridge Group questions this assumption and may lead to further revisions of the population estimates.

Age structure

The total size of a population is useful for many purposes, but it may mask important variations in age composition. The new data may be used in conjunction with a new technique which estimates age structure and vital rates (the numbers of births, deaths and marriages in relation to the number in the population in which they took place) from series of births and deaths (see Lee 1974, and Brunborg 1976). The combination of data and technique makes it possible to provide quinquennial estimates of age-group size, total fertility rates, and life expectancy for eighteenth-century England. Using the new method it is possible to estimate the population in each age group at five year intervals throughout the eighteenth century, based on the observed flows of births and deaths into and out of the population. The estimated age structures are conveniently portrayed by 'population pyramids'. Figure 2.2 shows these for 1700, 1750, and 1815, along with a pyramid for England and Wales in 1973 for purposes of contrast. The left and right hand sides of the pyramids show the male and female populations with the proportionate size of the age-group indicated by the length of the horizontal bar. For the eighteenth century it is assumed that half the population at each age was female; for 1973, the actual age–sex distribution is shown.

A comparison of the 1973 age pyramid with the others indicates that the early populations had relatively many young people and few old ones. This is a characteristic feature of preindustrial populations, primarily reflecting their higher birth rates, and not, as one might expect, their higher death rates. The pyramids also show that the population was considerably younger in 1815 than in 1700 or 1750, again a consequence of fertility differences. The economic implications of these age structures will be discussed later.

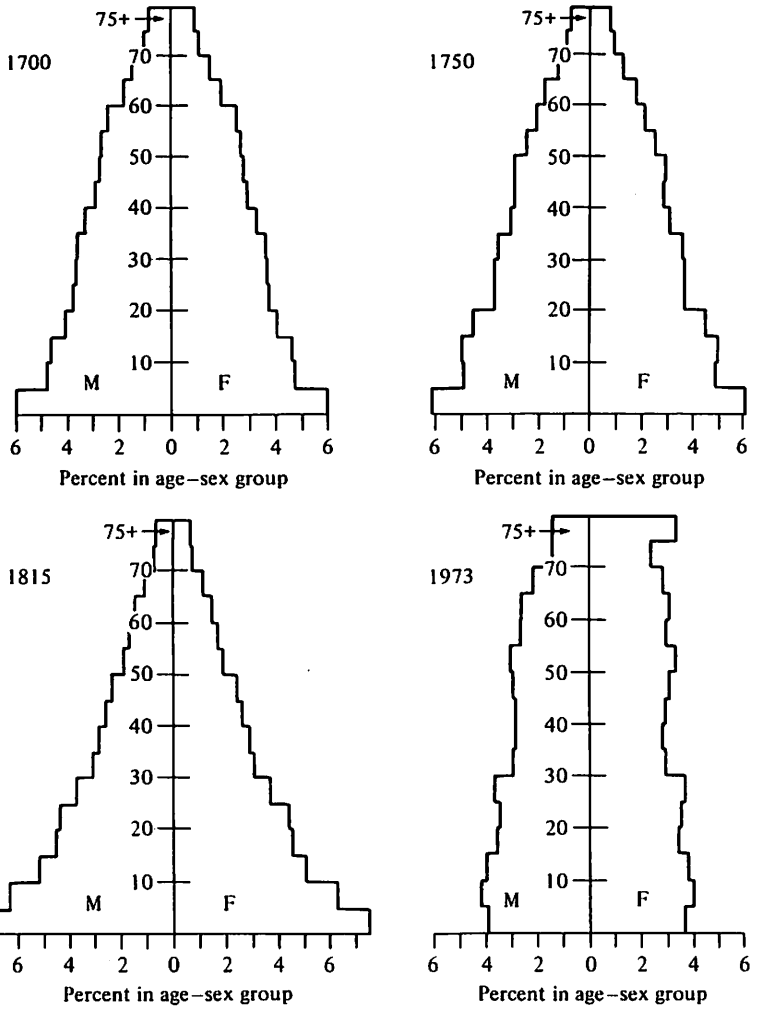

Figure 2.2 Population pyramids for England and Wales. Source: See text.

Mortality

As well as the population size, age structure and rate of growth, it is also of great interest to know the vital rates. Although it is easiest to calculate what are called 'crude' rates, by dividing vital events by the total population size, these rates depend very much on the age structure of that population; 10 or 60 year old males, for example, sire few children. It is therefore worth calculating measures which are pinned to a particular age, such as life expectancy at birth, or the marriage rate of 20 year olds; these are known as 'age-specific' rates.

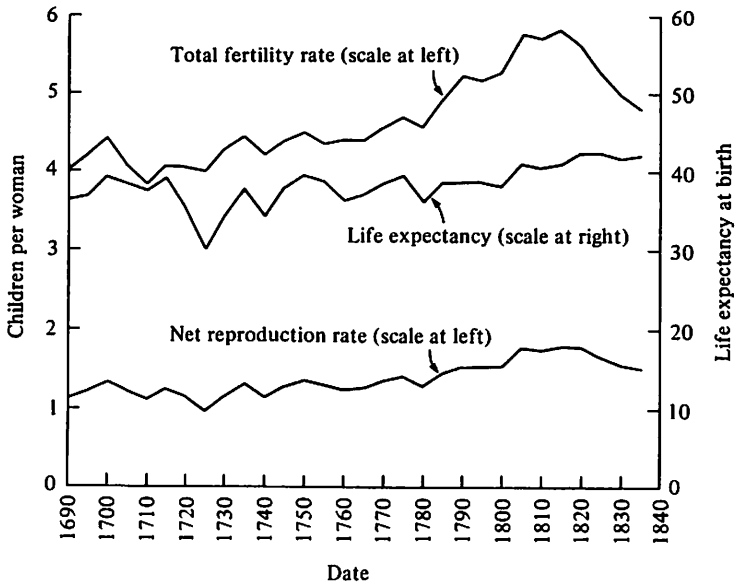

Figure 2.3 Fertility and mortality in England and Wales 1690–1839. Source: See text. Notes: (1) Figures are plotted at the initial date of the 5-year interval; e.g. 1690 means 1690–94. (2) 'Life expectancy at birth' is the average numbers of years someone could expect to live at birth in view of the then prevailing chances of dying at each age. (3) 'Total fertility rate' is the number of children the average woman could expect to have throughout her life. (4) 'Net reproduction rate' is the ratio of children to parents implied by the prevailing rates of fertility and mortality. A rate over 1.0 indicates that the population is growing.

Estimates of life-expectancy at birth during the eighteenth century are given in figure 2.3. According to these estimates, eighteenth-century life expectancy stayed in the mid-to-high thirties except for a drop to 30 in the 1720s. After 1800 it rose to the low forties where it remained until the late nineteenth century. These estimates are tentative; nonetheless, comparison with the experience of other national populations suggests that they are unlikely to be far wrong either in levels or in the timing of change. Figure 2.4 plots the results for England and Wales together with decennial estimates for France, 1740–1830, and quinquennial estimates for Sweden, 1750–1830. Aside from some specifically Swedish crises, such as the Finnish War of 1808–9 and ensuing epidemics, the level and trend of the English and Swedish life expectancies agree remarkably well. Similarly, although the level of life expectancy for French females is consistently about five years lower, the trend is nearly identical to England's. These comparisons show that there is nothing bizarre about the mortality estimates for eighteenth- and early-nineteenth-century England.

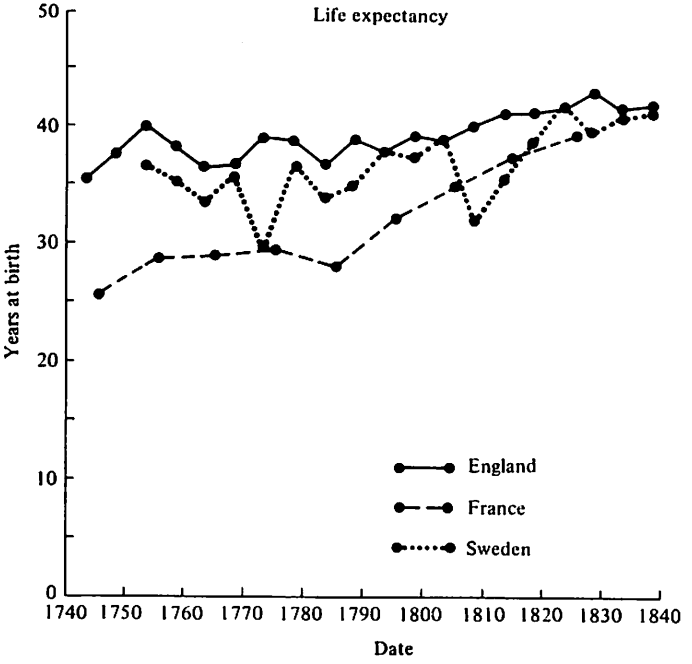

Fig. 2.4 Life expectancy in France, Sweden, and England 1740 to 1840. Note: French data are for females only; English and Swedish data are for both sexes. Observations are plotted on the midpoint of each interval. Source: France (Blayo, 1975; 141) ; Sweden (Bolander *et al.*, 1970: 81, 84); England (see text).

There were large variations in mortality over time. Preindustrial populations were afflicted by 'demographic' crises, that is, sharp rises in mortality and falls in conceptions and marriages. In earlier centuries such crises were often connected with harvest failures, as they continued to be in eighteenth-century France; but by the same period in England they were more usually the result of epidemics and thus largely independent of the state of the economy (Chambers (1972: 77–106; Wrigley, 1969: 62–76). The English population experienced two such crises in the first half of the eighteenth century: one from 1727 to 1730, with deaths peaking at 80 per cent above normal in 1729; another in 1740 to 1742, with deaths peaking in 1742 at about 40 per cent above normal. Although in both instances grain prices were high, they were not strikingly so, and neither of these was a pure 'subsistence' crisis of the old type. Contemporary medical observers reported a wide variety of diseases, almost all of which were airborne infections, including all manner of fevers, smallpox, chickenpox and whooping cough (Short 1967: 84). The epidemics lasted considerably longer than was usually the case with an epidemic caused by a single disease, and in those areas

where epidemics occurred they affected a far higher proportion of parishes than was usually the case, up to three-quarters of the city parishes and just over one half of the country parishes. On a wider canvas, Holland like England experienced the worst epidemic mortality of the eighteenth century in the same years, some parts of France were affected while others were not, while Scandinavia and much of the rest of Europe escaped altogether (van der Woude 1972: 205; Imhof 1976, vol. I: 77; Reinhard et al. 1968: chs. 10–13). After the first half of the century there continued to be minor crises from time to time, but the catastrophic crises were gone for good (Schofield 1972). The attenuation of crisis mortality in the eighteenth century was a general European pattern, and may well have been a major factor in the widespread improvement of life expectancy.

Fertility

Just as life expectancy is a pure measure of mortality, so the 'total fertility rate' is a pure measure of fertility, relatively unaffected by changes in the population age structure or mortality. The total fertility rate is defined as the sum across all ages of the age-specific birth rates; it therefore gives the number of children the average woman would have if she survived to the age of forty-five and experienced the current average fertility throughout her life. It is conceptually close to 'completed family size'; averaged over all surviving women, including spinsters, at the end of their reproductive years. Estimates of the total fertility rate are plotted in figure 2.3 above. They differ from Brownlee's estimates in suggesting less increase between 1700–39 and 1740–79, and more in the nineteenth century; they are consistent with the view (Krause 1965) that changes in the under-registration rates concealed the true demographic behaviour.

The naive view of fertility before modern contraception is that it was at the biological maximum. It was not. The biological maximum to the total fertility rate is about eleven children per woman, and fertility in eighteenth-century England amounted to less than half of this. The question is how society achieved limited fertility.

To answer this question we must distinguish between the effects of age, of marriage and of fertility within marriage. The new data from the Cambridge group do not allow us to do this directly, so we must turn to other methods. Information on age at marriage is available from two sources: marriage licences and family reconstitutions of individual parishes. Both have their drawbacks: the former are biassed in favour of high social status and education, while the latter generally only cover those who marry in the parish in which they were born. Yet some points stand out clearly in table 2.2. First, the average age at marriage of women was high, between 24 and 27 years, and thus on average women who married could have children (legitimately, at least) only during two-thirds of the

Table 2.2. *Age at first marriage* 1550–1849

Period	Males	Females
1550–1599	27.2	24.8
1600–1649	28.1	26.0
1650–1699	28.2	26.6
1700–1749	28.1	27.0
1750–1799	27.1	25.4
1800–1849	26.5	24.3

Note: The figures are unweighted averages of mean age at first marriage for a collection of 10 parishes (9 for 1550–99). The parishes are Alcester (Warwickshire), Aldenham (Hertfordshire), Banbury (Oxfordshire), Bottesford (Leicestershire), Colyton (Devonshire), Gainsborough (Lincolnshire), Hartland (Devonshire), Hawkshead (Lancashire), Shepshed (Leicestershire), Terling (Essex); Hawkshead was not included for 1550–99.
Source: Wrigley 1976b.

years during which they were potentially able to do so. In addition, about 10 per cent of women never married at all. Here England was entirely typical of most of northwest Europe: this 'West European marriage pattern' (Hajnal 1965) accounts for the relatively low levels of fertility to be found in preindustrial European communities compared with traditional societies elsewhere in the world.

Fertility in the preindustrial world was overwhelmingly marital, although eighteenth-century England did witness a striking increase in extra-marital fertility, from just under 2 per cent of all births around 1700 to 6 percent of all births around 1800 (see Laslett and Oosterveen 1973). Changes in the age of marriage would have had considerable impact on fertility levels. Information on changes in the age of marriage is difficult to acquire. For example, the marriage licences so far collected do not provide any information on ages at marriage for the same area at different dates, so changes over time cannot be inferred from them. The family reconstitution studies are some help, but so far few of these have been completed. Nevertheless, the 10 parishes which are listed in table 2.2 experienced a fall in the average age of marriage of women of about 2.7 years between the early eighteenth and the early nineteenth centuries. This is a very small number of parishes, but each of them experienced a fall in the age of marriage, although they differed greatly in location and economic characteristics. Moreover, an additional 2.7 years is easily enough to add one extra child to the four which the total fertility rate (figure 2.3) shows to have been the average at the beginning of the eighteenth century. It appears, therefore, that there was a fall in the age of marriage of women, and that this was an important factor in the increase in the total fertility rate.

Regional variations in population growth

We have so far concentrated on the national population trends, but there were important local variations. Mortality, for example, was much higher in towns than in the country, and seaports were particularly unhealthy (Wrigley 1969: 96–8); London required a perpetual stream of immigrants from rural areas to offset her deficit of births over deaths (Wrigley 1967). By contrast, fertility appears to have been higher in the industrialising north-west than elsewhere. Deane and Cole (1967: ch. 3) note that population growth was more rapid in industrial and commercial counties than in agricultural ones, and more rapid in the north-west than in the south-east. They also find that the more rapid growth of the industrial and commercial areas was caused not as one might suppose by migration, but rather by 'natural increase', i.e. the excess of births over deaths. The higher natural increase, in turn, was due to high birth rates rather than low death rates.

Appealing as these results are to historians interested in the connections between population trends and industrialisation, they must be regarded with caution until they are tested against better evidence. The estimates by Deane and Cole depend on the Rickman series in a particularly demanding way, subtracting one error-ridden series from another to infer migration. In addition, nonconformist religions were stronger in some areas, especially industrialising areas, than in others, causing differential underestimation of the true fertility and marriage patterns by figures, such as Rickman's, based on the statistics collected by the Anglican church. Migration itself affects the age structure and the vital rates in both the sending and the receiving areas (see chapter 21). Regrettably the Cambridge Group has as yet collected data for too few parishes to make a reasonable estimate of population for individual counties, though it may ultimately be possible to make estimates for broad regions or economic categories such as 'agricultural', 'industrial', or 'commercial'. In the meantime, the description and analysis of English population in the eighteenth century must remain largely based on national averages.

The effects of population growth

Real wages and the burden of children

The largest and most obvious effect of the sharp rise in population in the eighteenth century was on the national average wage of labour. Labour is one of the factors of production. When it grows in supply more rapidly than the others, its relative price (the real wage) will fall, unless productivity change is sufficiently rapid. The pace of innovation and capital formation was apparently high enough in eighteenth-century England to allow a growth rate of labour of the order of 0.4 to 0.6 per cent per year with constant real wages (Lee, 1979; compare chapters 1 and 7). Slower growth than this (as in the first half of the

century) allowed real wages to rise; faster growth (as in the second half) depressed them sharply. The logic of the argument is reinforced by the truth of another of its implications. The increase in the labour force relative to agricultural land would have increased the value of land and increased rents. Prices of agricultural goods therefore would rise more than prices of manufactured goods, since agricultural production was relatively land intensive and manufacturing labour intensive. True to these predictions, in the first half of the century the ratio of industrial to agricultural prices rose and in the second half it fell (see Lee 1979). During the second half of the eighteenth century, then, population grew more rapidly and the evidence on wages (imperfect though it is) indicates a decline in the real wage of labour. At the same time, per capita income rose quite markedly (see chapter 1 and Deane and Cole, 1967: 78). On the face of it, these opposite trends suggest a redistribution of income away from labourers and towards landowners and capitalists. Whether a redistribution of family income actually occurred depends in part on whether the children and wives of labourers increased their work enough to offset the decline in wage rates (chapter 9).

The connections between population increase and wages therefore seem clear. But it must be remembered that not all members of the population are workers, although they are all consumers. In the long run, population size and labour supply move roughly together; in the short run, however, changes in the average age and in the work supplied at each age ('labour force participation') allow some divergence of the two. An unusually large number of births, for example, will increase population without affecting the labour force for about fifteen years. Estimates of age structure can be used to adjust population size for changes of this sort, and thereby to get a better indication of changes in the labour supply. In principle, each age group can be multiplied by a weight reflecting its contribution to production, that is, average hours worked times wages per hour. Such age-specific weights are usually expressed as a proportion of the productivity of a prime age adult. The sum of all population age groups, weighted in this way, is called the number of 'equivalent adult producers'. Unfortunately such weights are not available for eighteenth-century Britain, but a set of weights representative of a contemporary developing economy (see Mueller 1976) was used to calculate in a rough way the number of equivalent adult producers as a proportion of the total population at five-year intervals from 1700 to 1840. Since a fixed set of weights was used, changes in labour force participation are not taken into account; only changes in age structure can affect the outcome. The calculated proportions of equivalent adult producers are constant from 1700 to 1750 and thereafter begin to decline steadily. From their peak in 1730 to their trough in 1820 they decline by about 11 per cent. Because of rising fertility, that is, the number of children grew more rapidly than the number of workers.

Consumption does not grow in strict proportion to the population, of course,

since children consume less than adults. To summarise the effect of change in the age structure on consumption, it is convenient to calculate the total number of 'equivalent adult consumers' just as for production. Fixed consumption weights representative of Western Europe around 1900 were used (Mueller 1976). The proportion of equivalent adult consumers in the total population declined by about 5 per cent from its peak in 1730 to its low point in 1820. Combining the results on consumption with those on production implies an increase in the ratio of consumers to producers of 11 per cent minus 5 per cent, or 6 per cent down to 1820. The upshot is that changes in the age structure of the population, due primarily to its higher fertility late in the century, did increase the consumption pressure on the typical worker. The increase, however, was small, and could easily have been swamped by the unmeasurable changes in participation in the labour force.

The level and composition of demand

The effect on labour supply is one side; the effect on the demand for goods is the other. As the population grows, so does aggregate income and aggregate demand, creating a buoyant and less risky environment for investors and entrepreneurs, and stimulating the demand for investment goods. Population growth may therefore encourage economic growth more than might be expected from the growth in labour supply alone (see e.g. Keynes 1937). A well-known economist has suggested that 'perhaps the whole Industrial Revolution of the last two hundred years has been nothing else but a vast secular boom, largely induced by the unparalleled rise in population' (Hicks 1939: 302n). The logic and evidence for this view were treated in chapter 1. Here we may mention the effect of population growth not on the aggregate level of consumption, but on the distribution of consumption between agricultural and industrial goods (John 1967a; Eversley 1967; Tranter 1973a). The influence, unfortunately, operates in two opposite ways: through changes in income per head and through changes in relative prices. Poor people spend a high share of their incomes on food. As income rises, the share falls: one says that the 'income elasticity' of expenditure on food is less than one, a proposition known as Engel's Law. As the share of food declines, the share spent on industrial commodities rises. The demand for industrial goods therefore depends not only on total national income but also on the number of consumers, i.e. on how many poor people there are. While population growth does raise total income and demand, it typically reduces real wages or average income. And because the allocation of demand between the industrial and agricultural sectors depends on average income, it may be that on this count the population growth of the eighteenth century diverted demand from the industrial sector rather than stimulating it.

On the other hand, as we have seen, by depressing wages and raising land rents

population growth made manufactured goods (using labour intensively) cheaper in comparison with agricultural goods. On this count, people would have substituted manufactured for agricultural consumption. In short, the net effect of population growth on the demand for industrial commodities is unclear, and the question whether population growth increased or decreased the home demand for manufactured commodities in the eighteenth century remains unresolved (although see Ippolito 1975). The conclusion is by now familar: economic reasoning and statistical fact narrow the possible range of interpretation, but do not always end the debate.

Causes of population growth in the eighteenth century

As with the consequences, so with the causes. The historical debate has centred on whether eighteenth-century population growth was caused by economic growth or merely happened to coincide with it (Habakkuk 1965; Deane and Cole 1967). The debate has often degenerated into one over whether the rise in population was caused by a rise in birth rates or a fall in death rates, the notion being that one or the other was itself economic in cause. Many writers have realised that the demographic facts alone could not determine whether this notion was true (Marshall 1929; Habakkuk 1965; Deane and Cole 1967). Nevertheless, the behaviour of the demographic facts is a convenient place to start.

From 1700 to 1739, population grew at an average annual rate of 0.3 per cent; from 1800 to 1839, it grew at 1.45 per cent. The new estimates from the Cambridge Group assign a clearly dominant role to the birth rate, which accounts for about 70 per cent of the increase in population growth rates. If the birth rate had remained unchanged, the declines in the death rate would have boosted annual growth rates to about 0.7 per cent per year in the early nineteenth century, a significant increase but far short of the actual.

The arithmetic dominance of fertility is reinforced by a comparison with the rest of Europe, which was also increasing in population. Over the eighteenth century as a whole the growth rate of population in England and Wales was not notably high even if the frontier populations of Finland and Eastern Europe are excluded from the comparison. Only at the very end of the eighteenth century and the beginning of the nineteenth did the population of England and Wales grow distinctly more rapidly than those of other European countries away from the frontier (see Dupâquier 1976: 190; Wrigley 1969: 152–6; Tranter 1973a: 43). But it was precisely in these years that fertility, as we have seen (figure 2.3 above) increased dramatically. Fertility, then, not mortality, was the peculiar feature of England's experience.

Most writers have emphasised a decline in mortality rather than an increase in fertility as the cause of the eighteenth-century population rise, and have

pointed to cheaper transport reducing the consequences of local harvest failure; fortunate improvements in climate; a reduction in the virulence of diseases; medical advances, especially the spread of smallpox vaccination (Razzell 1965); improved nutrition through new agricultural techniques and the spread of cheap food crops such as the potato. The few writers who emphasise an increase in fertility in the eighteenth century have pointed to the increased chances for marriage and subsistence that agricultural advance afforded, supplemented by earnings from 'proto-industry', or the development of cottage industry. Both sides of the debate tend to assume a smooth decline in mortality or a smooth rise in fertility. The new data complicate the issue. A hypothesis explaining the rise in fertility must now accommodate a decline in fertility after 1815; one explaining the fall in mortality must accommodate 50 years of ups and downs in the death rate between 1700 and 1750, followed by 50 years of stagnation, followed in the first 20 years of the nineteenth century by a rapid fall, followed again by a further half century of stagnation.

And in any case an 'explanation' of falling mortality or rising fertility must recognise that the connections of causation betwen population and other things (especially the economy) are mutual. The potato could make dense population possible, but dense population could make the potato necessary; the beginnings of industrialisation could cause early marriage and high fertility, but high fertility could provide the cheap labour for further industrialisation. The connections are complex, and require a simplified view of the main ones. The modern view among economists and demographers is a simplification of the thoughts of parson Malthus, built on three behavioural relationships and one truism about four variables: the wage (called w in what follows), the population (N, for 'numbers'), the birth rate (b), and the death rate (d) per thousand population. First, for familiar reasons, the wage falls when population rises. Second, since resistance to disease depended in part on nutrition, the death rate rises when the wage falls. Third, since in Western Europe couples did not in general marry without a sufficient livelihood, marriage and therefore the birth rate rise when the wage rises (Wrigley 1966; Lee 1973, 1974, 1978 and forthcoming). Finally as a truism, present population is (in the absence of migration) the result of past differences between the birth rate and the death rate.

The system which is comprised of these three relationships is portrayed in figure 2.5. The top panel shows the positive relation ($b(w)$) of the birth rate to wages, and the negative relation ($d(w)$) of the death rate to wages. At the intersection of these curves, the growth rate (equal to $b-d$) is zero, and the population has no tendency to change. The wage that corresponds to zero growth is the long-run equilibrium wage, or 'natural price of labour'; it is labelled w^* on the horizontal axis.

The lower panel of figure 2.5 shows – in the solid curve labelled $w(N)$ – the negative relation of wages to population; this curve represents the 'demand for

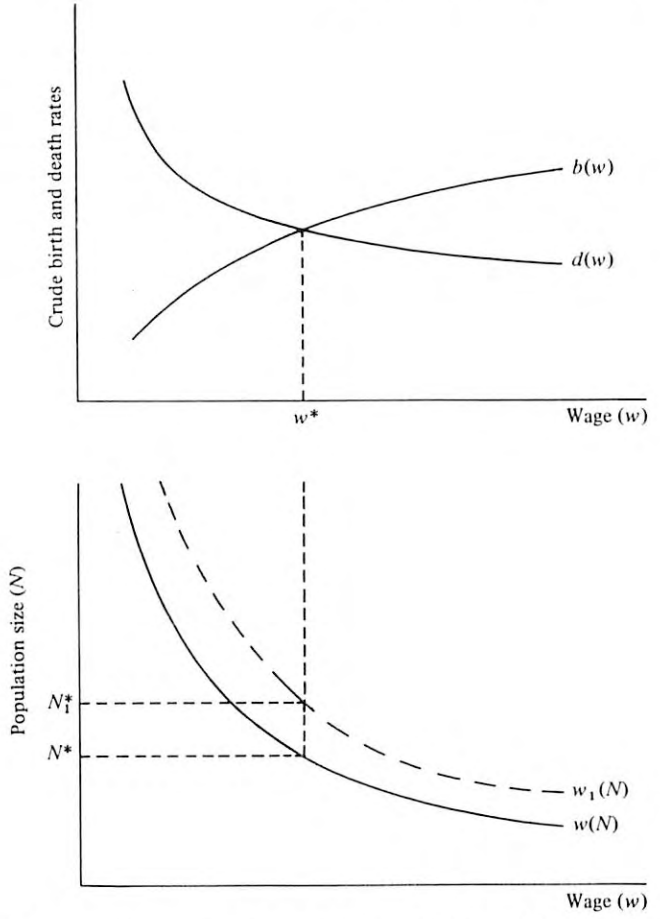

Figure 2.5 Demographic equilibrium before and after a shift in the demand for labour.

labour', or the amount of labour demanded at each real wage. There is a population size N measured on the vertical axis which corresponds to each wage on the horizontal axis; the exact correspondence is established by the curve $w(N)$; only if the population happens to be N^* will it be consistent with the zero-growth wage w^*, and therefore only when it is at N^* will the population have no tendency to change. If a society started with a population other than N^*, the population would rise or fall towards N^*. At a population below N^*, for example, the implied wage (read from $w(N)$) would be larger than w^*; in the top panel, this would imply that the birth rate would exceed the death rate, and population (in the bottom panel) would rise until the higher N^* and the lower w^* were achieved.

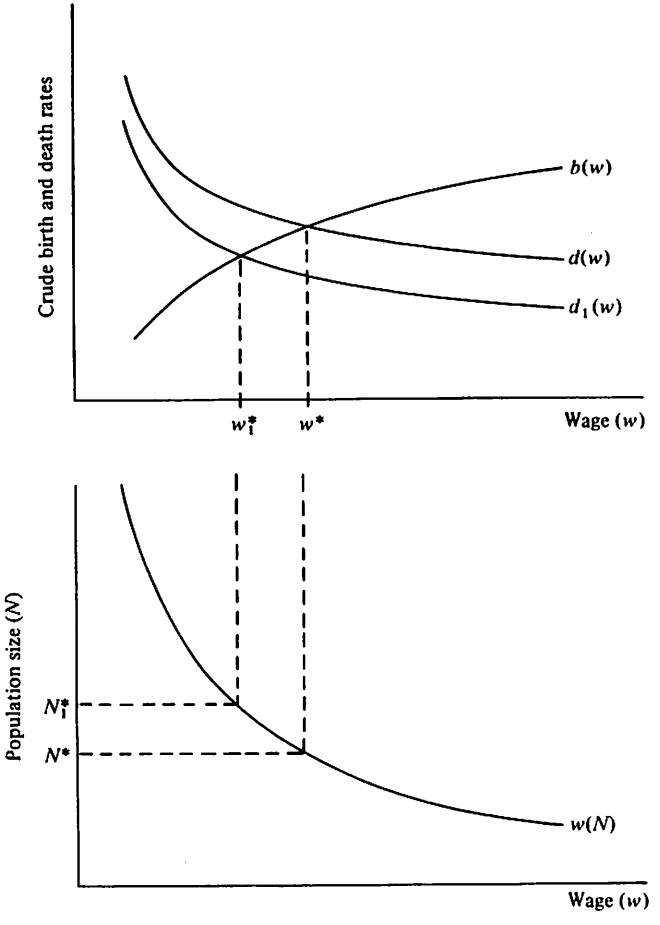

Figure 2.6 Demographic equilibrium before and after a shift in mortality.

Now consider the effect of an increase in the demand for labour, resulting, say, from investment in agriculture. This can be represented as an outward (i.e. away from the origin) shift in the curve in the lower panel, as indicated by the dotted line $w_1(N)$ in figure 2.5. The initial effect of such a shift is to raise wages, as the old population N^* intersects with $w_1(N)$ at a point further to the right than it intersects with $w(N)$, and thereby stimulate population growth. Note, however, that none of the relationships in the upper panel have changed, so the ultimate equilibrium wage is unaltered. We would expect that soon population would grow to its new equilibrium, N^*, and the wage would return to its old equilibrium, w^*. Even though the demand for labour has increased, the workers do not benefit in the end. This illustrates the 'iron law of wages' of the classical

economists, and the circumstances of England before the industrial revolution. Only sustained economic growth, pushing the demand curve out again and again, can benefit the working population more than temporarily. Only the frenetic pace of economic life since the eighteenth century has prevented the iron law from taking effect.

Figure 2.6 shows the effect, within the same framework of relationships, of an autonomous fall in the death rate, such as appears to have occurred towards the end of the eighteenth century and at the beginning of the nineteenth. Look at the top panel. At each level of the real wage (measured along the horizontal axis) the death rate (measured along the vertical axis) is lower. The effect, therefore, of a fall in the death rate as shown by an inward movement of the curve from $d(w)$ to $d_1(w)$ is to lower the equilibrium wage to w_1; population size increases at the expense of wages, while fertility falls somewhat in response to the decline in wages. Note that in this case the system responds so as to bring birth rates and death rates back to equality, but at a level lower than before. The effect of an autonomous upward shift in the fertility curve would be similar, and closer to the events of the late eighteenth century.

The most important point which stems from this model is that a decline in the death rate or rise in the birth rate, if it were 'exogenous' or caused outside the system of relationships depicted here, would cause population growth, but not *sustained* population growth. With such exogenous shifts, the birth and death rates would converge to equality again at a lower wage, as in figure 2.6. But toward the end of the eighteenth century the two rates did not converge; instead they diverged, resulting in the population explosion of the early nineteenth century. Apparently the demographic changes were not purely exogenous. Yet neither were they purely 'endogenous' or determined within the system. Sustained economic growth would have increased the wage, leading (endogenously) to rising birth rates and falling death rates. But in fact wages did not increase markedly in the late eighteenth and early nineteenth centuries; indeed several wage series suggest a decline (Phelps Brown and Hopkins 1956; Deane and Cole 1967: 19–21; von Tunzelmann 1979; chapter 9 below).

Neither purely exogenous nor purely endogenous, the causes of population change were a mixture of the two. On the one hand, the schedules of birth and death rates (the top panel in the figures) moved apart, producing growth at the existing wage; on the other, the demand for labour (the bottom panel) moved out vigorously enough to keep wages from falling even though the population was growing. By such fortunate events did the nation avoid the immiseration that accompanied population growth among less fortunate neighbours (Ireland in particular) and in earlier times (Marshall 1929: 248; Deane and Cole 1967: 134; Lee 1978).