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**SOME DIMENSIONS OF THE 'QUALITY OF LIFE'
DURING THE BRITISH INDUSTRIAL REVOLUTION**

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# ABSTRACT

The paper sets out estimates for various aspects of well-being during British industrialisation. Judgements about changes in living standards are shown to be sensitive to weighting procedures. It is argued that recent participants in the famous standards of living controversy have assigned undue importance to trends in heights and that concern for quality of life rather than real wages need not imply a pessimistic view of changes in aggregate well-being during the industrial revolution. Urban mortality experience is shown to be the least satisfactory aspect of well-being and it is suggested that this reflects difficulties of financing local public goods.

Programme on National Economic Performance

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# ACKNOWLEDGEMENTS

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## 1. INTRODUCTION

Some twenty years ago Hartwell and Engerman provided a superb review of the key issues and the state of play of the standard of living debate. They distinguished between three questions which must be addressed. First, whether, given some set of exogenous changes, the working classes were better off than they would have been without industrialisation; second, whether, given the industrial revolution, there was a counterfactual set of policies which would have permitted the working classes to be better off; and third, whether the standard of living of the working classes improved in the period from, say, 1750 to 1850.[1]

Relatively little has subsequently been accomplished on the first two questions. On the issue of what happened, however, there have been significant developments. There has been substantial progress in better measurement of real wage growth where there have been several important contributions.[2] There has also been a major research effort on heights.[3] The results from this project are now given prominence in the textbooks as an approach to measuring changes in living standards which potentially is more comprehensive than real wages — 'Nutrition and the environment affect stature, which can be taken as the summation of all influences on economic welfare'.[4]

Recent commentaries on the standard of living debate have indeed stressed the need to move beyond real wages and have anticipated renewed emphasis on measurement of broader concepts of the standard of living.[5] The heights literature can be thought of as one way to get some insight into the 'quality of life'. Obviously, there are many ways of defining this notion and formidable problems of aggregation with which to contend. It is desirable, therefore, to

set out information relating to particular facets and also to consider alternative indices proposed by investigators with different methods.

The most promising place to start seems to be with the much discussed methodology adopted by the United Nations in the <u>Human Development Report</u> and its more ambitious cousin, the approach to comparing levels of well-being implemented by Dasgupta and Weale.[6] These notions of the quality of life stress the need to consider capabilities rather than just incomes. Development economists informed by this view emphasise that there are policy implications arising from it, in particular with regard to public spending, which would not be accepted by the traditional income-centred approach.[7] Indeed, paying attention to the quality of life on an internationally comparative basis may also help reinvigorate research into the first two of Hartwell and Engerman's questions.

In addressing this agenda, this paper investigates the following questions

(i) What do different approaches to measurement imply about changes in aggregate living standards during the British industrial revolution?

(ii) Relative to other countries, what aspects of the quality of life appear particularly unsatisfactory in mid-nineteenth century Britain?

(iii) How good is the correlation between levels of real GDP/person, human development and the 'quality of life' in the 'advanced world' of the mid-nineteenth century?

(iv) What, if any, policy recommendations might a quality of life approach have suggested for the improvement of British living standards during the industrial revolution?

## 2.    MEASURING THE QUALITY OF LIFE

There is widespread agreement that real GDP/head or real wage rates capture very important components of but are not comprehensive measures of economic welfare. At the same time, there is no generally accepted index of a broader concept of living standards and it is recognised that both the conceptual and practical problems of measuring the quality of life are formidable.

Some of these points can be elaborated by reviewing the contribution made by anthropometric research, which seems to be an appropriate starting point given its recent high profile. In fact, there seem to be two different strands of thinking about the value of research on heights among researchers in the area. At times, height seems to be suggested as a good index of welfare *per se* while at other times it is suggested as a good diagnostic in a particular historical situation that real income/wages are failing to measure changes in welfare very well.[8] The latter seems to be much the more defensible position.

The advantage of evidence on heights is that it is sensitive to elements of living standards which are not captured by GDP or real wages. In particular, both work effort and the disease environment are likely to be reflected in height.[9] In the context of the British industrial revolution this will tend to capture the impact of urbanisation which was abnormally high by continental European standards.[10] In turn, this may well signal an important policy failure in local government and thus a possible avenue to exploration of Hartwell and Engerman's second question.

Unfortunately, there are also serious difficulties in the use of heights as a proxy for living standards. It is essential to remember that attained height is potentially sensitive to relative price effects and that changes in prices as economic development proceeds may result in moves to higher indifference curves being accompanied by falls in height. Komlos has stressed that this may have been the implication of a rising relative price of food and thus of nutrition during European industrialisation, while Weir has drawn attention to the role of relative prices in the intra-household allocation of resources and the tradeoff between quantity and quality of children.[11] Similarly, Williamson has argued strongly that the

average British household accepted the worse environment in urban areas as a price well worth paying for higher wages.[12]

Clearly, it can also be maintained that there are important components of living standards that are reflected neither in real wages nor in heights. These might include, for example, literacy where levels may reflect public rather than private expenditure decisions and civil and political rights which workers cared about deeply during the industrial revolution and after.

While information on stature could in principle be used to adjust standard national accounts concepts to reflect a broader measure of economic welfare, in practice the information requirements are severe and certainly exceed our current knowledge in two fundamental respects. First, we would need to devise a way of avoiding double counting of the impact on height of expenditures already included in GDP and, second, we need to find a way of quantifying the welfare implications of changes in height. More precisely, we need a way of estimating willingness to pay for non-private income influences on height since height *per se* is surely not an argument in the utility function.[13] This leaves only the second, diagnostic, role for heights evidence at present.

The Human Development Index (HDI) of the United Nations, described and refined in successive editions of the <u>Human Development Report</u>, is seen by its authors as a contribution to the search for a better and more comprehensive measure of socio-economic welfare than GDP. It is the lives that people lead that are taken to be of intrinsic importance rather than the incomes that they enjoy.

HDI is a composite of three basic components: longevity, knowledge and income. Human development is seen as a process of expanding people's choices. Income is seen as contributing to this end primarily in the escape from poverty; above a threshold level it is considered to make a sharply diminishing contribution to human development, eventually tailing off to nothing. Longevity, measured by life expectancy, and knowledge, measured by a weighted average of literacy and schooling, are regarded as central to the enhancement of capabilities but not closely correlated with or strictly dependent

on private income. The components are combined in a single index by measuring them in terms of the percentage of the distance between the minimum and the maximum values travelled in each case and averaging these scores into one index.[14]

Subject to data limitations, HDI can be calculated for subsets of a country's population or for the nation as a whole. The UN also publishes a version where account is taken of the distribution of income distribution where the average income level is adjusted by
(1 - G) where G is the Gini coefficient of income inequality. In effect, this implies a rank-order (poorest to richest) weighting of incomes and calculates the 'equivalent' level of income allowing for the 'cost' of inequality.[15] In the context of the standard of living debate, this variant is also of interest.

The HDI approach to measuring the quality of life also has obvious weaknesses. In common with heights, the approach runs into problems with regard to the weighting of different components of well-being. In this case, unlike with heights, it is at least possible to work out the implicit set of weights involved which are closely related to the choices for the maximum and minimum values for each component. When this is done, however, the results appear arbitrary. For the 1994 version of HDI, used in the calculations reported later, a one unit increase in HDI would result from either raising income by $(1990)15.56 or raising life expectancy by 0.18 years or raising literacy by 0.45 percentage points or schooling by 0.135 years. This may be thought by many to weight education rather heavily relative to life expectancy.

Obviously, it is interesting to investigate whether trends in HDI and heights over time are similar. HDI might also be interpreted as a diagnostic to highlight misleading inferences about welfare from GDP but is sensitive to different aspects of the problem. A first attempt at this has been made by Floud and Harris for Britain during 1756-1980; for the long-run, they find that there is a broad similarity of movement which they regard as reassuring.[16]

Other authors in the human development/capabilities tradition stress that a key problem with HDI is that its coverage is too narrow.

They argue that there are other key components of well-being which depend on state provision rather than private income and should be included in a more comprehensive index of the quality of life. Dasgupta maintains strongly that it is important to extend the concept of well-being to include rights in the political and civil spheres and in this there is a clear echo of the approach taken to the standard of living debate by radical writers like Thompson (1963).[17] This seems attractive in principle — and certainly subsumes important aspects of welfare unrelated to height — but raises two formidable problems: how to measure rights and how to incorporate them in an index with the other components of welfare.

Dasgupta and Weale suggest a way round these difficulties that permits them to implement a broader quality of life evaluation of well-being in a comparison of living standards in poor countries in the 1970s.[18] Six aspects of the quality of life are identified in the DW index, namely, per capita income, life expectancy at birth, infant mortality rate, adult literacy rate, and indices of political and civil rights. Countries are ranked on each of these characteristics. This facilitates inclusion of available indices of political and civil liberties which typically rate countries on an ordinal rather than a cardinal basis. The Borda Rule is then used to provide a way of aggregating such ordinal data. This ranks each observation on each criterion and then sums its scores to obtain an aggregate score on which its Borda ranking is then based.

Dasgupta and Weale use indices of political and civil rights judgmentally assigned on a scale of 1 to 7 and taken from Taylor and Jodice. These attempt respectively to measure "the extent to which people are able to play an active and critical role in the choice of their leaders" and "the extent to which people are openly able to express their opinions without fear of reprisals".[19] Political liberty is the sole concern of the political rights index while freedom of the press and independence of the judiciary are the central ingredients judged in the civil rights index. Precise definitions are given in the appendix.

Despite the attractions of this approach, there are clearly also large drawbacks. While the simplicity and transparency of the

Borda Rule are appealing, this does not dispose of the weighting problem which bedevils all exercises in this area. Thus, two 'votes' are given to each of rights and mortality but only one to income and, of course, any cardinal information which may be available on trade-offs between components (for example, longevity and wages) is ignored. Assessments of rights are inherently subjective and the concept embraced by Dasgupta and Weale may not be easily calibrated for the early nineteenth century or may be thought not to correspond closely with the concerns of the citizens of the time. No account is taken of income distribution and others have argued that a wider range of values should be included, although, data permitting the approach is flexible enough to be adapted to reflect these concerns.[20]

Two alternative approaches to the weighting problem in the DW index have been proposed and which are defined more precisely in the appendix.[21] One is to note that it will not matter in cases of Pareto Dominance, ie, where a comparator is better or at least as good on all components. The second is to experiment with weighting schemes to see whether they make much difference in practice as long as all components of the index are retained, a procedure that has been termed 'Intersection Borda Ranking'.

It follows from this discussion that it is clearly desirable to move beyond both GDP per head and heights in considering changes in economic welfare or the quality of life. Given that there is no ideal procedure to adopt, it seems best to set out information on possible components of well-being separately and to compare the outcomes of different methods of aggregation.


## 3. AGGREGATE LIVING STANDARDS IN BRITAIN DURING THE INDUSTRIAL REVOLUTION

In this section, data are assembled for Britain in benchmark years familiar from the standard of living debate with a view to implementing the conceptual approaches set out above. The aim is to address the first of the questions posed in the introduction,

namely to assess changes in living standards and to compare different indices of socioeconomic welfare. The results are presented as a stimulus to further research along these lines by a wide range of historians rather than as a definitive set of conclusions. Table 1 reports estimates of various aspects of well-being while Table 2 shows the indices discussed in the last section. Data for life expectancy and literacy are taken from the obvious, well-known sources listed in Table 1; the remaining estimates require some discussion.

Maddison provides estimates for UK GDP per head for 1820 based on obtaining a purchasing power parity adjusted estimate of 1992 income and working backwards using growth rates for GDP. This measures income on a very similar basis to that used in the HDI estimates of the UN. To obtain figures for Britain, Ireland was taken out on the basis proposed by Maddison. Income levels for other years were worked forward or back from 1820.[22]

The estimates on height contained in Table 1 represent the work of Floud *et al*. This has been the subject of some debate and Komlos has recently argued that alternative statistical procedures should be adopted to cope with truncation biases in the raw data. His results would eliminate the increases in average height through 1820 and would suggest decreasing height from the 1760s to the 1780s with a very slight recovery through the 1830s followed by further decline to the 1850s when height is estimated to be 1.3% lower than in the 1760s.[23]

It is well-known that detailed evidence on infant mortality in Britain prior to civil registration of deaths from 1837 has been relatively sparse. The Cambridge Group have recently filled this gap based on family reconstitution evidence and their new results are adopted in Table 1.[24] Schooling is based on Matthews *et al's* well known estimate extrapolated backwards using literacy rates.[25] This seems to be the only feasible way to proceed. It may not be ideal but is probably reasonable given the close correlation between adult literacy and previous school enrolment rates found across counties in mid-nineteenth century Britain.[26]

Table 1 attempts to assess rights in Britain during the industrial revolution period on a similar basis to that of Taylor and Jodice. The detail of this may well be contentious even if the principle is regarded as acceptable and the relevance of such an exercise to workers' well-being certainly requires some justification. It should be noted that for comparisons through time of British conditions using the Borda Rule only relative rankings need to be accurate not actual scores.

The key to being coded 1 or 2 for political rights is the ability of a wide electorate to vote a leader or party out of office, with a 1 awarded if the great majority of persons can participate in the electoral process. The very restricted franchise both before and after the Reform Act of 1832 clearly rules out a 1.[27] Consideration of the operations of parliament and the nature of the 'party system' before the Second Reform Act of 1867 also seems to rule out a 2 since governments were sustained or defeated in parliament and were not determined by popular vote in general elections.[28] On the other hand people could vote for their representatives in regular elections even if, to modern eyes, the procedures appear to have been non-democratic. A 3 seems justified throughout the period covered by the standard of living debate. Workers were effectively denied suffrage throughout and, from their point of view, a constant ranking would also be applicable.

Assessing an appropriate score for civil rights is much harder and the situation was much more changeable. By the later eighteenth century, it may be reasonable to speak of the independence of the judiciary and it has recently been argued that in general the ideology of the law served to constrain authority not to rely on coercive power.[29] Nevertheless, the period between the French Revolution and the later 1820s should be seen as one of severe repression of workers' rights reflected in the Combination Acts and the use of the military to suppress popular disturbances with 12,000 troops used against the Luddites in 1812. From the mid-1830s to 1850, the general trend is one of easing of repression and major advances for working class organisations such as trade unions, coops and friendly societies.[30]

In terms of press freedom, the picture until late in the day is one of substantial interference by government and suppression through heavy taxation and the law of seditious libel. Pressure on the press was intensified during the period of repression identified above (for example, the 'six Acts' of 1819).[31] The reductions in stamp duty after 1836 and the availability of a defence of truth against a charge of criminal libel after 1843 led to rapid increases in newspaper circulation including radical organs like the Chartist Northern Star (founded 1837).[32]

The ratings of civil rights in Table 1 are necessarily tentative. Further work is highly desirable, in particular since more attention needs to be paid to women's rights. There does, however, seem to be reasonable justification for the relativities over time, particularly with regard to workers, who might be expected to care especially about trade union rights and a radical press. Further support for this view might be found in the flowering and withering of Chartism between the 1830s and the 1850s.[33]

A central feature of Table 1 which seems likely to be robust to subsequent refinements of the estimates is that of disparate movement of the various indicators. For example, in the early years, while growth in income and real wages is at best very modest, life expectancy and perhaps height improve but civil rights deteriorate. After 1830, income and real wages grow more quickly and civil rights improve markedly, mortality conditions worsen and heights decline, perhaps appreciably. This conflicting pattern of changes both emphasises the potential importance of looking at broader measures of living standards than private income but also underlines the difficulty of arriving at an index of well-being which commands general assent.

Table 2 presents some indices of living standards which can be compared not only with each other but also with the income and heights variables of Table 1. The DW and HDI and Distribution-Adjusted HDI indices have already been described in Section 2. GDI refers to the Gender-related Development Index recently devised by the UN as a complement to HDI and given great prominence in the 1995 Human Development Report. This simply

adjusts the average attainments in each component of HDI in accordance with the degree of disparity in achievement between women and men. The weighting formula expresses a 'moderate degree' of aversion to inequality. Precise details both of the definition and the arithmetic calculation are shown in the appendix.

The HDI offers a quite optimistic assessment of aggregate trends in well-being during the industrial revolution. Its upward movement reflects improvements in literacy, schooling and life expectancy which on balance augment the rise in incomes. The behaviour of this index is in sharp contrast with that of heights, particularly if the Komlos series for heights is used. The long-run tendency to similar movements in heights and HDI emphasised by Floud and Harris seems to have broken down in the early nineteenth century.[34]

The Distribution-Adjusted HDI is difficult to estimate because, as is well-known, data on income distribution only exist for a few years and are highly imperfect. Williamson reworked the available material to obtain Gini coefficients based on the work of the political arithmeticians for 1759, 1801 and 1867 but his estimate for the last of these years appears to be flawed and Feinstein's revision is surely preferable.[35] In Table 2 the Gini for 1867 is assumed also to apply to 1850. Feinstein's revision means that the Gini coefficient would vary only slightly through time whereas Williamson's shows rising inequality over time. British income distribution was highly unequal throughout the period and the Distribution-Adjusted HDI level is well below that of HDI; even on the Williamson estimate for 1867, however, there are clear improvements between the benchmark years.

The GDI is also distinctly lower than the HDI but shows increases throughout the period, although at a distinctly slower rate than that of HDI. It should be emphasised that these estimates are very tentative, especially with regard to the income component. Interestingly, however, on the evidence available at this point, the relatively slow growth in the GDI accrues primarily from earnings which stagnate between 1760 and 1830 rather than longevity or

education. In turn, this arises from declining female participation rates as well as moves in relative wage rates.

Similar to the HDI and again different from the heights evidence, Table 2 shows that using the Borda Rule to aggregate the six indicators of the quality of life in the DW Index) also shows a pattern of steady improvement after 1780 with 1850 emerging as the best year on this method of aggregation. Replacing income by rankings of years based on Feinstein's recent index of real earnings produces an identical result.[36] At this point, however, it is opportune to return to the weighting problem since 1850 is not the best year on all components of the DW index (nor indeed the HDI) because of the deterioration in mortality after 1830.

Further analysis of the components of the DW index reported in Table 1 shows that there is some evidence of Pareto Dominance, namely that 1850 dominates 1760 and 1780, and that 1830 dominates 1760, 1780, and 1820. Experiments with alternative weighting schemes found that 1830 is superior on Intersection Borda ranking to 1800 and 1820 and by the same criterion 1850 is superior to 1820 and 1820 is superior to 1760.[37] Any judgement on 1830 compared with 1850 turns out to be very sensitive to the relative weights given to life expectancy and infant mortality. Thus, an investigator who wished to weight the demographic indicators very heavily relative to all other components and recalculate an adjusted Borda Rule ranking on this basis might conclude that quality of life fell between 1830 and 1850.[38] It may be that, in effect, this is what the heights data is doing. If so, this would be a valuable warning, as Section 5 below bears out.

Two points in particular have emerged from this review. First, it is often supposed that looking at the overall quality of life would be more supportive of pessimist views on living standards than focusing only on real wages. The hypothesis is not, however, generally supported by the results in Table 2. These are not, of course, conclusive both because the weighting problem still remains, even if it does not appear acute on these particular indices, and because there is still room to argue about variables that have been omitted from the analysis or may have been badly measured.

Second, it would appear that considerable caution needs to be exercised in considering the heights evidence in the context of broad measures of living standards. In this period, heights move with some but not all the non-income components of the 'quality of life' and give different signals from either the HDI or the DW index. This seems to confirm both that information on heights is likely to be one of a number of valuable diagnostics, that movements in real wages or real GDP per head may not correlate well with changes in well-being and also that heights are better not used as an index of overall welfare

## 4. INTERNATIONAL COMPARISONS OF WELL-BEING IN
## THE MID-NINETEENTH CENTURY

Other than comparisons of GDP/head, at least until recently, quantitative comparison of nineteenth century living standards has been quite rare. The heights literature now offers some additional evidence but broader notions of the quality of life have not been examined. This section makes an attempt to fill this gap both in the interests of further enquiry into the value of national accounts as indicators of comparative living standards and to get some further purchase on Hartwell and Engerman's questions. Once again, the estimates are made in the hope of encouraging more scholars to join in.

Table 3 assembles data for a sample of twelve countries similar to that in Table 1. The quality of the data is probably quite low but it may be good enough to draw some interesting conclusions. It is not, however, possible at present to compute GDI or Distribution-Adjusted HDI estimates. The first four columns of the table appear to be the best estimates currently available and require no particular comment.

The estimates on literacy differ in some respects from those most often quoted, in particular with regard to Sweden. In compiling the data, attention has been paid to ability in basic writing

rather than simply reading and to female as well as male attainments. Markussen has recently emphasised that the Nordic countries are unusual in terms of the time lag between the development of reading and writing skills and this view is reflected in the table.[39] The evidence is mostly based on military recruits and marriage registers.

There is insufficient evidence on schooling to make international comparisons directly c1860. More information exists for later years and I have estimated the following regression on an international cross-section for 1913:[40]

$$\text{Schooling Years} \ = \ -1.375 \ + \ 0.083 \text{ Literacy Rate} \quad R^2 = 0.75$$
$$\qquad\qquad\qquad (-1.580) \qquad (7.480)$$

This is used here to infer years of schooling for Table 3.

The remaining components are, of course, more problematic and, as far as I am aware, similar estimates have not previously been attempted. With regard to political rights, the United States is the only country in this list which even approaches universal male suffrage and has a well articulated party system. Blacks and women were denied the vote, however, and a 2 is the most that can be awarded. The 3s all have low proportions with the vote but relatively fair elections and Socialists were not outlawed. The 4s are essentially 'constitutional monarchism' while in the 5s elections with tiny electorates were 'massively fixed'.[41]

With regard to civil rights, by the 1850s the 1s all have effective freedom of the press, legal trade unions and do not use excessive force in law enforcement. The United States would also qualify but for the problem of the South and the continuing threat that it imposed to civil rights, as became clear with the advent of the Civil War and the powers assumed by President Lincoln. The 5s in every case have censorship of the press, no freedom of assembly, trade unions are illegal and are characterised by Goldstein as suffering persistent arbitrary use of force in law enforcement.[42] The intermediate cases have some but not all of these features.

Table 3 shows Britain with the highest income per head in 1870. Only in one other category does Britain come out (equal) top,

namely in civil rights. In education Britain ranks third equal, in life expectancy fifth, and in heights only seventh. These last two indicators are surely strongly influenced by the very high level of urbanisation in Britain and the policy problems to which it gave rise, a point which will be explored further in the following section.

Nevertheless, as Table 4 reports, Britain ranks top on the HDI measure and first equal on the DW index. There are, however, five countries (Denmark, Netherlands, Norway, Sweden and USA) over which Britain neither had Pareto Dominance nor Intersection Borda Ranking Superiority. Moreover, Table 4 reports six cases (all relating to the Nordic countries) where a country has Intersection Borda Ranking Superiority over the other country despite having a lower real GDP/person.

The indices compiled in Table 4 are obviously liable to problems of measurement error. Nevertheless, they may be adequate to provide support for the following observations which also build on the rank correlations reported in Table 5.

(i) Britain's leadership in income per head carries over to the HDI and the DW index. In this respect, at least, the traditional approach to international comparisons of British living standards does not appear to be misleading.

(ii) Overall, however, the evidence here is that international comparisons of living standards in the mid-nineteenth century based simply on real GDP/head may be less satisfactory than for the recent past, as is suggested by the conflicts between Intersection Borda Rankings and national income estimates. The 0.51 rank order correlation between the DW index and real GDP per head is a good deal lower than that found by Dasgupta and Weale for their sample of developing countries in the 1970s (0.84).[43]

(iii) Correlations between the individual components of the quality of life and real GDP/person are nevertheless similar to those for the developing countries sample of the 1970s analysed by Dasgupta and Weale. They found rank order correlations of 0.69 with infant

mortality and 0.59 with literacy whereas for Table 3 these coefficients are both 0.64.[44]

(iv)   There is further reason to be sceptical of heights as an overall index of living standards.   Correlation of heights with both GDP/head and HDI are notably low.  For Britain, it also appears that height was lower than in two countries which are Pareto Dominated in terms of the DW index.


## 5.     EXPLORING SOME COUNTERFACTUALS

Comparative data suggest that British infant mortality was relatively high and life expectancy relatively low in the mid-nineteenth century.  These outcomes might, of course, have been addressed by more effective policy interventions, in particular responding to the problems arising from rapid urbanisation.   In considering this possibility, this section takes up the second of Hartwell and Engerman's key issues in the standard of living debate.

The response to this question may vary depending on whether evaluation of likely outcomes is based on the effects in enhancing capabilities or incomes so that it can clearly be seen as a (famous) example of the fundamental debate on development priorities raised by the human development school.[45]   In some cases interventions may be recommended on both grounds; for example, Solar has recently argued that the Old Poor Law not only provided a better system of social security than prevailed elsewhere in eighteenth century Europe but also tended to promote economic growth.[46]

It might be thought that the Borda Rule can be used as a criterion for the evaluation of policy interventions.   This is not always the case, however, and on occasions there may be enough quantitative evidence to overrule this approach.   This can be illustrated in the context of the standard of living debate by examining the implications of some estimates by Williamson.

If comparisons of the quality of life are to be made using the DW index, as in Table 2, a policymaker in 1850 might think an

intervention would be justified if it led to a situation in which 1850 was at least as good as every previous year on all components of the Borda index. Clearly, this would require improvement in life expectancy and infant mortality and would also imply an improvement in the Borda Rule score for 1850. Given the large discrepancy between rural and urban mortality stressed by Woods, had there been lower migration from country to town, the required improvement in demographic conditions could have been achieved.[47] Greater protection rather than free trade might have brought this about.[48]

To reveal the limitations of the Borda Rule criterion, consider the following illustrative calculation based on the differentials in life expectancy suggested by Woods and on the computable general equilibrium estimates of factor market failure provided by Williamson.[49] Had the rural population remained at its 71% 1821 share of total population in 1851 instead of falling to 56%, then life expectancy would have been 1.43 years higher. In terms of Table 1, E would rise to 40.9 years and associated with this M would fall to 148.[50] Williamson's model suggests that the fall of 34.1% in non-rural employment which would be entailed would have cost around 10.4% of GDP through a less efficient allocation of labor, thus reducing Y in Table 1 to 2550.[51] This meets the Pareto Dominance criterion set.

Lower migration could have produced an improvement in the quality of life according to the Borda Rule. Yet such quantitative evidence as we have would call for more migration not less. Williamson's regression estimates indicate that real wages were higher in cities than in the countryside even after allowing for a substantial urban disamenities premium. His best guess estimates are of a real wage gap in the 1830s of 33.2% after adjusting for cost of living differences and allowing for a disamenities premium of 9.7%.[52] Apparently, taking into account the trade-offs willingly made in the labor market, an inferior environment was outweighed by higher wages.

In this case, the Borda Rule, confined to ordinal comparisons, would be misleading and a poor basis for policy advice. Similarly,

inferring falling living standards from declines in heights in urban areas would be wrong. People presumably did not seek to maximise height but improved their real standard of living by regarding a worse environment (and being shorter) plus higher wages as better.[53] This underlines the crucial importance of weighting in compiling quality of life indices and the dangers of employing arbitrary implicit weights. The assumptions on which Williamson's conclusions rely are, of course, strong but the key point is not the accuracy of his estimates but the importance of trying to quantify trade-offs in measuring living standards.

Nevertheless, paying attention to problems of urbanisation reflected in Britain's disappointing mortality performance and heeding the warning signals from the DW index and heights can be justified. Recent research has re-interpreted the decline in mortality in the second half of the nineteenth century. Both Szreter and Hardy now attribute a high proportion of declining mortality from infectious diseases to public health initiatives, involving both capital expenditure on sanitation and education on hygiene.[54] Szreter's discussion implies that this may have accounted for as much as 75% of the decline in mortality. In this the enforcement of statutory duties on local authorities through legislation such as the 1875 Public Health Act and the provision of soft loans through the Local Government Board were key elements. The amounts spent on resources were, in fact, relatively modest — only reaching 2.5% of GDP in 1900.[55]

Putting these pieces of information together, it seems plausible to argue that, with appropriate public intervention, expenditure equivalent to less than 3% of GDP per year during the second quarter of the nineteenth century could have raised life expectancy to about 44.5 years and reduced infant mortality to around 129 in 1850.[56] This would again satisfy the Borda Rule criterion set out above and would seem to be recommended on the basis of the human capabilities approach.

In this case, however, there is also an efficiency argument to be made along traditional cost benefit lines. Brown and Williamson both point out a study of Preston in 1845 which calculates that

returns from investment in sanitation would far exceed the costs.[57] Brown presents calculations which indicate that for millowners in the town savings in disamenities premia paid to workers would have easily outweighed the rental costs of the capital involved.[58]   The problem seems to have been one of classic market failure — suboptimal expenditure on public goods in the context of free rider problems, unequal incidence of benefits and a narrow local tax base.[59]

Overall, then it appears that the historical evidence is that quite modest public spending increases in mid-nineteenth century Britain could have enhanced the quality of life and at the same time have been justified in terms of rate of return.  This is very much consistent with the contemporary situation in developing countries according to advocates of the human development approach to policymaking. Proponents of both income-centered and capabilities-based approaches to policy formulation could argue for greater public expenditure and that, in the presence of market failures, policy interventions were available to improve living standards.


## 6.   CONCLUSIONS

In the introduction four specific questions were posed.  The answers which have been suggested are as follows.

(i)    The paper explores a number of ways in which improvements might be made to private income as a measure of well-being.  The view taken of changes in living standards is shown to be sensitive to weighting because of the disparate movements in components of welfare.  Overall, it appears that moving from income to 'quality of life' measures does not necessarily strengthen the pessimist case in the standard of living debate despite recent pessimistic inferences drawn from evidence on heights.

(ii)   Comparisons with mid-nineteenth century Europe highlight disappointing mortality conditions in Britain at the end of the

industrial revolution. This is in considerable part clearly due to unusually rapid British urbanisation.

(iii) In the mid nineteenth century the correlation between real GDP/person and measures of the quality of life seems to be weaker than for recent times. This suggests that an approach to evaluating economic policy and performance based on capabilities and well-being may be even more important for economic historians than for contemporary development economists.

(iv) The quality of life approach indicates that there was an important potential role for public spending in mid-nineteenth century Britain to enhance capabilities by improving public health. There is also an efficiency case for intervention based on rates of return as well as the argument based on well-being.

In the context of Hartwell and Engerman's three issues in the standard of living debate, this paper has argued that paying explicit attention to the quality of life and to international comparisons is helpful. Both these compilations of data and indices suggest strongly that there were interventions to cope with the costs of urbanisation which could have been beneficial during the industrial revolution. At the same time, the strong showing of Britain in the international comparisons of living standards at least leaves open a positive answer to their first and most difficult question.

# ENDNOTES

1. Hartwell and Engerman, 'Models of Immiserisation', p.193-4.

2. Lindert and Williamson, 'English Workers' Living Standards', Horrell and Humphries, 'Old Questions, New Data', and Feinstein, 'Changes in Nominal Wages'.

3. Floud *et al*, *Health, Height and History*.

4. Daunton, *Progress and Poverty*, p.440.

5. Lindert and Williamson, 'English Workers' Living Standards', Engerman, 'Reflections'.

6. Dasgupta and Weale, 'On Measuring'; for a fuller discussion of the underlying methodological stance, see Dasgupta, *An Inquiry*.

7. Anand and Ravallion, 'Human development'.

8. The former standpoint is adopted by Floud *et al* in their work on heights during British industrialisation: 'The concept of 'average nutritional status' has an enormous amount in common with the concept of 'average living standard'; it might indeed be thought that they are identical. Thus the measurement of nutritional status through the measurement of height represents... a powerful method by which to measure the standard of living', *Health, Height and History,* p.19. The latter position is taken by Steckel in reviewing the decline in heights during American industrialisation: 'the search for explanations should recognise that traditional national income accounting measures, real wage series and average heights focus on different aspects of living standards... Thus a particular type of prosperity may have accompanied industrialisation while other aspects of the standard of living deteriorated', 'Stature and living', p.294.

9. Leunig and Voth, 'Did Smallpox', offer clear statistical evidence of the impact of smallpox during childhood on adult height. As they point out, however, the welfare implications may not be those that the heights literature would normally assume. Given the lethal implications of catching smallpox in later life, in the eighteenth century being subjected to smallpox in childhood could be good news.

10. Floud *et al*, *Health, Height and History*, p.326.

11. Komlos, *Nutrition*; Weir, 'Parental Consumption Decisions'.

12. Williamson, *Coping with City Growth.*

13. These issues are nicely spelt out in Steckel, 'Stature and the Standard', pp.1917-9.

14. The most complete description of the underlying rationale and methods of calculation is in United Nations, Human Development Report 1994, pp.90-108. The basic arithmetic of the estimates given in this paper is displayed in the appendix.

15. This point is set out in detail by Sen, 'Welfare Basis'.

16. Floud and Harris, 'Health, Height and Welfare'.

17. Dasgupta, *An Inquiry*, ch.1-5; Thompson, *The Making*.

18. Dasgupta and Weale, 'On Measuring the Quality'.

19. Taylor and Jodice, *World Handbook*, p.50.

20. The possible components of well-being are carefully reviewed by Qizilbash, 'Pluralism'.

21. Ibid, pp.26-9.

22. The 1820 GDP estimates are in Maddison, 'Monitoring', p.196 and the treatment of Ireland follows Maddison, 'Dynamic Forces', p.220.  It should be remembered that real wages grew more slowly than real GDP/head with no growth from 1790 to 1820 and a rise of about 30% from 1820 to 1850, see Feinstein, 'Changes', p.31.

23. Komlos, 'Secular trend', p.136.

24. Wrigley *et al*, *English Population*.

25. Matthews *et al*, *British economic growth*, p.573.

26. Mitch, 'Impact of subsidies', p.378.

27. O'Gorman, *Voters*.

28. Hawkins, ''Parliamentary government''.

29. Manchester, *Modern Legal History*; Daunton*, Progress and Poverty*, p.489.

30. Thompson, *Chartists*, pp.334-7.

31. Wickwar, *Struggle*.

32. Aspinall, *Politics and The Press*; Wadsworth, 'Newspaper Circulations'.

33. Stedman Jones, *Languages*, pp.158-77.

34. This seems also to emerge quite clearly from Floud and Harris's own estimates of HDI which also show a continuing increase over 1821-1851 as well as 1781 to 1821, 'Health, Height and Welfare', Table 7.

35. The 1867 estimates used by Williamson are for individuals whereas for earlier years they are for families. For a review of the matter, see Jackson, 'Inequality'.

36. The estimates were taken from Feinstein, 'Changes'.

37. Following the suggestions in Qizilbash, 'Pluralism', I experimented by giving a weight of 0.5 to one component and 0.1 to each of the other five for all possible combinations. I also tried 0.3 on two components with 0.1 for each of the remaining four and 0.2 on two components and 0.15 on each of the remaining four for all possible combinations.

38. 1830 is better than 1850 if 0.5 is attached to E or to M and where 0.3 is given to each of E and M. 1830 is inferior to 1850, however, if weights of 0.2 are given to each of E and M.

39. Markussen, 'Development of writing', p.37.

40. Crafts, 'Human development index', p.5.

41. 'Constitutional monarchism' is the term chosen by Anderson and Anderson, *Political Institutions,* pp 39-40; elections in Spain and Italy are described as 'massively fixed' by Goldstein, *Political Repression*, pp.19-20.

42. Ibid, p.67.

43. Dasgupta and Weale, 'On Measuring', p.124.

44. Ibid, p.124.

45. Anand and Ravallion, 'Human Development', pp.134-5.

46. Solar, 'Poor Relief', p.16.

47. Woods, 'Effects of Population'.

48. See the simulations in Williamson, 'Impact', p.136.

49. Woods, 'Effects of population', p.650; Williamson, *Coping*, p.207.

50. Woods, 'Historical relationship', has shown that infant mortality and life expectancy were closely related as in a model life-table in mid-nineteenth century Britain and this permits the inference of M.

51. By the same token, eliminating the factor market failure detected by Williamson would not improve the 1851 position in the terms of the DW index.  His estimates suggest that, had markets worked efficiently, GDP would have been raised by 7% by a reallocation of labour which would have reduced the rural labour force to 44% of the total in 1851, *Coping,* p.207.  This level was actually reached in 1871.  If the intra-urban distribution is assumed in the counterfactual 1851 to have been that of 1871, then this implies that E falls to 38.5 and M rises to 162 — both below the actual 1820 level.

52. Ibid, p.193, 256.

53. cf Floud *et al*, *Health*, p.305.

54. Szreter, 'Importance'; Hardy, *Epidemic Streets*.

55. Peacock and Wiseman, *Growth of Public Expenditure*.

56. In 1901 urban population was about 2.5 times the 1851 level while real GDP was about 2.8 times the 1851 level. Only marginally higher expenditure on public health as a share of GDP seems likely to have been required. The estimated increase in life expectancy of 5 years is based on 75% of the total change estimated by Woods, 'Effects of Population' and the infant mortality estimate uses the formula in Woods, 'Historical Relationship'.

57. Williamson, *Coping*; Brown, 'Condition of England'.

58. Ibid, p.614.

59. Williamson, *Coping*, p.295.

# TABLE 1

## Living Standards Indicators in Industrial Revolution Britain

|      | Y    | H     | E    | M   | L    | SCH | R1 | R2 |
|------|------|-------|------|-----|------|-----|----|----|
| 1760 | 1803 | 167.4 | 34.2 | 174 | 48.5 | 1.4 | 3  | 3  |
| 1780 | 1787 | 168.0 | 34.7 | 173 | 49.5 | 1.5 | 3  | 3  |
| 1800 | 1936 | 168.9 | 35.9 | 145 | 52.5 | 1.8 | 3  | 4  |
| 1820 | 2099 | 170.7 | 39.2 | 154 | 54.5 | 2.0 | 3  | 4  |
| 1830 | 2209 | 170.7 | 40.8 | 149 | 57.5 | 2.3 | 3  | 3  |
| 1850 | 2846 | 165.3 | 39.5 | 156 | 61.5 | 2.7 | 3  | 1  |

**Sources:**

Y (GDP/Head): based on Maddison, *Monitoring the World Economy*, Crafts and Harley, 'Output Growth', and Feinstein, 'Capital Accumulation'.

H (Height of army recruits born at this date when 20-3): from Floud *et al*, *Heights, Health and History*, pp. 142-7.

E (Life expectancy at birth): from Wrigley and Schofield, *Population History*.

M (Infant mortality): from Wrigley *et al*, *English Population History*.

L (Adult literacy rate): from Schofield, 'Dimensions', pp. 442, 445.

SCH (Average years of schooling): from Matthews *et al, British Economic Growth,* p.573 extrapolated back using literacy rates.

R1 (Political rights index): based on Hawkins, 'Parliamentary Government', and O'Gorman, *Voters*.

R2 (Civil rights index): based on Aspinall, *Politics and The Press*, Manchester, *Modern Legal History*. Thompson, *Chartists* and Wickwar, *Struggle*.

# TABLE 2

## Alternative Indices of Living Standards in Industrial Revolution Britain

|      | HDI   | DW Index | Distribution Adjusted HDI | GDI   |
|------|-------|----------|---------------------------|-------|
| 1760 | 0.272 | 6        | 0.216                     | 0.232 |
| 1780 | 0.277 | 5        |                           | 0.240 |
| 1800 | 0.302 | 4        | 0.238                     | 0.263 |
| 1820 | 0.337 | 3        |                           | 0.283 |
| 1830 | 0.361 | 2        |                           | 0.309 |
| 1850 | 0.407 | 1        | 0.307/0.321               | 0.335 |

**Sources:**

Derived from Table 1 and Appendix Tables 1 and 2. For description of the indices see text and for detailed explanation of the derivation of the estimates see the appendix. The alternative estimates of the Distribution-Adjusted HDI for 1850 are based on Williamson's estimate for the Gini coefficient of 0.551, *Did British Capitalism*, p.68 and Feinstein's of 0.475, 'Rise and Fall', p.723, respectively.

**TABLE 3**

**Aspects of Living Standards in Britain
and Its International Peer Group c1860**

|  | Y | H | E | M | L | SCH | R1 | R2 |
|---|---|---|---|---|---|---|---|---|
| Britain | 3263 | 165.3 | 41.2 | 151 | 65 | 4.0 | 3 | 1 |
| Belgium | 2640 | 165.5 | 41.1 | 165 | 50 | 2.8 | 3 | 2 |
| Netherlands | 2640 | 165.1 | 37.7 | 197 | 70 | 4.4 | 3 | 2 |
| USA | 2457 | 171.1 | 41.9 | 226 | 65 | 4.0 | 2 | 2 |
| Denmark | 1927 | 166.1 | 44.5 | 136 | 65 | 4.0 | 3 | 1 |
| Germany | 1913 | 164.3 | 33.0 | 211 | 70 | 4.4 | 4 | 5 |
| Austria | 1875 | 167.2 | 31.7 | 259 | 30 | 1.1 | 4 | 4 |
| France | 1858 | 164.7 | 41.0 | 179 | 55 | 3.2 | 4 | 5 |
| Sweden | 1664 | 168.2 | 44.6 | 144 | 55 | 3.2 | 3 | 1 |
| Italy | 1467 | 162.2 | 27.7 | 231 | 20 | 0.3 | 5 | 3 |
| Spain | 1376 | 160.9 | 33.7 | 187 | 25 | 0.7 | 5 | 5 |
| Norway | 1303 | 168.6 | 48.7 | 107 | 35 | 1.5 | 3 | 1 |

**Sources:**

Y (GDP/Head, 1870): Maddison, *Monitoring the World Economy.*

H (Heights, 1850): Austria from Komlos, Nutrition, p. 57; Britain, France, Germany, Netherlands, Sweden, USA from Floud and Steckel, 'Conclusion'; Spain from Gomez-Mendoza and Perez-Moreda, 'Heights and Welfare'; remainder from Floud, 'Heights of Europeans'.

E (Life expectancy at birth, 1860): Austria from Helczmanovski, 'Austria-Hungary', Belgium and Netherlands from Deprez, 'Low Countries', Britain from Wrigley and Schofield, *Population history*, Denmark from Andersen, 'Denmark', France and Sweden from Wrigley, *People*, Germany from Lee, 'Germany', Italy from Vallin, 'Mortality in Europe', Norway from Dublin *et al*, *Length of Life,* Spain from Poblacion espanola, USA from Haines, 'Estimated Life-Tables'.

M (Infant mortality rate): from Chesnais, *Demographic Transition* except Germany from Lee, 'Germany', and USA from Haines, 'Estimated Life-Tables'.

L (Literacy rate): Austria, Belgium, Britain, France, Germany, Italy from Cipolla, *Literacy and Development;* Denmark and Norway from Markussen, 'Development of writing'; Netherlands from Adelman and Morris, *Comparative Patterns*, Spain from Nunez, 'Literacy and Economic Growth', Sweden from Johansson, *History of Literacy*; USA from Soltow and Stevens, *Rise of Literacy*.

SCH (Average years of schooling): estimated from literacy, see text.

R1 (Political rights index): based on Anderson and Anderson, *Political Institutions*, Goldstein, *Political Repression* and, for the USA, Shade, 'Political Pluralism'.

R2 (Civil rights index): based on Goldstein, *Political Repression*, Goldstein, *Political Censorship* and, for the USA, Burns and Burns, *People's Charter*.

## TABLE 4
## Rankings for Britain and Its International Peer Group on Alternative Indices of Living Standards, c1860

|             | Y   | HDI        | DW Index | H   |
|-------------|-----|------------|----------|-----|
| Britain     | 1   | 1 (0.461)  | 1=       | 7   |
| Belgium     | 2=  | 5 (0.378)  | 7        | 6   |
| Netherlands | 2=  | 2 (0.416)  | 6        | 8   |
| USA         | 4   | 3 (0.413)  | 3        | 1   |
| Denmark     | 5   | 4 (0.393)  | 1=       | 5   |
| Germany     | 6   | 7 (0.343)  | 8        | 10  |
| Austria     | 7   | 10(0.220)  | 10       | 4   |
| France      | 8   | 8 (0.342)  | 9        | 9   |
| Sweden      | 9   | 6 (0.349)  | 4        | 3   |
| Italy       | 10  | 12(0.143)  | 12       | 11  |
| Spain       | 11  | 11(0.185)  | 11       | 12  |
| Norway      | 12  | 9 (0.292)  | 5        | 2   |

**Pareto Dominance**
Britain: Austria, Belgium, France, Italy, Spain.
Belgium: Austria, Italy, Spain.
Netherlands: Austria, Germany, Italy.
USA: Austria, Italy.
Denmark: Austria, France, Italy, Spain.

**Intersection Borda Ranking Superiority**
Britain: Germany.
Belgium: France
Netherlands: France, Spain
USA: France, Germany, Spain.
Denmark: Belgium, Germany, Sweden
Germany: Spain
Austria: Italy
Sweden: Austria, France.
Norway: Austria, Italy, Spain.

**Sources:** derived from Table 3. Figures in parentheses under HDI are th estimated absolute values. Pareto Dominance and Intersection Borda Ranking Superiority refer to the DW Index; for definitions, see text.

# TABLE 5

## Rank Order Correlations Between Living Standards Indices

|       | Y    | H    | DW   |
|-------|------|------|------|
| Y     |      |      |      |
| H     | 0.12 |      |      |
| DW    | 0.51 | 0.64 |      |
| HDI   | 0.86 | 0.26 | 0.85 |

**Source:**    Derived from Table 4.

# APPENDIX

This appendix contains technical details relevant to the construction of the DW, HDI and GDI indices discussed in the paper.

Aggregation with the DW index ranks observations using the Borda rule. In addition, Pareto Dominance requires that an observation scores at least as well on all variables and better on at least one than the observation with which it is compared. An observation is superior to another on Intersection Borda Ranking if, on all weighting systems where the weights sum to 1 and which admit each variable with a weight of at least 0.1, it has a higher Borda rule score.

The following definitions are used to establish the political rights variable in the DW index:

1: Political systems in which the great majority of persons have both the right and the opportunity to participate in the electoral process. Political parties may be freely formed for the purpose of making the right to compete for public office fairly general.

2: Political systems with an open process which does not always work well, however, due to extreme poverty, a feudal social structure, violence or other limitations on potential participants or results. As is the case with countries coded 1, a leader or party can be voted out of office.

3: Political systems in which people may elect their leaders or representatives but in which *coups d'etat*, large-scale interference with election results, and often non-democratic procedures occur.

4: Systems in which full democratic elections are blocked constitutionally or have little significance in determining power distributions.

5: Systems in which elections are closely controlled or limited or in which the results have little significance.

6: Political systems without elections or with elections involving only a single list of candidates in which voting is largely a matter of demonstrating support for the system.

7: Systems that are tyrannies without legitimacy.

The following definitions are used to establish the civil rights variable in the DW index.

1: Political systems in which the rule of law is unshaken. Freedom of expression is both possible and evident in a variety of news media.

2: Political systems that aspire to the above level of civil rights but are unable to achieve it because of violence, ignorance, or unavailability of the media, or because they have restrictive laws that seem to be greater than are needed for maintaining order.

3: Political systems that have the trappings of civil liberty and whose governments may be successfully opposed in the courts, although they may be threatened or have unresolvable political deadlocks and may often have to rely upon martial law, jailing for sedition, and suppression of publications.

4: Political systems in which there are broad areas of freedom but also broad areas of illegality. States recently emerging from a revolutionary situation or in transition from traditional society may easily fall into this category.

5: Political systems in which civil rights are often denied but in which there is no doctrine on which the denial is based. The media are often weak, controlled by the government and censored.

6: Countries in which no civil rights are thought to take priority over the rights of the state, although criticism is allowed to be expressed in limited ways.

7: Political systems of which the outside world never hears a criticism except when it is condemned by the state. Citizens have no rights in relation to the state.

The Human Development Index in Tables 2 and 4 is based on the 1994 version; this differs in some respects from earlier versions. It is most easily understood by following the calculation of HDI for Britain in 1850 using the data in Table 1.

HDI is (indexed life expectancy + indexed educational attainment + indexed adjusted income)/3. In each case the indexed figure is based on how far the country has progressed between the assumed minimum and the maximum values and lies between 0 and 1. The indexed values are calculated as follows.

## (a) Life Expectancy

$$\frac{39.5 - 25.0}{85.0 - 25.0} = \frac{14.5}{60.0} = 0.242$$

where 39.5 years is the estimate of life expectancy for 1850, 85 years is the assumed maximum achievable and 25 years is taken to be the minimum value possible.

## (b) Educational Attainment

This has two components based on the literacy rate and schooling. The literacy rate (61.5%) is regarded as already an appropriate index since the maximum feasible is 100% and the minimum 0%. Years of schooling have an assumed maximum of 15 years and a minimum of 0 years and are thus indexed as

$$\frac{2.7 - 0.0}{15.0 - 0.0} = 0.180$$

The educational attainment index is a weighted average of the two components = 2(0.615) + 0.180 = 0.470.

## (c) Income

Income is discounted heavily over a certain threshold such that the maximum adjusted income is \$5385. Minimum income is taken to be \$200. British income in 1850 is below the threshold where adjustment starts and the indexed income figure is therefore

$$\frac{2846 - 200}{5385 - 200} = \frac{2646}{5185} = 0.510$$

Therefore HDI = (0.242 + 0.470 + 0.510)/3 = 0.407.

To obtain the Distribution-Adjusted HDI the income variable is multiplied by (1 — Gini Coefficient of Income Inequality) prior to obtaining the indexed income figure. Thus for Williamson's estimate of G = 0.55 the income figure relevant to this measure is

$$\frac{2846(0.45) - 200}{5385 - 200} = \frac{1080.7}{5185} = 0.208$$

Therefore the Distribution-Adjusted HDI = (0.242 + 0.470 + 0.208)/3 = 0.307.

The Gender-related Development Index (GDI) is a further development of HDI to take account of disparities between men and women. It is a good deal more demanding on data and involves value judgements about the extent to which these disparities are regarded as undesirable; at present the UN adopts a standard assumption on this and the present estimates use the same assumption. The index requires separate estimates for men and women of life expectancy, educational attainment and income. These data are set out in Appendix Table 1.

GDI is an average of 'equally distributed' indices of the usual three components. These indices are set out in Appendix Table 2. The calculation of these for 1850 follows.

## (a) Life Expectancy

Maximum and minimum values are assumed to differ: 87.5 and 27.5 for women, 82.5 and 22.5 for men. Proceeding as before, in 1850 this gives a female index of (40.47-27.5)/60 = 0.216 and a male index of (38.53-22.5)/60 = 0.267. These are combined using the population proportions female (0.5103) and male (0.4897) using the following formula, which embodies the degree of inequality aversion, to obtain the equally distributed index:

$$[\, 0.5103(0.216)^{-1} + 0.4897(0.267)^{-1} \,]^{-1} = 0.238$$

## (b) Educational Attainment

Gender differentials in schooling were assumed to be the same as in literacy. The measurement of eduactional attainment is carried out as for the HDI but separately for each gender. Schooling is assumed in 1850 to have been 3.32 years for men and 2.08 years for women. Proceeding as before, this gives educational attainment indices of 0.534 for men and 0.406 for women. These are then combined to obtain the equally distributed index as follows:

$$[\, 0.5103(0.406)^{-1} + 0.4897(0.534)^{-1} \,]^{-1} = 0.460$$

## (c) Income

The income index is arrived at using estimates of proportional income shares by gender to derive an equally distributed income coefficient as follows:

$$[\, 0.5103(0.398)^{-1} + 0.4897(1.602)^{-1} \,]^{-1} = 0.630$$

This is then used to adjust the income estimate (2846 x 0.630) before inserting this into the income attainment formula. Thus we have

$$\underline{(2846 \text{ x } 0.630) - 200} = 0.307$$

5385 - 200

The GDI is then simply $(0.238 + 0.460 + 0.307)/3 = 0.335$.

# APPENDIX TABLE 1

## Gender Specific Data on Components of HDI

| | Life Expectancy | | Literacy | | Income Shares | |
|---|---|---|---|---|---|---|
| | F | M | F | M | F | M |
| 1760 | 33.9 | 34.5 | 36 | 61 | 0.560 | 1.440 |
| 1780 | 34.1 | 35.3 | 39 | 60 | 0.558 | 1.444 |
| 1800 | 36.2 | 35.6 | 42 | 63 | 0.528 | 1.473 |
| 1820 | 40.3 | 38.1 | 46 | 63 | 0.409 | 1.592 |
| 1830 | 41.9 | 39.7 | 51 | 64 | 0.420 | 1.581 |
| 1850 | 40.5 | 38.5 | 54 | 69 | 0.398 | 1.602 |

**Sources:**

Life expectancy data for 1760 and 1780 from Wrigley *et al, English Population*; for 1850 based on the standard English life-table and for intermediate years the gender relativities for Quakers in Vann and Eversley, *Friends*, p.228 are used to adjust the aggregate estimates in Table 1.

Literacy data from Schofield, 'Dimensions', p.445.

Income shares require information on participation rates and on relative earnings. This is very sparse and what is available must be regarded as of dubious quality. I have relied on ongoing unpublished research by Charles Feinstein who has kindly allowed me to make use of his provisional estimates. The earnings differentials are based on female domestic servants relative to male building workers. Female participation rates are assumed to follow a pattern similar to that implied by the results in Horrell and Humphries, 'Old Questions'.

# APPENDIX TABLE 2

## Equally Distributed Indices for Compiling GDI

|      | Life Expectancy | Educational Attainment | Income |
|------|------|------|------|
| 1760 | 0.138 | 0.320 | 0.239 |
| 1780 | 0.145 | 0.339 | 0.236 |
| 1800 | 0.174 | 0.367 | 0.248 |
| 1820 | 0.234 | 0.394 | 0.222 |
| 1830 | 0.261 | 0.426 | 0.241 |
| 1850 | 0.238 | 0.460 | 0.307 |

**Source:** derived from Appendix Table 1 using the methods described in this appendix.

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