A composite perspective on British living standards during the Industrial Revolution

Daniel Gallardo Albarrán

April 2016
A composite perspective on British living standards during the Industrial Revolution

Daniel Gallardo Albarrán
University of Groningen
d.gallardo.albarran@rug.nl

April 25, 2016

Abstract

Few topics in economic history have received more attention than the profound transformations undergone by Great Britain during the 18th and 19th century. Even though the positive outcomes of this process for human living standards nowadays are not disputed, the same does not apply to the century spanning from 1750 to 1850 in Great Britain. Studies looking at key well-being dimensions individually such as income, health, working time and inequality individually often show contradictory evidence. To account for differences in their evolution, this paper presents a new framework grounded on economic theory to integrate them in a single measure and put their development into a broader perspective. I conclude that the new welfare measure does not support the idea of a two-phase process in the evolution of British living standards during the period 1781-1851 which indeed can be observed when considering the individual indicators of income, health or working time separately. The reason for this is that welfare gains came first almost exclusively from health improvements until the 1810s and then from wages (and to a lower extent non-working time). Secondly, the discrepancies between different real wage estimates in the literature appear less substantial in a framework that extends the concept of well-being. And thirdly, real wages typically underestimate the extent to which welfare increased over this period. Actually, health might have contributed to an improvement in well-being at least as substantial as the most optimistic estimate of real wages.

Keywords: British industrial revolution, living standards, welfare, wages, health.
Introduction

Few topics in economic history have received more attention than the profound transformations underwent by Great Britain during the 18th and 19th centuries. Over roughly one hundred years, this country set the basis for a dynamic and self-sustaining economic process that has improved the lives of millions of people up to the present day. Nevertheless, even though the positive outcomes of this process for human living standards nowadays are not disputed, the same does not apply to the century spanning from 1750 to 1850 in Great Britain.

Since contemporaries criticized the consequences of the new production and urban systems on the human status of the mass of the population (Engels, 1962; Chadwick, 1842), there has been substantial debate whether these concerns can be supported with quantitative evidence for at least four well-being dimensions: income, health, working time and inequality. However, most of the studies in this literature have looked at these dimensions individually, which can be problematic as their evolution and timing can differ significantly. For example, whereas real wage and working time studies suggest a period of welfare stagnation for British workers until the 1820s and a subsequent improvement (Lindert and Williamson, 1983, 1985; Feinstein, 1998; Clark, 2001, 2005; Allen 2001, 2007), health measures improve from the late 18th century until the 1810s and then it stagnates until mid-19th century (Wrigley et al., 1997; Szreter and Mooney, 1998). On top of this, the upward trend of real wages after the 1820s is not conclusive either since different estimates can vary by a factor of two as illustrated by the studies of Lindert and Williamson (1985) and Feinstein (1998). Therefore, if I want to assess the evolution of British welfare, should I draw on the evidence for income which shows a clear improvement after the 1820s? Or should I dismiss this development because mortality stagnated during the second quarter of the 19th century? Moreover, do differences in wage estimates matter if I extend the concept of living standards?

This study is an attempt to reflect on some important and well-known quantitative contributions of scholars in the field by putting their views into a broader perspective and assessing their implications for the standard-of-living debate when considering other dimensions of well-being.¹ For this purpose, I use a framework grounded on economic theory drawing on Jones and Klenow (Forthcoming) to create an income-equivalent measure and combine the dimensions of income, health, working time and inequality during the period 1781-51.²

Three main conclusions can be derived from this exercise. Firstly, the results do not support the idea of a two-phase process in the evolution of British welfare during the analyzed period which indeed can be observed when considering the analyzed well-being dimensions separately. The reason for this is that welfare gains firstly came almost exclusively from health improvements until the 1810s and then from wages (and to a lower extent from non-working time). Therefore, despite a change in several economic and demographic variables seem to have occurred in the first two decades of the 19th century, the results suggest that their net effect on well-being seem to have been positive. Secondly, the

¹ In the following, I will use the concept of living standards, well-being and welfare interchangeably to refer to the status of British workers when considering income, health, working time and inequality.
² In the remaining of the paper, I will refer to this income-equivalent measure as welfare or well-being for the sake of simplicity.
discrepancies between different real wage estimates in the literature appear less substantial in a framework that extends the concept of well-being. And thirdly, real wages typically underestimate the extent to which welfare increased over this period. Actually, health might have contributed to an improvement in well-being at least as substantial as the most optimistic estimate of real wages.

The rest of the paper is structured as follows. Firstly, I will elaborate on the unit of analysis to study the evolution of well-being in Great Britain and the concept of living standards that will be adopted. Secondly, I will discuss some relevant contributions to the literature of the last three decades which form the core of the analysis. Thirdly, I will discuss the methodology employed. Fourthly, I will present the results and finally I will conclude.

**Who and what are we looking at?**

The debate of the ‘Condition of England’, as Thomas Carlyle (1845) and then Engels (1962) put it, has been traditionally about the working class. But, which occupations should we look at to analyze trends in this broadly-defined group? Lindert and Williamson (1983) look at ‘blue-collar workers’ that encompasses those whose earnings fall below the 80th percentile of the income distribution such as farm laborers (accounting for the bottom 40% of all workers), cotton spinners or artisans at the national level.\(^3\) This approach might be viewed as being too narrow since the consequences of the industrial revolution differed substantially by regions, professions, age or gender. Theoretically, one could create separate indicators to account for differences in performance across different groups and regions which would require a substantial amount of reliable and over-time comparable data. In this research though, since I draw on other authors’ data I indirectly take their approach and analyze the development of living standards creating a national welfare index acknowledging its potential limitations in terms of representativeness. Nevertheless, this should not be viewed as a drawback for the purpose of this study because, as Feinstein (1998, 627) points out, “Ultimately, however, if we are to reach any broad conclusions about the outcome for the working class as a whole, we must resort to some form of comprehensive national measure”.

To examine the evolution of living standards of the working class during the 18th and 19th century, I first need to specify the elements that will be considered. Easterlin (2000) argues that well-being is an ever-growing concept that entails many dimensions and in order to choose which aspects to look at, he uses international surveys that ask individuals what they value most in life. This approach has the advantage of avoiding arbitrary choices by the researcher. On the other hand, if we want to take these contemporary views as representative of an individual in the 18th and 19th centuries, we have to assume that they have remained constant over more than 200 years. Useful as this approach might be, this research motivates the study of four dimensions of living standards on historical grounds.

---

\(^3\) Sometimes such a comprehensive coverage of professions is not possible and several authors had to rely on individual sectors or professions which proxy for the overall ‘condition’ of the working class as could be defined by Lindert and Williamson (1983).
Social reformers of the 19th century like Edwin Chadwick, Friedrich Engels or Karl Marx were primarily concerned about at least four aspects of the mass of the population: income, health, working time and inequality. Of these dimensions, Engels (1962) and Marx (1867) probably focused most on income because it was the basis for the subsistence of workers and their families and largely determined their social status. Also, they criticized and view economic inequality as a natural and undesirable outcome of the industrial revolution and its new modes of production. In their view, the concentration of wealth by the capitalist elite at the expense of the working class would reduce workers’ ability to enrich themselves and therefore social welfare. Another two aspects of British workers that had a predominant position in contemporary descriptions of the living conditions of the working poor is health and working time (Chadwick, 1842; Engels 1962; Hill, 1875). Regarding health, overcrowding and unhealthy housing together with poor personal hygiene are typical accounts of this time period. Concerning working time, long working hours were often seen as detrimental for adults and specially children. Engels (1962) emphasized the neglect of the youngest part of society that often were left alone and grew up in the streets. Also, children who were engaged in sectors with long working hours often fell asleep at school.

For income, health and working time, qualitative evidence seems to point out that these two dimensions were an important part of worker’s well-being for 19th century contemporaries. But, if we could ‘ask’ the workers directly, would these impressions be confirmed? Williamson (1982, 1990) address this question by estimating the extent to which English workers had to be ‘bribed’ to move from the countryside to an urban environment using data from the Poor Law Report of 1834. The results show that workers had to be paid a wage premium to accept the working conditions in an urban setting which typically involved higher prices, living in unhealthy environments and working long hours. As one might expect, the wage premium differed across England because some regions were more industrialized than others. For instance, the industrializing north offered larger premiums than the rural southern counties. In other words, not only higher urban incomes were valued by people but also the means for obtaining them and their consequences.

As we have seen, qualitative and quantitative evidence from the period suggests that income, health, working time and inequality were an important part of worker’s lives. In other words, any change in these dimensions influenced their standard of living to some degree. Therefore, if I aim at analyzing the evolution of well-being of the British working class, at least I need to consider these four elements.

---

4 On the other side of the Atlantic, similar concerns about income, health and inequality were expressed by Jacob Riis (1901).
5 It should be noted that Williamson (1982) does not mention the issue of long working hours as being part of the wage premium. However, the premium he estimates is not exclusively related to health differentials but also to other factors related to everyday life and work in big cities which were different from the countryside and captured by his regression variable INFM (infant mortality rate).
6 This framework should not be treated as inflexible since other dimensions such as political freedom or education were important as well.
Literature review

What do we know about the evolution of living standards during the period 1781-1851? For the four dimensions considered, we can find a large amount of qualitative and quantitative evidence that points at different (and sometimes opposite) trends in well-being. In this section, I will look at quantitative studies.  

In the first place, I will consider the dimension that has probably generated most controversy since the 19th century, namely workers’ income. To study this dimension, the literature has traditionally relied on information concerning normal or full-time earnings to create real wage rates. Even though studies using this type of information have a long history, in this section I will take as a point of departure the contributions by Peter Lindert and Jeffrey Williamson (1983, 1985). With a great deal of new data on wages and prices, the authors brought the optimists case to the forefront by arguing that between 1820 and 1850 real wages nearly doubled. This impressive increase in real wages would soon be qualified by Crafts (1985) on the basis of the prices used to deflate nominal wages such as house-rents, cereals and clothing. After correcting them, Crafts suggested that the growth rate of real wages might have been 20 percent lower than what Lindert and Williamson (1983) initially claimed. Nevertheless, despite this revision was substantial, the optimists case remained strong.  

Despite the views of the optimists were not supported by everyone in the literature, their position would only be substantially challenged with the study of Feinstein (1998). In his work, Charles Feinstein provided new wage and price series for Great Britain and the United Kingdom. The wage data contained data on males and females and they also allowed for changes in the composition of the labor force within industries. With these new pool of data, he concluded that real wages increased significantly less than what the optimists believed, namely around 30 percent over the whole period. Why were Feinstein’s estimates so different? This disparity could come from nominal wages, prices or both. Regarding nominal wages, Feinstein (1998, 634) argues that the trend of his data and that of Lindert and Williamson (1985) is very similar. Thus, the source of the disagreement on real wages came mainly from the index used to deflate nominal wages. In this aspect, Feinstein made two big changes. One is related to expenditure weights in the price index and the base year. And the other is that he included more products like potatoes or oatmeal and used more reliable rent series. These changes made his price index decline less after 1815 than the one by Lindert and Williamson (1985).  

Later revisions have both supported the pessimists and the optimists view. On the optimists side, Clark (2001, 2007) looks at farm wages to provide a lower bound estimate of the general movement of real wages and concludes that these increased around 7 percent more than what Feinstein (1998) suggests. On a later paper, Clark (2005) argues that evidence from wages for building craftsmen imply a 82-percent increase over the whole period.

---

7 See Voth (2004) for a more comprehensive review.
8 Their view was further supported by other studies such as Williamson (1981, 1982, 1984) and Lindert and Williamson (1985).
9 See Horrell and Humphries (1992) or Mokyr (1988).
On the pessimists side, Allen (2001) shows that the real wages of building craftsmen in London stagnated until Waterloo and then slightly improved until 1850. Moreover, by considering a longer time period he observes that the gains achieved by 1850 are part of a cycle rather than a trend. Several years later, Allen (2008) revised the price series of Clark (2005) and Feinstein (1998) to come up with a new cost-of-living index that incorporates the best of the two in terms of expenditure weights and price series. Applying the new price index to the nominal wage series of Feinstein the author finds that pessimism is preserved since the increase in real wages stands around 45 percent.

To graphically understand the different positions held by these scholars, I have assembled a dataset with wages and prices to replicate their real wage series and presented them in the following figure: 10

Figure 1: Real wages during the period 1781-1851.

Figure 1 shows the development of real wages of both pessimists and optimists. In this figure, two points are worth highlighting. Firstly, the lack of consensus only concerns the period after 1815 since both views agree that real wages stagnated or slightly grew from the 1780s to the 1810s. This upholds the idea of two well-differentiated periods during the first decades of the industrial revolution with mixed consequences for peoples’ well-being. The second point concerns the extent to which real wages estimates differ and their implied increase. Whereas the optimists report a sizeable improvement that ranges between 60 and 80 percent (see Figure 1A in the Appendix), the pessimists argue for an increase around 40 percent.

10 For the sake of clarity, I have not included the series by Lindert and Williamson (1983, 1985), Feinstein (1998) and Clark (2007). These can be found in the Appendix A, Figure 1A.
Before examining the broader implications of these trends on worker’s living standards, it is worth putting them into a broader perspective by looking at other important dimensions of well-being such as health, working time and inequality.

**Table 1. Indicators of health, working time and inequality during the period 1781-1851**

<table>
<thead>
<tr>
<th>Years</th>
<th>Life expectancy at birth (years)</th>
<th>Working time (annual hours)</th>
<th>Inequality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781</td>
<td>36</td>
<td>2,971</td>
<td>--</td>
</tr>
<tr>
<td>1816</td>
<td>41</td>
<td>3,313</td>
<td>0.526</td>
</tr>
<tr>
<td>1836</td>
<td>41</td>
<td>3,305</td>
<td>0.536</td>
</tr>
<tr>
<td>1851</td>
<td>40</td>
<td>3,185(^a)</td>
<td>0.543</td>
</tr>
</tbody>
</table>

Note: the years considered in the table represent tipping points in the evolution of wages and were selected to compare their trend with that of health, working time and inequality. The sources for life expectancy at birth and working time are Wrigley et al. (1998) and Voth (2001) respectively. For inequality (Column III) is Williamson (1985) and Feinstein (1988) for column IV. The figures reported in this table for working time and inequality were obtained by interpolating using data from 1760, 1800, 1830 and 1850 in the case of working time and from 1801 and 1867 in the case of inequality.

\(^a\) This number refers to 1850.

Table 1 shows data for some selected years on health, working time and inequality. If we compare this information with the one for real wages, the overall picture about the evolution of well-being becomes less clear which suggests that pinpointing the timing of welfare improvements (broadly understood) confined to a single measure of living standards can be problematic. In contrast with real wages, the period spanning from 1781 to the end of the Napoleonic wars is an optimistic one in terms of health with an increase in life expectancy of 5 years (see Table 1, column I). After 1816, when all real wage series are rising, health stagnates until the end of the period. This development was partially driven, among other factors, by the deterioration of living conditions in growing urban settlements due to crowded housing and inefficient human waste disposal. As a result, mortality in provincial cities with more than 100,000 inhabitants in England and Wales was not only higher than the national average, but it did not improve from the 1820s to the 1860s (Szreter and Mooney, 1998). A large part of the death toll was being paid by the weakest part of society, namely children. Huck (1995) finds that after the 1820s infant mortality rates rose steadily in nine parishes in the industrial north of England.

Before turning to working time, it should be noted that the evidence is more scattered and unreliable than for income or health. Therefore, it is useful to look at it in terms of trends rather than levels. From 1781 until 1816, there is a rise in the amount of annual working hours and a subsequent slight decline which does not compensate for the prior increase (see Table 1, column II).\(^11\) The reason for this increase was not longer working days, but rather an increase in the number of working days. Courtroom evidence from London and the north of England shows that typically non-working days like Mondays and holy days in the mid-18\(^{th}\) century became regular working days in the 19\(^{th}\) century (Voth, 2000).

\(^{11}\) Contemporaries like William Blake or Friedrich Engels pointed out that the new systems of production pushed people into working environments characterized by both long working hours as well as effortful and hazardous tasks. In this paper, I do not account for changes in the nature of the work performed but only for the amount of time devoted to this purpose.
Given the scattered evidence we have on working time, can we make general claims? Before doing so, three issues must be taken into account. Firstly, the pattern described above might not have been a general phenomenon in the British economy due to differences across industries in the organization of labor. For instance, Clark and van der Werf (1998) argue that hours in agriculture seem to have remained roughly constant during the industrial revolution. Secondly, variation across regions make the endeavor of obtaining a national estimate complicated (Hopkins, 1982). And thirdly, the described evidence is mainly representative of male labor due to data constraints. This largely neglects child and female labor, which was particularly present in some industries such as textiles (Berg and Hudson, 1992). Regarding female labor, household budgets evidence suggest that female participation rates might have decreased from 65 to 45 percent of married women over our period (Horrell and Humphries, 1995: 98). With respect to child labor, evidence on trends during this period are not conclusive. However, we can conclude from the census of 1851 that child labor might have been relatively important since 36 percent of children between the age of 10 and 14 worked (Voth, 2004; Humphries, 2001).

What are the implications of the working-time literature for the living standards’ debate? If we assume the overall evolution shown in Table 1 to be generally true, increasing working hours until the 1820s suggest a decrease in worker’s well-being rather than a stagnant pattern as implied by real wage figures. Furthermore, we can find some support for the pessimists’ case after the Napoleonic wars since annual working hours did not return to 18th-century levels.

The final aspect of British workers to consider is the degree to which the society in which they lived provided more or less equal opportunities over time. The outcome of such a complex development could be captured with measures of economic inequality like the Gini coefficient. As columns III and IV in Table 1 show, the evidence on this is not conclusive at all. Whereas Williamson (1985) argues that inequality increased in the second half of the 19th century, Feinstein (1988) suggests a slight decrease. In any case, the size of both the increase and decrease in inequality is not particularly large.

Given these different developments in the dimensions considered, it becomes clear that a more comprehensive measure of well-being is needed to assess overall workers’ welfare, namely a composite indicator. Crafts (1997) took such an approach and created two composite indices drawing on Dasgupta and Weale (1992) and the Human Development Index.12 Despite he observed that well-being seem to have increased over the whole period, this observation must be taken cautiously due to two methodological issues concerning the welfare indices. Firstly, the weighting scheme used for combining the different dimensions has a large impact on the indicator and the conclusions derived from it are not robust to changes in such weights. And secondly, these indicators do not show the extent to which welfare increased but rather whether it was increasing or not. These issues leave some questions opened such as: does the chronology implied by wages and working time hold after accounting for health and inequality? Do the varied estimates of real wages matter when confronted with trends in other welfare dimensions? Are the pessimists and optimists’ views irreconcilable? To answer these questions, the next section presents a new theoretical framework grounded on economic theory drawing on Jones and Klenow (Forthcoming). This methodology uses a utility framework similar to the

---

12 Williamson (1984) also developed a composite index to combine income and health.
one in Williamson (1984). However, the indicator developed in the present article is superior in at least three different aspects. Firstly, I will not only consider the well-being dimensions of income and health as Williamson (1984) does, but I will also take into account the aspects of working time and inequality. Secondly, for the dimensions of income and health I will use new and more reliable estimates of their evolution. And thirdly, whereas Williamson (1984) provides welfare calculations for three benchmark years, I provide yearly estimates which are particularly useful for identifying breaking points.

**Methodology**

The starting point for combining the different welfare dimensions is choosing the unit of analysis. As discussed before, I will analyze the evolution of living standards of the British working class by relying on indicators of income, health, working time and inequality at the national level. Therefore, the present measure will be an income-equivalent estimation of national welfare for an average individual belonging to the working class. Following Jones and Klenow (Forthcoming), the welfare of this individual in a given year will depend on her income level, time spent working, the level of inequality in the society and her health. Formally, we can express this as follows:

\[
V(e, y, l, i) = e(\bar{u} + y + l - i)
\]

where the welfare or utility of an individual \( V \) depends on the years she is expected \( e \) to enjoy her income \( y \), to spend time outside the workplace \( l \), economic inequality \( i \) and a constant \( \bar{u} \).

To compare welfare over time, I take as a reference the starting year of the analyzed period (1781) and observe the evolution of these four variables with respect to that year. Then, I calculate the factor by which income would have to be adjusted so that a representative British worker in 1781 is as better off as he would be in another year after 1781 with different levels of income, health, leisure and inequality. An example can be illustrating. Consider an increase in income of 10 percent in a given year with respect to 1781 while the rest of the variables stay constant. Then, the improvement in living standards will be the proportion of income that would have to be increased so that our British worker in 1781 is as well off as in the second year, namely 10 percent. The result of this exercise would be exactly the same as if measured with a real wage index based in 1781. What if other variables change? Then, the resulting increase or decrease in welfare will depend on the individual contribution (be it negative or positive) of the four dimensions. For example, if working time and mortality decrease while the rest stay constant with respect to 1781, then the improvement in welfare is measured as the proportion of income of a British worker in 1781 that would have to be increased so that he is as better off as he would be in the second year when he is expected to live longer and work less.

\[
V(e_0, \lambda_t y_t, l_t, i_t) = V(e_t, y_t, l_t, i_t)
\]

---

13 This section largely draws on Jones and Klenow (Forthcoming) and therefore partially uses their mathematical notation. For a more detailed exposition of the methodology, see Appendix B.
where \( t_0 \) is 1781, \( t \) is any year from 1782 to 1851 and \( \lambda_t \) is the factor by which income has to be adjusted in 1781 so that welfare in that year equals welfare in year \( t \).

In order to implement the welfare calculation of Equation 1 and 2, I need to specify how and which variables will be observed over time. For income, I have assembled a dataset that replicates the real wage series from both pessimists and optimists presented earlier (also see Figure 1A).\(^{14}\) For the dimension of health, I took life expectancy at birth figures from Wrigley et al (1998). For non-working time, I took annual hours worked from Voth (2001) and divided them by total time endowment which I assumed it was 5840 hours (16 hours a day multiplied by 365 days). The resulting figure is then subtracted to one to see the proportion of time that an average British worker spent in non-working activities. However, as I mentioned in the previous section, these figures mainly refer to male working time so assuming that only males were working longer would neglect similar evolutions for children and women. To overcome this problem, I will consider that for males, females and children the evolution in annual working time was the same. By doing this, I adopt a pessimistic view on this dimension to provide a lower bound estimate (if the evolution of working time for women and children was not more unfavorable than what male figures suggest).\(^{15}\) Regarding inequality, I did something similar as for non-working time and took a pessimist approach by using the Gini coefficients by Williamson (1985) to provide a lower bound welfare estimate. Finally, to obtain the value for the constant (0.38) in Equation 1 I draw on Williamson (1990).

**Results**

Before looking at the results of the welfare estimations, it is worth recalling the main conclusions drawn after reviewing some evidence on the development of British well-being considering income, health, working time and inequality separately. Firstly, trends in wages, health and working time suggest the existence of two well-differentiated time periods with mixed consequences for British workers. Whereas wages and working time point to welfare stagnation before the end of the Napoleonic wars and an improvement afterwards, health measures show some improvement in the first period and stagnation until mid-19\(^{th}\) century. Secondly, the most optimistic and pessimistic estimate differ by a factor of two. And thirdly, the improvement in living standards ranged between 86 and 38 percent over the whole period when considering real wages.

Do we see a similar pattern when we combine income, health, working and inequality? Figure 2 presents three welfare indices for the period 1781-51 using two real wage series to account for the optimists

---

\(^{14}\) In almost all cases, the authors reported yearly data on their wage and price series except for Clark (2005) which uses 10-year averages. This presented a problem since his data was not comparable with the other series and creating similar averages for the other series would result in a significant loss of data points. Therefore, I decided to create yearly estimates using Clark’s data by assuming that his averages refer to the mid-year in every 10-year period and then I interpolated between benchmarks.

\(^{15}\) I tried with different specifications by, for instance, assuming that children’s working time did not change over this period and the results did not change. However, given some historical evidence this seemed like the wrong choice.
The first conclusion that can be drawn from the three indices is that welfare increased steadily over the whole period 1781-1851, which contradicts the evidence for real wages since substantial progress was achieved before 1820 (this result also holds if I consider other real wage estimates, see Figure 2A in Appendix A). Therefore, these results do not support the existence of two well-distinguishable phases in the evolution of workers´ welfare.

**Figure 2. Welfare during the period 1781-1851 (1781=100)**

![Graph showing welfare indices over time](image)

Note: the welfare indices presented in the figure differ only in one respect, namely the real wage series. The underlying data for health, working time and inequality is the same to account for the effect of using different wage series on ‘total’ welfare.

Secondly, the relative importance of the discrepancies between optimists and pessimists in terms of real wage increases is reduced by roughly a half when considering other dimensions of well-being. Whereas the most optimistic real wage increase (Lindert and Williamson, 1985) doubles the most pessimistic (Feinstein, 1998), the largest increase reported by the welfare indices is 40 percent larger than the smallest one (see Figure 2A in the Appendix). If we consider the series of Clark (2005) and Allen (2007), the increase in the former is 32 percent higher than the latter. In terms of welfare, the index using Clark’s wages is only 15 percent larger than using Allen’s wages.

And thirdly, the increase in living standards achieved by 1851 is larger than what measures of real wage alone suggest. Whereas Clark (2005) and Allen (2007) suggest an increase in living standards of 60 and 40 percent respectively throughout the whole period, the welfare indices report an increase of 80 and 68 percent. It is worth mentioning that these figures, similar to real wages, should not be taken at face values but rather as a general indication of the increase in welfare of the British working class over this period since ranges are more informative than absolute values.

---

16 The rest of the wage series were also used to create other welfare indices but are not presented in Figure 2 for the sake of clarity. Figure 2A in Appendix A presents welfare estimates using other real wage series.
So far, I have looked at welfare combining income, health, working time and inequality. In order to understand the forces that were driving it, I provide a breakdown in Figure 3 which shows the contribution of income (measured with Clark’s real wage series), health, working time and inequality to well-being with respect to 1781 in log points. For instance, in 1835 we can see that the positive contribution of real wages and health to welfare is roughly the same (35 and 39 log points respectively). On the other hand, working time and inequality contribute negatively to welfare because people were not only working longer hours in 1835 than in 1781, but the level of inequality was higher. As a consequence, the two combined subtract 12 log points to the welfare attained due to wage and health increases.

What are the forces that explain the three points highlighted above? With respect to the steady increase in welfare over the whole period, Figure 3 shows that from the beginning of the period until 1810, the stagnant picture portrayed by wages and working time is reversed once health is accounted for. Then after progress in this dimension comes to a halt at the end of the Napoleonic wars, because of rapid urbanization and its associated maladies, real wages become the main driver of welfare improvements. At the same time, the levels of inequality increase but its negative effect on well-being is offset by a decreasing trend in the number of annual hours worked after 1830. In light of this evidence, the idea of a two-phase process is overturned by the different trends in health, wages and working time.

Figure 3. Cumulative contribution of wages, life expectancy, working time and inequality to welfare

Note: Health, Working time and Inequality refers to the contribution of life expectancy at birth, annual working time and economic inequality to welfare with respect to 1781 (see Table 1 for the sources). For real wages, I used Clark (2005).

---

17 See Appendix B for more information about this decomposition.
With regard to the relative importance of the discrepancies in the evolution of wages between the optimists and the pessimists, Figure 3 illustrates neatly that the role of health as a major driver of welfare growth subtracts substantial relative weight to wages as a source of welfare. And concerning the third point, we see in Figure 3 that the source of doubling living standards over this period is both wages and life expectancy. The relative weight of these two depends on the wage series that we use as a reference. But in any case, if I take the series based on Clark (2005) to be an upper bound estimate for the real wage increase, we can conclude that health contributed to well-being at least as much as real wages (or even more). Thus, not accounting for health in the first decades of the industrial revolution seriously underestimates welfare improvements by at least as much as if we did not consider wage improvements.

**What are the implications of this study for the debate?**

The last decades of research into the consequences of the British industrial revolution have brought a large amount of evidence on a number of economic, demographic and social aspects of Great Britain in the 18th and 19th centuries. An important part of this new evidence is characterized by painting a more complex picture of what earlier generations of scholars initially thought and by sometimes providing new conflicting evidence on several domains.

One of these domains concerns the study of living standards of the British working class during the 18th and 19th centuries. For example, whereas real wage and working time studies suggest a period of welfare stagnation for British workers until the 1820s and a subsequent improvement (Lindert and Williamson, 1983, 1985; Feinstein, 1998; Clark, 2001, 2005; Allen 2001, 2007), health measures improve from the late 18th century until the 1810s and then it stagnates until mid-19th century (Wrigley et al., 1997; Szreter and Mooney, 1998). On top of this, the upward trend of real wages after the 1820s is not conclusive either since different estimates can vary by a factor of two as illustrated by the studies of Lindert and Williamson (1985) and Feinstein (1998).

This study is an attempt to reflect on some important and well-known quantitative contributions of scholars in this field, the so-called optimists and pessimists, by putting their views into a broader perspective and assessing their implications in the British living standard debate. For this purpose, I applied a framework grounded on economic theory to combine income, health, working time and inequality with two main aims. The first is to put together the views of pessimists and optimists concerning these four dimensions to measure the overall evolution of welfare in Great Britain for the period 1781-51. The second aim is to assess the relative importance of differences in real wage estimations between the pessimists and the optimists when considering other dimensions of well-being.

Two main conclusions can be derived from this exercise. Firstly, welfare seems to have increased steadily throughout the analyzed period without major breaking points as individual indicators of well-being suggest. This might at first glance support the optimists’ case; however both Figure 1 and 2 show that welfare growth rates did not change in the second quarter of the 19th century when productivity gains accelerated in Great Britain and its benefits trickled down to the working classes in the form of higher real wages. A closer look at the forces driving this process reveals that the health toll paid by a growing
urban population together with long working hours and rising inequality hampered progress in well-being. Secondly, health played an important part in the welfare increase over the whole period. This does not only reduce the relative importance of differences in real wages between the pessimists and optimists, but it also shows that welfare might have nearly doubled from 1781 to 1851. Therefore, neglecting the health dimension over this period seriously underestimates the overall increase in welfare. Actually, the results indicate that not including health (as measured with life expectancy at birth) is comparable to ignoring the most optimistic increase in wages over the whole period.

Contrasting the evidence of an increase in the pace of improvements in several economic indicators during the nineteenth century, the condition of the working class seem to have followed an upward steady trend that did not significantly change at least since the late 18th century. To find the roots of this long-term process, the attention must be shifted to an earlier pre-industrial period.
Appendix A

Figure 1A. Real wage development during the period 1781-1851

Note: these estimates were compiled with the information given in each paper.

Figure 2A. Welfare development during the period 1781-1851

Note: the welfare indices presented in the figure differ only in the real wage series used. The underlying data for health, working time and inequality is the same to account for the effect of using different wage series on ‘total’ welfare.
Appendix B

In the following, I will explain in detail the framework used for the calculations of the income-equivalent metric, which draws on Jones and Klenow (Forthcoming). Consider a representative individual (a 19th-century worker in our case) with a certain set of preferences with which welfare will be compared over time. This individual lives behind a veil of ignorance and she does not know in which year of the analyzed time period she will live for her whole life.

To value an individual’s satisfaction, the expected lifetime utility of an individual is defined as follows:

\[ U = E \sum_{a=1}^{100} \beta^a u(Y_a, l_a) S(a) \]

where \( S(a) \) is the probability that the individual is alive up to age \( a \), \( \beta^a \) is the discount rate, \( Y \) is the individual’s annual income and \( l_a \) is non-working time. To assess differences in welfare across countries with this methodology, two further steps need to be taken. The first one consists of extending the previous equation as follows:

\[ U_t(\lambda) = E_t \sum_{a=1}^{100} \beta^a u(\lambda Y_a, l_a) S_t(a) \]

where the subscript \( t \) refers to a certain year and \( \lambda \) multiplies income. \( U_t(\lambda) \) then is the expected lifetime utility of an individual in a given year \( t \) when income is multiplied at every age by \( \lambda \). The second step involves choosing a benchmark year with which welfare comparisons will be made. For this purpose, I chose the beginning year of the analyzed time period, namely 1781.

Taking 1781 as a benchmark, welfare differences with respect of this year are estimated by answering the following question: by which factor do we have to adjust the income of the individual in 1781 so that she is as well off as she is in a different year? Formally, the answer to the previous question can be expressed as follows:

\[ U_{1781}(\lambda_t) = U_t(1) \]

To apply this theoretical framework, we first need to choose the function that will determine an individual’s welfare as follows:

\[ u(C, l) = \bar{u} + \log Y + v(l) \]

where \( \log Y \) is log-transformed income, \( v(l) \) the utility from non-working time and \( \bar{u} \) is the utility of just being alive. I assume that the utility derived from income (or wages) takes a logarithmic form. This is form is particularly useful in this study because it introduces diminishing returns to increases in wages. In other words, the welfare a worker obtains from a certain wage increase is higher the lower the starting level is. To introduce the inequality component in the previous formula, suppose that the distribution of income is log-normally distributed in a certain year with mean \( c_i \) and variance of log-consumption \( \sigma_i^2 \).

---

18 Since this section largely draws on Jones and Klenow (Forthcoming), I also use their mathematical notation.
19 The consumption component in this function is of the CRRA form (Constant Relative Risk Aversion) with a risk aversion parameter of one.
then $E[\log Y] = \log c - \sigma^2/2$. To account for income inequality, Gini coefficients are converted to the standard deviation of log consumption under the assumption of log normality. Moreover, assume that consumption grows at a fixed rate $g$ and that working time is constant across ages. Then, expected lifetime utility is:

$$U_t = \left[ \sum_a \beta^a S_t(a) \right] \cdot \left( \bar{u} + \log Y_t + v(l_t) - \frac{1}{2} \sigma_t^2 \right) + g \cdot \sum_a \beta^a S_t(a) a$$

where $g$ represents the consumption growth rate over time. This equation can be simplified by setting $g=0$ so that the second additive term disappears and by choosing a value of one for $\beta^a$ to rewrite survival rates as $e \equiv \sum_{a=1}^{100} S(a)$, which equals life expectancy at birth. The simplified version of the previous equation is then:

$$U_t = e_t \left( \bar{u} + \log Y_t + v(l) - \frac{1}{2} \sigma_t^2 \right)$$

where $e_t$ is life expectancy at birth. This equation represents the basic tool to compute utility flows over time in Great Britain with respect to 1781. Jones and Klenow (Forthcoming) also provide an additive decomposition of the amount that each dimension of living standards adds to total welfare relative to 1781 (this is the formula used to obtain Figure 3):

$$\log \lambda_t = \frac{e_t - e_{1781}}{e_{1781}} \left( \bar{u} + \log Y_t + v(l) - \frac{1}{2} \sigma_t^2 \right) + \log Y_t - \log Y_{1781} + v(l_t) - v(l_{1781}) - \frac{1}{2} (\sigma_t^2 - \sigma_{1781}^2)$$

In this decomposition, differences in life expectancy are weighted by the flow utility in year $t$ (this is the case when using the compensating variation).

**Calibrating the model**

The last steps to use the above-presented utility framework consists of choosing a functional form for valuing non-working time and calibrate $\bar{u}$. Following Jones and Klenow (Forthcoming), I assume that the form taken by non-working time implies a constant Frisch elasticity of labor supply. Therefore, the elasticity of labor supply with respect to the wage is constant while holding the marginal utility of income fixed. Given that labor supply in this framework is given by $1 - l$, then:

$$v(l) = -\frac{\theta}{1 + \frac{\varepsilon}{\varepsilon}} \left( 1 - l \right)^{\frac{1+\varepsilon}{\varepsilon}}$$

where $\varepsilon$ is the Frisch elasticity, $\theta$ the disutility from working and $l$ is non-working time. $l$ is calculated as:
The value chosen for $\epsilon$ is 1 (changing the value of this parameter did not alter the results). To estimate $\theta$, I used:

$$
\theta = (1 - \pi)(1 - l)^{-1+\epsilon}
$$

where $\pi$ is the marginal tax rate and it is assumed to be zero. As a result, I obtained a value of 3.1 for $\theta$.

Finally, to calibrate $\bar{\mu}$ I first inferred the value of a statistical life (VSL) from Williamson (1990). However, this VSL is extremely low. There can be two reasons for this. Firstly, the empirical setting used has endogeneity issues and therefore the estimated coefficients do not reflect the real trade-off between income and health. And secondly, and most importantly, the data used by Williamson (1990) to look at risks premium in terms of wages are infant mortality rates. This measure of health greatly overestimates the risk of adults in an urban environment, since mortality rates were especially high below the age of five. However, once an individual survived after that age, her prospects of living greatly improved. The consequence of using such measure for calculating risk premiums is that the implied VSL will look very low because the individuals are not being compensated for that risk (but for a lower risk of dying which would be better captured by adult mortality rates for example).

In any case, I first used the VSL implied by Williamson (1990) and I obtained implausible estimates for pre-1834 years when real wages and life expectancy are lower (utility flows were negative). To overcome this problem, I applied an income elasticity of 1.3 to incorporate the idea that the value of health increases with income (this is supported by Hammit and Robinson (2011)) and obtained a value for $\bar{\mu}$ of 3.1. Then I made robustness tests with elasticities of 1.4 and 1.5 (this makes the VSL lower in the past as it decreases more than income) and they largely supported the main results. If I choose instead an agnostic approach and take an income elasticity of 1 to assume that individuals valued health in historical times in the same way as today, then the outcome supports the baseline estimations.

---

[20] The actual formula suggested by Jones and Klenow (Forthcoming) is:

$$
\theta = \frac{w(1 - \pi)(1 - l)^{-1}}{Y}
$$

where $w$ is the wage of the individual and $Y$ is income. However, assuming that income equals wages (as they do as well) leads to the simpler formula that I used to estimate $\theta$. 

18
Reference list


