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DISEASE AND DEVELOPMENT: HISTORICAL AND CONTEMPORARY PERSPECTIVES †

Urbanization, Mortality, and Fertility in Malthusian England

By Gregory Clark and Neil Cummins*

The modern world is the product of two momentous changes: the Industrial Revolution of 1800, which brought sustained efficiency advances in economies, and the Demographic Transition of 1900, which channeled those efficiency advances mainly into increased income per capita, instead of increases in population. How these revolutions were connected has been a persistent unsolved puzzle in the history of growth. The Demographic Transition was achieved without any improvement in contraceptive technologies from those of 1800 and earlier. It was a possibility for all preindustrial societies. Why did it occur only after the Industrial Revolution?

The key component of the Malthusian economy which reigned before 1800 was a rise in net fertility, numbers of surviving children, with a rise in income. Yet a standard feature of the modern world is a decline of fertility with income. Theories of economic growth that do not simply invoke an exogenous shift in fertility preferences must reconcile these divergent demographic behaviors into a common objective shared by pre- and postindustrial parents. This has been done, for example, by assuming a subsistence consumption minimum that has to be achieved before children can be born, so that for a range of incomes just above the minimum, the fertility-income relationship is positive, yet for higher incomes it becomes neutral or negative (Oded Galor and David Weil 2000; Robert E. Lucas 2002; Galor and Omer Moav 2002). This assumption is at variance with the experience of countries like preindustrial England, however. Before 1800, as Figure 1 shows, wealth was strongly positively correlated with net fertility, even at incomes which were high by the standards of the Demographic Transition era of the late nineteenth century. Men with incomes from assets of £500 a year before 1800, who had on average five surviving children at death, would also be rich by the standards of 1900. It is also possible that the quality-quantity trade-off in children somehow became steeper after the Industrial Revolution (Gary Becker, Kevin Murphy, and Robert Tamura 1990). But again, the evidence from preindustrial England is for greater wage premia attached to education and training before 1800 (Clark 2005). And in a society where ownership of such assets as land was the most important source of income, more surviving children meant smaller bequests of assets to each, even more surely than more children reduce potential educational investments per child in the modern world.

For this reason, *A Farewell to Alms* (Clark 2007) argued that we could best explain high net fertility among the rich in the preindustrial world as a response to high child mortality rates. As Figure 2 shows the decline in net fertility was much less than that of gross fertility between the preindustrial and modern world. Thirty percent of children born in England before 1840, for example, were dead by age 15 (E. A. Wrigley et al. 1997, 250). With a lag of several generations the Industrial Revolution greatly reduced child mortality. Between 1886 and 1911 child mortality had fallen substantially, to 22 percent or less (Michael Haines 1995, 302). That mortality decline occurred first in the higher social classes, which also first reduced their gross fertilities. During the 1886–1911 period, mortality declined by only 16 percent for professional and clerical workers, but by 25 percent for unskilled manual workers (Haines 1995, 302).

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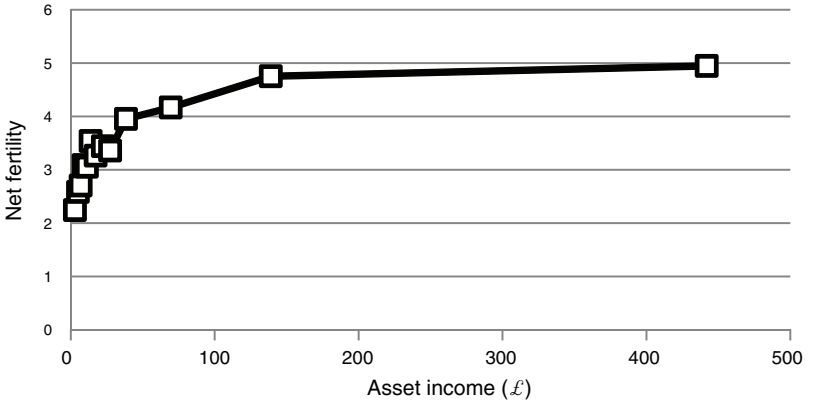

FIGURE 1. ASSET INCOME AND NET FERTILITY, 1500–1800

Note: Number of surviving children at time of will as a function of wealth.

Source: Clark and Cummins (2008).

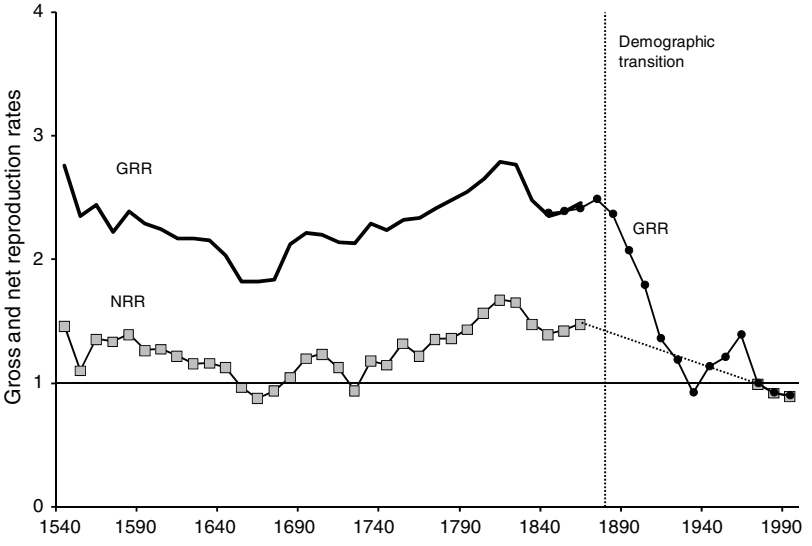

FIGURE 2. NET AND GROSS FERTILITY, ENGLAND, 1540–2000

Notes: GRR = gross reproduction rate; NRR = net reproduction rate.

Source: Clark (2007, fig. 14.6).

Perhaps, then, desired completed family size was always relatively low—two children or so. But in seeking to maximize the chances of at least one surviving child, preindustrial families chose high gross fertility rates. In the case of richer families, this also resulted in high rates of net fertility. Because of poorer health and nutrition, and lower economic resources, the poor in the preindustrial era were unable to match the rich in gross fertility. Thus, a large fraction of the poor died childless.

There were, however, substantial variations in the child mortality rates in the preindustrial world, depending mainly on population density. Child mortality rates were very high in large urban centers such as London, and low in the least densely populated rural environments. It is thus possible in the preindustrial period to test

Table 1—Mortality and Life Expectancy, 1500–1800

Group	Births	Fraction alive at 25	Fraction alive at 25 (males)	Average age at death – testators	Implied male life expectancy at birth
London	445	0.44	0.42	53.4	22.6
Town	1,161	0.63	0.60	57.0	34.8
Rural	1,628	0.67	0.69	58.1	40.5
Farm	2,123	0.69	0.71	59.7	42.8

the hypothesis that high net fertility rates among the rich were a product of high mortality rates by looking at this locational variation. This test suggests, however, that high preindustrial mortality rates do not explain the positive correlation between wealth and net and gross fertility before 1800. Further, we observe a decline in gross and net fertility rates among the rich in England starting much earlier than the famous Demographic Transition. But this decline occurs before there was any significant improvement in child survival rates, and significantly reduced the chances of the rich leaving a surviving child. So a unified model of preindustrial and modern fertility still eludes us.

I. Mortality Rates by Location and Wealth before 1800

To calculate child survival rates by location and wealth in England before 1800, we employ the wills of male testators. These wills record both the children surviving at the time of the will, and the wealth of the testator. A subsample of these wills can be linked to parish records of baptisms or births for the children of the testator. From this linkage we can derive an estimate of the fraction of children at each age born to testators in different locations and wealth classes who were still alive at the time of the will. The summary measure used here is the fraction of children surviving to age 25. This was the age of onset of reproduction in preindustrial England, with its pattern of late marriage ages for both men and women.

Table 1 shows the results of this exercise by location. Columns 3 and 4 show the percentage of all children, and of males, surviving to age 25, broken down between London, smaller towns, men in rural parishes with nonfarm occupations, and men engaged in farming. The well-known high mortality rates in big cities like London, which contained 11 percent of the population of England by 1750, show clearly in the table. Cities were particularly deadly for males. Only 42 percent of males reached age 25 in London before 1800. Interestingly, as we go from less to more dense locations, the relative death rates of male and female children change. In the most rural locations males had a 4 percent greater chance than females of reaching age 25, while in London females had a 5 percent better chance.

We can also calculate ages of death of the male testators from similar links to parish records of births or baptisms (column 5 of Table 1). Again, people in London are less healthy, but the difference in life expectancies for adult male will writers is much less than for their children. Combining all available information, we can calculate male life expectancy at birth for London, towns, and rural areas. London had one of the lowest life expectancies at birth for men of any well recorded preindustrial population, even on the eve of the Industrial Revolution, and even for relatively prosperous men.

Table 2 shows overall survival rates to age 25 by testators, arranged into quartiles of the wealth distribution among testators, measured by their estimated asset income and by location. The annual earnings of a laborer in this period would be about £10 per year, and of a craftsman £15, so the richest group had implied earnings from their assets alone at least three times that of a laborer, and double that of a craftsman. In rural areas the children of the rich were significantly more likely to survive to age 25. In London and towns, the rich seem to have had little survival advantage.

The health gradient even extended to rural parishes. If we classify parishes by their population densities in 1801, the year of the first

Table 2—Survival Chances to Age 25 by Wealth and Location

Asset income	London	Town	Rural	Farm
£0–6	0.40	0.59	0.61	0.64
£6–13	0.47	0.66	0.70	0.73
£13–31	0.42	0.61	0.67	0.71
£31–	0.44	0.63	0.72	0.75

Table 3—Surviving Children by Location and Asset Income, 1500–1800

Asset income	London	Town	Rural	Farm
£0–6	1.10	1.78	2.05	2.36
£6–13	1.49	2.37	2.65	3.03
£13–31	1.56	2.46	2.83	3.58
£31–	2.03	3.51	3.60	3.97

English census, then the percent of children alive at age 25 was significantly higher for rural parishes with fewer than 0.15 persons per acre than for those with 0.15–0.3 persons per acre. The highest recorded survival rate is thus for sons born to rich men in farming occupations in parishes with population densities below 0.15 persons per acre in the years 1750–1800. Eighty-four percent of these sons survived to age 25, which was better than the survival rates for the children of the professional and clerical classes in England in 1886–1911.

Thus, because of urbanization, both the rich and the poor in preindustrial England were exposed to very different mortality environments. For those engaged in farming in low-density rural parishes, the mortality risk for children was comparable to that of the upper social groups in 1886–1911, when the Demographic Transition was well under way. If limitation of births began as a response to lower child mortality rates, then we should start detecting declines in birth rates in the rich in the countryside even before 1800.

II. Mortality and Fertility before 1800

Tables 3 and 4 give measures of net fertility—here the numbers of surviving children at the death of the testator—and gross fertility by wealth and location in 1500–1800. Before 1800 we find no sign that gross fertility was correlated with child mortality rates. In fact, the lower the mortality risk for children, the higher were both net and gross fertility. In Table 3 the rich group at the lowest risk of mortality, those in farming in rural parishes, produced the largest numbers of surviving children. Whatever the mortality risk, before 1800 the rich always produced more surviving children than the poor. Jan de Vries (2008) argued that high mortality in cities like London before 1800, where the rich and educated were concentrated, would eliminate a general pattern of "survival of the richest" in preindustrial England. But the strong reproductive advantage of the rich in urban areas before 1800 also shows that the concentration of the rich in London would have to be impossibly strong to effect much reduction in the overall pattern of "survival of the richest." And, anyway, there were many poor people in London: the preindustrial rich depended heavily on servants, for example.

Table 4 shows the pattern of gross fertilities, inferred from Tables 2 and 3. Controlling for wealth, the areas of the lowest child mortality were generally those of the highest gross fertility. Thus, there was no sign of any contraction of fertility in response to lower child mortality for the rich in safe rural environments before 1800. Instead, the rich acted as though the number of children was always a normal good, with more births the higher the wealth level, whatever the mortality environment.

Table 4—Births by Location and Asset Incomes, 1500–1800

Asset income	London	Town	Rural	Farm
£0–6	2.75	3.02	3.31	3.81
£6–13	3.17	3.59	3.73	4.27
£13–31	3.71	4.03	4.10	5.19
£31–	4.61	5.57	4.93	5.44

Table 5— Surviving Children by Marriage Cohorts, Married Testators, 1740–1859

Marriage cohort	Observations	Poorest (£0–6)	Richest (£31–)	Difference rich-poor
1740–59	363	2.13	3.93	1.80
1760–79	535	2.21	4.35	2.14
1780–99	347	2.64	4.52	1.88
1800–19	402	3.15	3.15	0.00
1820–39	459	2.80	2.77	−0.03
1840–59	528	3.19	3.37	0.16

Source: Clark and Cummins (2008).

III. Fertility of the Rich, 1800–1869

Further evidence that high mortality rates cannot explain the high preindustrial fertility comes from changes in the fertility of the rich after 1800. Around 1800, more than 80 years before the general decline in fertility observed in England in the Demographic Transition, the fertility of the rich in England declined significantly. Within one generation the pattern observed all the way from 1500 to 1800 of high gross and net fertility rates among the rich compared to the poor disappeared. The net fertility of the rich declined, and that of the poor increased, so that the positive association of net fertility and wealth disappeared. Table 5 shows this change in net fertility for the richest and the poorest quartile of testators from 1740 to 1859. Generations before the classic Demographic Transition, the rich in England began to moderate their fertility.

This decline in the net fertility of the rich occurred in an era before any substantial decline in child mortality. For the general population, the chance of dying before the age of 15 was 0.294 in 1750–1800, compared to 0.264 in 1800–37 (Wrigley et al. 1997, 250). Comparing births in 1750–1800 to those in 1800–1850 for our sample of testators, the chances of a child surviving to age 25 actually decreased modestly for the rich in these years. But the contraction in gross fertility among the rich resulted in their having much lower chances of producing at least one child or grandchild still alive at the time of their death. Before 1800, the richest men who had been married at least once had a 91 percent chance of having a surviving child or grandchild. For rich men married 1800–1859, that chance declined to 79 percent as a result of the decline in the number of births their wives had. There is no evidence of men consistently seeking to maximize the changes of surviving children. By 1800–1859, the richest quartile of testators had a lower chance of having a child at death than the poorest quartile.

IV. Conclusions

The challenge of giving a unified account of the Malthusian and modern fertility regimes remains, and is significant. The evidence presented above suggests strongly that the unification attempted in Clark (2007) cannot be correct. The completely different association of wealth and fertility in the preindustrial compared to the modern world cannot be explained by subsistence constraints, by differences in

the quality-quantity trade-off, or by differences in the child mortality rates. The prospects for a unified account of economic growth in both the Malthusian and the Solovian eras thus look decidedly poor.

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