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## DEBATES

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### *Urbanization and England's Eighteenth Century Crude Birth and Death Rate*

David J. Loschky

University of Missouri - Columbia

England's eighteenth century birth, death and marriage rate series have been, are now and will continue to be the standard by which explanations for the period's demographic changes are evaluated. These figures are imperfect. Based, as they are, upon parish records, they are known to be inaccurate. But inaccurate or no, if there is any demographic story to tell, they tell it.

That these series are the standard which must be explained hardly needs illustration. Did the plague's end, brought about by changes in rat populations, initiate the demographic revolution? Reference to the national series provides the basis for judgement.<sup>1</sup> Did inoculation and vaccination against smallpox cause the death rate's decline? Computations based upon national series provide the answer.<sup>2</sup> Did an ebbing and flowing epidemic explain fluctuations in the national series? G.S.L. Tucker would have us believe so.<sup>3</sup> McKeown and Brown deduce the importance of environmental change from national series.<sup>4</sup> And Deane and Cole devote a very substantial portion of

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<sup>1</sup> In this instance reference is made to series from a variety of nations and sub-regions. But it is the reference to these series which provides the data to be explained. See K. F. HELLENER, *The Vital Revolution Reconsidered*, from «Population in History», edited by D. V. Glass and D. E. C. Eversley (Edward Arnold, 1965), pp. 79-86.

<sup>2</sup> P. E. RAZZELL, *Population Change in Eighteenth-Century England*, «Economic History Review», SS, vol. 18, no. 2, 1965, pp. 312-332.

<sup>3</sup> G. S. L. TUCKER, *English Pre-Industrial Population Trends*, «Economic History Review», SS, vol. 16, no. 2, 1963, pp. 206-218.

<sup>4</sup> T. McKEOWN and R. G. BROWN, *Medical Evidence Related to English Population Changes in the Eighteenth Century*, «Population Studies», vol. 9, no. 2, 1955, pp. 119-141.

their volume to defining national series which they then proceed to explain, hedging their answers as they may.<sup>5</sup> Earlier authors viewed these data in the same light. The series constructed by Griffith, Gonner, Brownlee and others were fabricated for the sole purpose of defining the changing demographic situation.<sup>6</sup> Their series then provided the data which they sought to explain.

Knowing the errors inherent in the national series, researchers have undertaken local studies. But when viewing these studies, two factors must be kept firmly in mind. First, while local studies are used to determine the causes for population changes, it is the aggregation of these local studies of unique and particular places which is compared with the national series. If local studies, as a group, produce fluctuations in accord with the national series, then we judge they have succeeded in explaining the national changes. If the fluctuations produced by local studies differ from the national movements, then we conclude our sample of localities is incomplete, that the entire national story has not yet been told. To be sure local research permits closer study of particular causes for demographic change. But these explanations only satisfy us if they explain the national events. Secondly, local studies are based upon exactly the same records as the national series. Certainly the coverage could be more complete if all localities were studied. But in either case the parish records themselves provide the primary material.

Our question is not then whether to accept or reject the national series. Accept them we must. But correct them we may. This paper will adjust the national crude death rate series in particular, and the birth rate series secondarily, to allow for urbanization's impact. Our adjustment must be considered provisional. There are serious data and analytic problems which may be solved with a great deal of further work. But we will prove that the direction of the adjustment we make here will not be changed. And the general magnitude of these same adjustments is also securely based.

These computations will show that crude death rates in urban and in rural regions fell far more than the present national series show, that this decline in mortality began near mid-century and that birth rates in urban and rural regions rose little if at all during the century's course.

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<sup>5</sup> A rough calculation shows Deane and Cole spent about 25 per cent of their pages on the population series for periods *before* the early nineteenth century. Surely, therefore, these series must be important in explaining British economic growth. PHYLLIS DEANE and W. A. COLE, *British Economic Growth, 1688-1959* (Cambridge University Press, 2nd Edition, 1967).

<sup>6</sup> G. TALBOT GRIFFITH, *Population Problems in the Age of Malibus* (Cambridge University Press, 1926); E. C. K. GONNER, *The Population of England in the Eighteenth Century*, « Journal of the Royal Statistical Society », vol. 76, February 1913, pp. 261-296; JOHN BROWNLEE, *The History of the Birth and Death Rates in England and Wales taken as a Whole, From 1570 to the Present Time*, « Public Health », June 1916, pp. 211-222 and July 1916, pp. 228-238. The same comments apply to the work of Glass working with King's materials and to the series constructed by Farr.

SECTION I.

During the eighteenth century urbanization proceeded rapidly. This had important consequences for the national crude birth and death rates. With as little as is known about rural and urban mortality, it is nevertheless abundantly clear that urban mortality was well above that for rural regions and quite probably urban fertility also exceeded rural fertility. Because urban death and birth rates exceeded rural rates, urbanization had to raise the national crude birth and death rate series. But that rise would not reflect changing mortality in urban and in rural places. The rise would simply reflect the fact that people moved from low mortality and fertility regions into high mortality and fertility regions. We circumvent this problem by breaking the national series into urban and rural series. Within these urban and rural series we more accurately will find the impact of rolling epidemics, of inoculation, of income changes and the like. But we will not find changes in crude rates due merely to migration from countryside to city.

Were the urban-rural birth and death rate differentials simply due to differing age structures? That conclusion is not tenable. Firstly, *if* urban age structures differed we may argue they were younger on the grounds that migrants were more likely young people.<sup>7</sup> A younger age structure would account for higher urban birth rates. But higher mortality rates are clearly found in the older age groups and in the first few years of life. Consequently, the younger urban population should have had a lower crude death rate than rural residents. But in fact urban crude death rates were the higher.

That spread between urban and rural crude death rates could not be accounted for by the higher urban birth rate with its attendant infant mortality. A simple numerical example will demonstrate this conclusion. Even granting very high infant mortality, say one-half of all infants died in their first year, this could only raise the urban crude death rate by one half the difference between the urban and rural crude birth rates. And we know the urban-rural death rate differential exceeded the urban-rural birth rate differential. A younger urban population, therefore, could explain the birth rate differential, but not the death rate differential. On the other hand, the assumption of an older urban and younger rural population explains the higher urban crude death rate but not the higher urban birth rate. The numbers, therefore, cannot be reconciled by a hypothesis which explains urban-rural birth and death rate differentials by differing age structures.

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<sup>7</sup> We would expect most migrants to have been young for England's age structure was young. So we mean here the age structure of the migrant group may have been younger than the rural age structure. Even if it were younger, unless annual migration was a substantial portion of urban populations, the differing age structure would have had little impact upon urban age structures and hence little impact upon urban crude birth and death rates.

But even more important than the recalcitrant numbers are accounts of urban sanitary conditions and their impact upon mortality. Moreover, reports of age-at-marriage differentials between urban and rural regions are too well founded to be brushed aside as merely illusory. Accounts of illegitimacy in cities also suggest higher urban birth rates. Certainly urbanization did have a strong influence upon the level of both national crude rates. Both urban rates were above the corresponding rural rates and for reasons other than age structure differentials. This much is universally granted.

Urbanization, therefore, must have pushed up the national crude birth and death rates. Consequently we must ask if the eighteenth century rise in the national birth rate<sup>8</sup> reflected nothing more than the consequences of increasing urbanization? Was that all there was to it? The national crude death rate fell, and in spite of a rising urban-rural population ratio. Therefore either the rural crude death rate, or the urban crude death rate, or both crude death rates fell more rapidly and began that decline earlier than « revealed » by the widely accepted national crude death rate. These conclusions can be stated with greater certainty than any others concerning the movement of national series. Consequently every analysis of England's demographic history which either was accepted or rejected because of its conformity with the existing national crude series must be reconsidered. Surely, then, the question is not *whether* urbanization influenced the level and movement of national crude birth and death rates, but rather *how important* urbanization was. Computations providing a tentative answer to this question are presented below.

## SECTION II.

Unfortunately we cannot simply collect local studies and from these construct urban and rural death and birth rate series. We must begin with the national series and from them deduce urban and rural series for the eighteenth century. The national series can be broken easily into urban and rural components if we have the following information: 1) an urban or a rural crude death and birth rate for one date during the century, say 1700, or a ratio between urban and rural rates for some date during the century, 2) the changing urban-rural population mix and 3) the national crude birth and death rate series. Given the information specified above we would have one equation and one unknown, for the national crude series is a simple arithmetic average of the urban and rural rates. In this average the urban-rural mix provides the weighting progression.

An estimate of either urban or rural mortality during some decade in the eighteenth century can be constructed from various data. Because they

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<sup>8</sup> The series of Griffith, Brownlee and Deane and Cole all show the crude birth rate rising during the 18th century.

do not include urban and rural death rates for *all* localities we cannot be certain that estimates will be exact. But we surely can compile lower bound estimates above which the true change in urban and rural death rates will lie. We also can establish urban and rural birth rates which should reflect quite well those rates' histories.

Because of the unique Jones and Judges' London Study we begin with an estimate for urban mortality in 1700.<sup>9</sup> Their late 1690's data reveal an urban death rate of about 40 per thousand.

Forty per thousand may well have been a very low estimate for urban mortality. Other information suggests London's mortality frequently was much higher. E. A. Wrigley notes that

With crude death rates frequently running up to 50 per 1,000 or more... (the London death rate in the gin drinking period of the early eighteenth century may have been as high as 80 per 1,000 in the worst decades).<sup>10</sup>

Moreover other metropolitan centers were thought to be equally unhealthy, among which are Birmingham, Liverpool, Manchester.

Manchester's crude death rate, first estimated by Griffith, was amended later by Hammond.<sup>11</sup> Hammond was particularly concerned with Griffith's 1821 estimate of slightly above 14 per thousand. Using more complete records Hammond put the 1821 rate at 48.3 per thousand. Finding this to be «fantastic» she split the difference between the two estimates and settled for a rate of about 31 per thousand. Had the Jones and Judges or the Wrigley discussions been published when she wrote, Hammond might have been more inclined to stick with her original figure. Obviously these Manchester figures are open to question. But assuming the differences *between* successive decades were reliable, we can generate an estimated crude death rate for 1800.

Accepting the Hammond average and adding the decline of nearly 11 per thousand Griffith shows to have occurred between 1801 and 1821, we obtain a rate of about 42 per thousand for 1801. Working with the original Hammond estimate we obtain a crude death rate in 1801 of 59.3 per thousand for Manchester. Both rates, it can be seen, are above the 40 per thousand cited by Jones and Judges for 1700. The original Hammond estimate, adjusted back to 1801, approximates the Wrigley estimates for London during the eighteenth century.

The lowest eighteenth century urban crude death rate we find is that given by Jones and Judges for London in 1700. All other urban rates, even

<sup>9</sup> P. E. JONES and A. V. JUDGES, *The Population of London in the Late Seventeenth Century*, «Economic History Review», vol. 6, no. 1, October 1935, pp. 45-63.

<sup>10</sup> E. A. WRIGLEY, *Population and History* (Weidenfeld and Nicolson, London, 1969), p. 97.

<sup>11</sup> BARBARA HAMMOND, *Urban Death-Rates in the Early Nineteenth Century*, «Economic History», vol. 1, January 1928, pp. 419-428.

though they are for later periods (such as 1800 by which time it is agreed mortality had begun to fall, or for other cities whose mortality probably was not higher than London's), exceed the 40 per thousand given by Jones and Judges. On these grounds an urban crude death rate in 1700 of 40 per thousand appears very conservative. Nevertheless, it would be well to estimate a second urban death rate for 1700 below which we know the true rate could not possibly have fallen.

Fixing a lower bound urban death rate poses somewhat different problems than affixing a reasonable rate. A critical question is whether there is some crucial size which a village must reach before its death rate rises substantially above rural rates. Eli Heckscher's work provides some important insight into this question. Discussing mortality in small Swedish and northern European villages he draws the following conclusion:

The most surprising part of the situation is that the unhealthiness of towns was not confined to the large ones. Most of the so-called towns, on the continent, as well as in Sweden, were quite small communities, from many points of view no more than glorified hamlets or villages. Even well-informed observers, such as Wargentin, therefore thought that the smaller towns did not differ materially from the countryside in demographic character. But when figures became available just after the turn of the century they tell a much more interesting tale, as will be seen from the following table.

ANNUAL MOVEMENT OF POPULATION IN 1800-15,  
PER 1,000 INHABITANTS

	Birth-rate	Death-rate	Excess-rate
Stockholm	34.6	41.2	— 6.6
The rest of Swedish towns	31.1	30.2	0.9
The Swedish countryside	33.0	24.8	8.2

In the period of 1816-40 the differences were even more striking, excess rates being — 12.1, 0.0, and 11.1 for the three groups respectively.

Even among the smallest of these tiny places there were some which emulated or even exceeded the capital in unhealthiness. Thus, in 1802-1815, no less than five towns had a higher death rate than Stockholm; and in 1815-40 one of the very smallest, with only 448, had the same death-rate as Stockholm.<sup>12</sup>

Evidently crude death rates for very small villages were well above rural rates. Consequently we must be prepared to count as urban (places which for our purposes have high death rates associated with population densities above rural densities) villages which are quite small. This Swedish information is consistent with the results of a reconstitution study completed by

<sup>12</sup> ELI F. HECKSCHER, *Swedish Population Trends Before the Industrial Revolution*, «Economic History Review», SS, vol. 2, no. 3, 1950, p. 277.

Loschky and Krier.<sup>13</sup> Four small villages, ranging in size around 300 to 400 people, and the surrounding countryside were examined and the results, as mentioned, were consistent with the Heckscher data.

Excluding Stockholm, the ratio between the urban and rural crude death rates reported by Heckscher was 1.22. We accept this as the lower bound estimate for the ratio between English urban and rural death rates. Indeed it seems certain the English ratio was higher. Firstly, Stockholm has been excluded from the Swedish urban death rate figure. Secondly, mortality in London and Manchester was certainly equal to or greater than that in Stockholm. And lastly, London, by itself, contained a disproportionate percentage of the English population. But any upward adjustment of this ratio must always raise the suspicion of its being too high until such time as we have much more information on English urban mortality.<sup>14</sup>

As with mortality statistics, figures for urban-rural birth-rate differentials are sparse. We use the 39.0 figure given by Jones and Judges as our estimate of the urban birth rate.

Deane and Cole provide us with the last piece of information needed, an estimate of the changing urban/rural ratio for the eighteenth century.<sup>15</sup> In their judgment scarcely 13 per cent of England's population lived in places 5,000 or larger in 1700, while 25 per cent did so by 1800. As we have already seen, mortality in places well below 5,000 was much higher than it was in the countryside. Consequently, we need an estimate for the population living in places of around 300 to 500 and above in both 1700 and 1800. Deane and Cole do not provide this data. Neither do they refer to their sources. However, Mitchell produces a table listing the United Kingdom's

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<sup>13</sup> DAVID J. LOSCHKY and DONALD F. KRIER, *Income and Family Size in Three Eighteenth Century Lancashire Parishes: A Reconstitution Study*, «Journal of Economic History», vol. 29, no. 3, September 1969, pp. 429-448.

<sup>14</sup> It would be most desirable, of course, to define a functional relationship between crude death rates and population density. Given such a function and adequate data, urbanization's impact upon Griffith's and Brownlee's series could be computed. Unfortunately we do not know what this functional relationship would look like. Neither do we have adequate data from which to construct such a function. For the present, therefore, we must settle for a much cruder analysis of urbanization's influence upon the national rates.

Our procedure, as is made clear in the text, is to construct an estimate which reflects, to the best of our knowledge, the paths of urban and rural crude death rates. Additionally we construct a lower bound estimate for the changes in urban and rural death rates. The lower bound estimate will show smaller changes in both urban and rural death rates than our estimate. The lower bound estimate is made to be so conservative an estimate of changed mortality that the true changes *must be* as great or greater than the lower bound estimate. The estimate, on the other hand, is meant to reflect our best guess of the rate changes.

These remarks apply, *mutatis mutandis*, to our birth rate discussion.

<sup>15</sup> PHYLLIS DEANE and W. A. COLE, *British Economic Growth*, p. 7.

population in 1801.<sup>16</sup> If from this list are subtracted Scottish towns, the resultant urban population is 24.9 percentage of the English and Welsh population for 1801. Whatever Deane and Cole's sources, the agreement is remarkable.

We use Mitchell's table to estimate the population living in places of 500 and above in 1801. Then assuming the percentage of the population living in villages 500 and above grew at the same rate as the percentage living in places 5,000 and above, and using the 13 per cent figure cited by Deane and Cole for 1700, we determine the proportion of the population living in villages 500 and above in 1700. The same procedures generate estimates of the urban population for 1750, again using Deane and Cole's figure for places of 5,000 and above. Finally, assuming growth consistent with the figures for 1700, 1750, and 1800, we generate estimates of urbanization for 1760, 1770, 1780, and 1790.<sup>17</sup> This method is remarkably factual in nature. Unfortunately, there appears to be no theory of urban growth less factual in nature that will yield as an inference English urban population. Consequently we have no recourse except to the crudely empirical method set forth above.

Collecting the information in Mitchell's table, and applying the method outlined above, it appears the population in places of 500 and above in 1800 was slightly more than double the numbers living in places of 5,000 and above. We find a multiple of 2.25. This gives us 56 percent of the population living in places 500 and above in 1801. The figure for 1700 is 29 percent. Deane and Cole, however, claim that *scarcely* 13 percent lived in urban settings in 1700, so in deference to their adverb we presume by 1700 28 percent lived in places of 500 and above. Deane and Cole's 15 to 16 per-

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<sup>16</sup> B. R. MITCHELL with the collaboration of PHYLLIS DEANE, *Abstract of British Historical Statistics* (Cambridge University Press, 1962), pp. 24-26.

<sup>17</sup> Mitchell's figures have been used in the following manner. Beginning with the largest city, London, the populations of successively smaller locations were added until the population of all cities above 10,000 had been added in. This information was graphed against city size. To the graph was also added the total population of England in 1801, which was placed against a city size of 1 person. In other words, by the time one had exhausted the population of all places which had one person or more living in them, one had accumulated the total population of England. Through these points a line was passed which should well represent the relationship between city size and total population living in those places. In fact no actual computations were made on the grounds that with the exception of the figure for London and for all England the numbers were very strongly concentrated between city sizes of 10,000 and 80,000. In view of this intense concentration of observation an actual computation could add nothing of interest to our results other than an air of specious accuracy.

The figures given by Mitchell for places between 1,000 and 10,000 have not been included in the computation on the grounds that his data must be in *serious* error in that range of city size. We find, for example, 34 places with populations between 10 and 20 thousand but only 8 places with a population listed as less than 10 thousand. Had a seemingly sound list of towns and villages of less than 10,000 been available somewhat more refined methods of estimation would have been used.

Urbanization and England's Eighteenth Century Crude Birth and Death Rate

TABLE I

URBAN AND RURAL BIRTH AND DEATH RATES  
FOR SELECTED 18th CENTURY DATES

	Lower Bound					Estimate	
Urban/Rural death rate ratios	1.22					1.96 Griffith	1.65 Brownlee
Urban/Rural birth rate ratios						1.34 Griffith	1.35 Brownlee
	1700	1750	1760	1770	1780	1790	1800
Percentage of England Urbanized 2.25% of Deane & Cole's rate	28	35	37	40	45	51	57
<i>Griffith's rates</i>							
Crude Birth Rate	31.1	34.1	33.3	34.0	34.4	35.4	34.2
Crude Death Rate	26.0	28.2	26.7	27.9	28.3	25.7	23.1
<i>Our Rates</i>							
Birth Rate							
Urban	39.0	40.8	39.5	40.0	40.1	40.5	36.7
Rural	29.1	30.4	29.4	29.8	30.0	30.2	27.4
Death Rates							
Lower Bound							
Urban	30.2	31.8	30.2	31.2	31.4	28.2	25.0
Rural	24.5	26.1	24.7	25.6	25.7	23.1	20.4
Estimate							
Urban	40.2	41.2	38.8	39.4	38.8	33.9	29.2
Rural	20.5	21.0	19.8	20.1	19.8	17.3	14.9
	1701-10	1741-50	1751-60	1761-70	1771-80	1781-90	1791-1800
<i>Brownlee's rates</i>							
Crude Birth Rate	31.6	36.9	36.9	37.0	37.5	37.7	37.3
Crude Death Rate	28.6	33.0	30.3	30.0	31.1	28.6	26.9
<i>Our Rates</i>							
Birth Rate							
Urban	39.0	44.5	44.0	43.8	43.6	43.2	42.0
Rural	28.8	32.9	32.6	32.5	32.2	32.0	31.1
Death Rates							
Lower Bound							
Urban	32.9	37.3	34.2	33.6	34.5	31.4	29.0
Rural	27.0	30.5	28.0	27.5	28.2	25.8	23.8
Estimate							
Urban	40.0	44.3	40.4	39.3	39.8	35.5	32.4
Rural	24.2	26.8	24.4	23.8	24.1	21.5	19.6

(TABLE I continued)

CHANGES IN URBAN AND RURAL BIRTH RATES AND DEATH RATES  
FOR SELECTED 18th CENTURY DATES

<i>Griffith's Rates</i>							
	1700-50	1760	1770	1780	1790	1800	Net Change 1700 to 1800
Birth Rate	+ 3.0	— .8	+ .7	+ .4	+ 1.0	— 1.3	+ 3.1
Death Rate	+ 2.2	— 1.5	+ 1.3	+ .4	— 2.6	— 2.6	— 2.9
<i>Our Rates</i>							
Birth Rate							
Urban	+ 1.8	— 1.3	+ .5	+ .1	+ .4	— 3.8	— 2.3
Rural	+ 1.3	— 1.0	+ .4	+ .2	+ .2	— 2.8	— 1.7
Death Rates							
Lower Bound							
Urban	+ 1.6	— 1.5	+ .9	+ .2	— 3.2	— 3.2	— 5.2
Rural	+ 1.6	— 1.4	+ .9	+ .2	— 2.6	— 2.7	— 4.1
Estimate							
Urban	+ 1.0	— 2.4	+ .7	— .7	— 4.9	— 4.7	— 11.0
Rural	+ 0.5	— 1.2	+ .3	— .3	— 2.5	— 2.4	— 5.6
<i>Brownlee's Rates</i>							
	1741-50	1751-60	1761-70	1771-80	1781-90	1791-1800	Net Change 1700 to 1800
Birth Rate	+ 5.3	—	+ .1	+ .5	+ .2	— .4	+ 5.7
Death Rate	+ 4.4	— 2.7	— .3	+ 1.1	— 2.5	— 1.7	— 1.7
<i>Our Rates</i>							
Birth Rate							
Urban	+ 5.5	— .5	— .2	— .2	— .4	— 1.2	+ 3.0
Rural	+ 4.1	— .3	— .1	— .2	— .3	— .9	+ 2.3
Death Rate							
Lower Bound							
Urban	+ 4.4	— 3.1	— .6	+ .9	— 3.9	— 2.4	— 3.9
Rural	+ 3.5	— 2.5	— .5	+ .7	— 2.4	— 2.0	— 3.2
Estimate							
Urban	+ 4.3	— 3.9	— 1.1	+ .5	— 4.3	— 3.1	— 7.6
Rural	+ 2.6	— 2.4	— .6	+ .3	— 2.6	— 1.9	— 4.6

cent living in places of 5,000 and above yield our figure of 35 percent living in places of 500 and above in 1750.<sup>18</sup>

It remains to select national crude birth and death rate series. We use the Brownlee and Griffith data.<sup>19</sup> We estimate urban and rural death rates from the national figures in the following manner. If 28 percent of the 1700 population was urban (by our definition), and if England's crude death rate was 26.0 in 1700, and if the urban crude death rate was 1.22 times the rural crude death rate, then the rural death rate for 1700 was 24.5 and the urban crude death rate was 30.2. If, on the other hand, the 1700 urban death rate was 40.0 per thousand, then with a national rate of 26.0 and an urban percentage of 28, the rural death rate was 20.5 and the ratio between the urban and rural rates was 1.96. Assuming this ratio constant we derive figures for 1750, 1760, 1770, 1780, 1790, and 1800.<sup>20</sup> Again, assuming a constant ratio between urban and rural birth rates we generate estimates for urban and rural rates using both Griffith's and Brownlee's figures. These series are presented above in Table I.

Several features of the tables deserve attention. Firstly, *in each* series the end-of-century rates show both a greater absolute and a greater percentage fall from 1700 to 1800 than shown by the Griffith or Brownlee series. Table II below summarizes the relevant data.

TABLE II  
NET CHANGES IN DEATH RATES BETWEEN 1700 AND 1800  
*Griffith's Crude Death Rate*

His Decline Between 1700 and 1800		Our Decline Between 1700 and 1800	
Absolute	Percentage	Absolute	Percentage
- 2.9	11%		
		Estimate	
		Urban - 5.2	} 17%
		Rural - 4.1	
		Lower Bound	
		Urban - 11.0	} 27%
		Rural - 5.6	

<sup>18</sup> We derive this by taking the sum of their two estimates, 15 and 16 percent, multiplied by 2.25 and divided by two. In other words, we have simply averaged their estimate and expanded by our 2.25.

<sup>19</sup> G. T. GRIFFITH, « Population Problems », 34 and 36, and JOHN BROWNLEE, *The History*.

<sup>20</sup> In fact the ratio probably increased. What Manchester's crude death rate was in 1700 is unknown, but it is difficult to believe it fell to an 1801 level of 60 per thousand. Furthermore, Wrigley puts London's crude death rate generally well above the 40 per thousand figure for 1700 which we use. The consequence of a rising ratio between urban and rural death rates would be a rural death rate falling *more rapidly and earlier* than our data in Table I suggests. This same argument applies, *mutatis mutandis*, to the 1.22 ratio used in the lower bound estimates.

(TABLE II continued)

*Brownlee's Crude Death Rate*

His Decline		Our Decline	
Absolute	Percentage	Absolute	Percentage
- 1.7	6%		
		Lower Bound	
		Urban	- 3.9
		Rural	- 3.2
		Estimate	
		Urban	- 7.6
		Rural	- 4.6

Breaking the national series into urban and rural components to allow for urbanization's impact reveals several very interesting conclusions. First, of course, there are significant declines in both urban and rural crude death rates between 1700 and 1800. These changes between 1700 and 1800 are greater (in both absolute and in percentage terms) than the original Griffith and Brownlee figures. Moreover, the implications of our computations are also significantly different. For example, both Griffith and Brownlee find mortality *beginning* to fall by 1800. On the other hand we find a rural crude death rate, using Griffith's series, of 14.9 in 1800. This death rate looks remarkably similar to present day crude death rates and suggests that the demographic transition was *nearly complete* in rural England by 1800, so far as mortality was concerned. But we do not press this interpretation too far since our other data for 1800 do not all suggest the same conclusion.

In all cases, however, we do find substantial absolute and percentage declines in crude death rates between 1700 and 1800. Clearly, then, death rates had begun their systematic decline during the eighteenth century. This conclusion is not at all obvious from the national series unadjusted for urban growth. The century-long six percent decline shown by Brownlee could have been nothing more than a temporary fluctuation which fortuitously preceded important nineteenth century developments. Griffith's data show a more definite downward movement, but still one which is considerably less obvious than our computations show.

Not only is there much stronger evidence for persistently declining rates beginning in the eighteenth century, but also the magnitude of the decline is substantial. We find an estimated urban death rate decline between 1700 and 1800 of 11.0 per thousand (Griffith's figures). In all cases our death rate fall is two to three times the fall shown by the unadjusted national figures. These conclusions are particularly interesting. For some authors claim to find no justification for the smaller fall shown by the original figures. McKeown and Brown, for example, finding no other justification for the declining death rate, are driven to the inference that changes in environment

alone accounted for the incipient decline they find in the 1790's.<sup>21</sup> If environmental forces were the important factor then they were a great deal stronger than has been granted thus far.

These computations suggest a further revision in our view of the eighteenth century. According to Griffith the first signs of permanently lower mortality appear faintly in 1790, and in the decade 1781-90 according to Brownlee. In both cases the differences from the 1700 rates are very slight. Our lower bound estimates of the difference between uncorrected and corrected series also show 1790 as the first date by which the crude death rate fell below the 1700 level. Nevertheless, our estimates show that the difference between 1790 and 1700 rates is greater than in either the Griffith or the Brownlee series. 1790 or earlier can be pinpointed as a significant turning point with greater certainty using the more cautious estimate. On the other hand, using our estimate (as opposed to the lower bound estimate) the permanent decline in mortality below 1700 levels appears *by the 1760's*. This places England in what demographers refer to as the Demographic Transition's second stage a good thirty years earlier than hitherto suspected.

That this long term decline in mortality occurred despite the 1770's is unexpected since it is often claimed this decade was one of high mortality. Table III presents information bearing upon this point.

TABLE III

MORTALITY DURING THE 1770's

*Net changes in death rates between 1700 and the 1770's*

Griffith's series: 1700 to 1770		Brownlee's series: 1701-10 to 1771-80		
His Figure		Our Figures		His Figure
+ 1.9		Griffith	Brownlee	+ 2.5
Lower Bound				
Urban	+ 1.2		+ 1.4	
Rural	+ 1.1		+ 1.2	
Estimate				
Urban	— .5		— .2	
Rural	— .3		— .1	

<sup>21</sup> THOMAS MCKEOWN and R. G. BROWN, *Medical Evidence*. Essentially McKeown and Brown assert that a decline in the crude death rate can occur for one of four reasons. They reject the impact of changing birth rates, of advances in medical knowledge, and of changes in virulence, leaving only the fourth alternate. This alternate, of course, includes everything else that could influence crude death rates. They associate this fourth alternate most closely with environmental changes. We might refine this fourth alternate further by associating it with income changes without doing substantial injustice to McKeown and Brown.

(TABLE III continued)

*Net changes in death rates between 1760 and the 1770's*

Griffith's series: 1760 to 1770		Brownlee's series: 1761-70 to 1771-80	
His Figure		Our Figures	His Figure
+ 1.3			+ 1.1
	Griffith		Brownlee
Lower Bound			
	Urban	+ .9	+ .9
	Rural	+ .9	+ .7
Estimate			
	Urban	+ .6	+ .5
	Rural	+ .3	+ .3

Most of our computations still show a rise in death rates during the 1770's. That rise, however, is about one-half the rise shown by Griffith and Brownlee. Much attention has been paid to this decade's unhealthiness. Considerable effort has been expended to explain the fluctuations shown by Griffith and Brownlee. Our computations suggest the efforts are out of proportion to changes in rural and urban mortality.

But more important than the 1770's or the 30 year shift in the beginnings of permanent mortality decline is the significant change in dating relative to the burgeoning industrial revolution. Rather than following the rising tide of industrialization, it appears more likely that mortality changes preceded it. Some provisional explanations can be forwarded for such a connection between mortality and industrialization. A lowering of death rates, particularly if this occurred throughout the age spectrum, would amount to an increase in human capital for the United Kingdom. Specifically, fewer young urban-industrial adults dying per thousand would mean just that many more trained individuals available for industrial employment with a consequent reduction in the costs of training replacements.<sup>22</sup> Pending further detailed investigations, however, explanations borrowed from theories connecting economic and demographic development must be conjectural at best. Yet they serve the important function of suggesting fruitful lines of research.

<sup>22</sup> Migration is always accompanied by some cost to society. Firstly the individual must obtain information concerning likely places to move to and search for work in once having moved. Then there is commonly some cost incurred in retraining the migrant for his new tasks. If urban death rates fell from around 1760 then the number of migrants from rural regions required to man the new industries would be less and those costs associated with migration would be lower. Consequently while the national death rate would rise because of increasing urbanization, yet the falling urban death rate would result in a saving of human capital. If, on the other hand, crude death rates were rising in both urban and rural regions, as suggested by the Griffith and Brownlee series, the need for migration into urban areas would be greater and the loss of human capital greater.

Were changes in mortality significant for industrial development, a further commonly held view of England's industrialization needs correction. The rising birth rate shown by both Griffith and Brownlee has been used to explain the pace of industrial development. With death rates declining earlier than hitherto suspected less weight now needs to be placed upon birth rate changes.

From a demographic point of view more needs to be said concerning the birth rate. According to both Griffith's and Brownlee's series crude birth rates rose between 1700 and 1800. In both cases the major increase took place before 1750 but no decline in rates is visible until the last decade of the century. In fact the period 1750 to 1800 appears to be a plateau or a time during which a further small increase in birth rates occurred. When the impact of urbanization is considered these conclusions change somewhat, although not as dramatically as in the case of death rates. Rather than seeing a rise in birth rates between 1700 and 1800, as does Griffith, we find a decline. This difference is significant on two counts. First, of course, we find both urban and rural birth rates declining by around 2 per thousand, while Griffith sees a rise of over 3 per thousand. The difference between these net changes is around 5 per thousand. Considering that the birth rate in 1700 stood slightly over 30 per thousand, this net difference of 5 per thousand amounts to something like 16 percent of the original birth rate and represents a considerably different view of England's demographic history. Secondly, Griffith sees essentially no net change between the birth rate in 1750 and the birth rate in 1800. On the contrary we find a decline between these two periods, although of small magnitude.

Our reconstruction of Brownlee's birth rate series yields conclusions somewhat different in emphasis both from Brownlee's original series and from our discussion above. Brownlee sees a century long rise in birth rates, the net change between the beginning and end of the century being a rise of 5.7 births per thousand. We also find a rise between 1700 and 1800 but one somewhat smaller, between 2 and 3 per thousand. Our difference with Griffith was one of both direction and considerable magnitude. Our difference with Brownlee is one of neither direction nor considerable magnitude. On the other hand Brownlee finds the century's second half one of relative stability in the birth rate. Griffith, of course, did also. And our reconstructed Griffith series, while showing a decided decline between 1750 and 1800, found this largely due to substantial changes between 1790 and 1800. But contrary to this picture of relative stability or of substantial decline only in the last decade, our reconstructed Brownlee series show a *persistent decline* in the birth rate between 1750 and 1800. In each and every decade the birth rate for both urban and rural regions shows a decline. This reading of England's demographic history shows not only a birth rate decline a good half-century before it was thought to fall, but one falling *pari passu* with the

crude death rate. This again puts a considerably different complexion upon eighteenth century demographic changes. Thus, while our conclusions differ depending upon whether we view our reconstruction of Griffith's or Brownlee's series, in either case there is considerable change in emphasis. In one case we find a decline in rates between 1700 and 1800, in the other a persistent decline from 1750 onward.

#### CONCLUSION.

Neither Griffith nor Brownlee had perfect data with which to work. Yet they constructed very influential national crude birth and death rate series. It is against these series that explanations for England's demographic development are measured. To the extent the explanations accord with these series they are adjudged sufficient; to the extent they differ from these series they are adjudged insufficient. Consequently if we can improve the series we must attempt to do so. In this argument we have split the series into their urban and rural components. These series now tell a quite different demographic story. Mortality fell far more than we had suspected. Moreover the mortality decline began earlier than had been thought, quite possibly by mid-eighteenth century. Furthermore crude birth rates did not rise over the century. Rather, the century quite possibly saw a decline in urban and rural crude birth rates. And that decline may have begun as early as mid-century, falling along with a falling crude death rate. Explanations for England's demographic transition and for the industrial revolution should hereinafter take into account these facts, facts which differ substantially from the traditional story.