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# UNREAL WAGES? A NEW EMPIRICAL FOUNDATION FOR THE STUDY OF LIVING STANDARDS AND ECONOMIC GROWTH IN ENGLAND, 1260-1860

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# Unreal Wages? A New Empirical Foundation for the Study of Living Standards and Economic Growth in England, 1260-1860[1]

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**Abstract**

Existing measures of historical real wages suffer from the fundamental problem that workers' annual incomes are estimated on the basis of day wages without knowing the length of the working year. We circumvent this problem by presenting a novel wage series of male workers employed on annual contracts. We use evidence of labour market arbitrage to argue that existing real wage estimates are badly off target, because they overestimate the medieval working year but underestimate the industrial one. Our data suggests that modern economic growth began two centuries earlier than hitherto thought and was driven by an 'Industrious Revolution'.

*Keywords*: England; industrial revolution; industrious revolution; labour input; living standards; wages; Malthusian model.

*JEL Codes*: J3, J4, J5, J6, J7, J8, N33

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## Introduction

Historical real wages are critically out of tune with trends in GDP per capita. This discrepancy raises doubts about the relevance of core theories that build on these wages to provide explanations of when and how Western Europe grew rich. The issue with existing real wages is best understood in the light of two conflicting views about long-run economic development. The traditional 'Malthusian' view, articulated in Clark (2008) and Galor (2011), sees all societies worldwide as being characterised by wide swings in real wages linked to rising and falling populations, but with no sustained real-wage improvement until after c. 1800. The competing 'Revisionist' view, expressed in De Vries (2008) and supported by recent estimates of per capita GDP in Broadberry et al (2015), argues that it is possible to discern incremental but compounded gains long before 1800, notably in England and the Low Countries. These conflicting views are illustrated by Figure 1, which shows how English real wages, captured by the grey line, rise sharply in response to the demographic disaster of the Black Death, then fall as the population recovers, and eventually stagnate during the classic years of the industrial revolution. Figure 1 also shows how per capita GDP, captured by the dotted line, follows a very different pattern, with modest economic growth in the aftermath of the Black Death gathering momentum after c. 1650.

**Figure 1**
Indices of real wages (grey) and GDP per capita (dots), 1260-1850


*Note:* Real wages are constructed by dividing the implied annual income of casual workers by 365 days multiplied by a daily consumer price index (see Table A1). Casual workers' nominal annual income is computed by multiplying their daily payments by 250 working days. Real wages and GDP per capita are indexed using their respective averages of the period 1260 to 1850. *Sources*: Casual wages: Clark (2007). CPI per day: Allen (2009). Per capita GDP: Broadberry et al (2015).

The divergences between the trajectories of real wages and per capita GDP have called for clarification. The standard response draws on two central narratives relating to changing factor payments. The first narrative, known as the 'Golden Age of Labour', refers to the episode of c. 1350 when real wages surged while per capita GDP stagnated (see Figure 1). The Black Death, and ensuing demographic catastrophe, is thought to cause prices to fall and wages to rise, so benefiting workers at the expense of land-owners (e.g. Postan 1966; Dyer 1989). The second narrative, known as 'Engels' Pause', refers to the episode after c. 1650 when real wages stagnated while per capita GDP grew (e.g. Allen 2009). In this case, technical progress supposedly skewed income in favour of profits, so benefiting capitalists over

labourers. The diverging trends are not unique to England, but apply with equal strength to France, Germany, Holland, Italy, and Spain (Campbell 2016).

As is made clear in the macroeconomic growth tradition, the discrepancy between real wages and per capita GDP, and hence the conflict between the Malthusian and Revisionist views about economic development in the long run, can be reconciled by focusing attention on variations in annual incomes caused by changes in labour supply per head (e.g. Angeles 2008; Broadberry et al 2015; Campbell 2016; Hatcher 2011; Nuvolari and Ricci 2013; De Vries 2008). The problem lies in following this up at an empirical level. Hitherto, annual incomes have been constructed on the basis of day rates paid to casual workers who moved from job to job. To gross these up on an annual basis requires knowledge of the number of days worked, which is rarely provided in the surviving records. As a result current estimates of workers' annual labour incomes are potentially subject to measurement error pertaining to scholarly ignorance about day workers' annual labour input. This issue has been widely acknowledge in previous real-wage studies ever since Phelps-Brown and Hopkins (1956: 296) first warned against interpreting their pioneering day-wage series as a measure of living standards in the absence of knowledge about how many days of work labourers were getting.

In trying to side-step the issue, previous research has relied on a simple but crude assumption: workers always and everywhere worked for 250 (or sometimes 260) days per year (e.g. Allen 2001; Allen 2007; Allen et al 2011; Allen et al 2012). Equal to a 5-day working week plus two weeks' holiday. Such an assumption is perhaps not unreasonable in today's world, but in the historical context, as Hatcher (2011) has emphasised, it involves two controversial suppositions about the days that workers were able, needed or wished to work. The first supposition is that day work was always *available* 250 days per year, which Hatcher claims is out of touch with reality, not least because it would have made day labourers better-off than many of their land-owning counterparts. The second supposition is that day workers

always *supplied* 250 days of labour, which Hatcher points out not only involves an entirely inelastic labour supply curve, but also contradicts evidence that medieval workers were known to have set themselves goals in terms of cash and ceased to work after achieving them (e.g. Dyer 1989).

While few and far between, the historical record does provide a few indications of the length of the working year. These suggest that labour input varied widely (see Allen and Weisdorf 2011). To take the extremes: numbers provided by Blanchard (1978) indicate that the medieval working year was sometimes 165 days long, while estimates generated by Voth (2000; 2001) suggest that the early industrial working year was as long as 330 days. If these numbers are even roughly correct, existing annual income proxies, which are based on 250 days of work, over-estimate medieval incomes as much as they underestimate early industrial incomes, by some 30 per cent. The discipline's best guesses about annual wage incomes could well be way off target. Such margins of error challenge the discipline, raising important questions about the reliability of existing real-wage series, with ramifications for core theories of long-run growth, which build on these series, including the Malthusian model (e.g. Clark 2008), unified growth theory (Galor 2011), and the so-called 'little divergence' and 'great divergence' hypotheses (e.g. Allen 2001).

This paper tackles the issue in a new way by constructing a wage series for unskilled English male workers employed on *annual* contracts betwen 1260 and 1850. The use of wages for yearly employment circumvents the central problem related to estimating the annual income of day workers in the absence of information about days worked. With the important exception of Clark and Van Der Werf (1998), discussed below, previous studies have ignored annual payments in the construction of wage series in part because workers by the year usually received board and lodging in addition to any cash payment and so their inclusion entailed a challenging imputation for the value of such perquisites. In this paper, as

explained in detail later on, we represent board and lodging by the historical consumption basket proposed in Allen (2009) as a way to monetise annual workers' non-pecuniary benefits, and so construct a new and arguably more plausible long-run series of real wages for historical England.

Three major findings emerge from our study. First, our annual real wages fit markedly better with trends in per capita GDP than do those inferred from day work under the assumption that the working year was 250 days long. If day workers earned roughly the same as their annual counterparts, a hypothesis that we justify below, then the post-Black Death working year was as short as 100 days, whereas the industrial working year was as long as 325 days. The intervening gradual rise in the number of days worked lends clear empirical support to Jan De Vries' idea of an Industrious Revolution (De Vries 1994; 2004) and to Allen's allusion to Britain's industrial revolution as '1% inspiration and 99% perspiration' (Allen 2011: 33). Our second finding is that the 'Golden Age' glittered much less brightly in terms of actual annual remuneration than estimates grossed up arbitrarily from day wages suggest, a finding that agrees with John Hatcher's reference to previous estimates of day workers' annual incomes as 'unreal wages' (Hatcher 2011). Our last and perhaps most striking finding is that our annual real wages grow continuously after 1650. This is not only a challenge to any lingering attachment to the Malthusian model as a relevant interpretive frame for economic development in pre-industrial societies. It also suggests that early modern growth began c. 1600 or more than two centuries before the onset proposed in previous work.

## Methodology

The share of workers employed by the year is difficult to quantify historically, but scattered evidence indicates that they were a significant component of the pre-industrial labour force, representing at least 15-20 per cent of the adult male population (Stone 1966). They were particularly important in agriculture where they provided solutions to some of the employers' problems: the traditional service contract, which often combined commitment for a year with residence in or near the place of work, made it easier to align incentives, ensure the availability of labour at key points in the agricultural cycle, and reduce monitoring and muster costs (Woodward 2000). In return, such contracts cut the costs of travelling to and from work and insured workers against rising rents and food prices. For most farmers a mix of permanent workers and independent wage labourers best met their needs, the ratios depending upon farm type, price variation and the broader political and economic context (Kussmaul 1981; Whittle 2015; Foster 2002). Moreover, annual service combined with residence in the employer's household was not limited to agriculture. It was also the dominant contractual form for domestic servants and even a common option for journeymen and apprentices in manufacturing and trades. The latter is evidenced by wage assessments from the fourteenth to seventeenth centuries, which sought to regulate the annual remuneration not only of farm servants of various grades, but also of resident assistants working with many different kinds of tradesmen and manufacturers (see e.g. McArthur 1898; Archbold 1897).

Kussmaul's vivid metaphor describing farm service as '… one of the large reptiles of economic history extraordinarily successful in its time … and driven rapidly to extinction when times changed' (Kussmaul 1981: 134) suggested that annual service contracts were obliterated in the early modern period as a result of rising food prices, increasing rents and employers' growing preference for privacy. More recent revisionist views suggest that this is

an exaggeration. The social dislocation caused by the civil war and the absence of many gentry from their homes promoted the resort to day work without a food livery, but when peace returned there was some restoration of traditional contracts (Foster, 2002: 77). At any rate, census enumerators' books, farm surveys and oral histories have shown that farm service was probably badly under-recorded in the early occupational censuses and remained important even in the nineteenth century, especially in the north of England and in Scotland and Wales (Sheppard 1961; Devine 1984; Short 1984; Howkins 1994; Caunce 1997). Farm servants might have been a dying breed, but even as late as 1871, the final year in which a distinction was made between servants and labourers in the Census, they made up 16 per cent of hired workers in English agriculture. Earlier, they had been much more numerous. Welsh farmers especially continued to prefer to employ farm servants well into the nineteenth century both because of the year-round requirements of looking after stock and because it was cheaper to board servants than raise cash for wages (Richardson 2016). Even in south-east England where decline is said to have appeared first, in 1831 between 15 and 38 per cent of the agricultural labour force were 'farm servants' (Snell 1985: 84).

Moreover, farm service was not limited to young or unmarried men, as in Laslett's famous 'life-cycle service'. In Wales, married labourers often lived in cottages on the farm and were given board, a system that became even more prevalent later in the nineteenth century. The Royal Commission on the Agricultural Labourer, Vol. II Summary Report, quoted the 1867 Report of the Commission on the Employment of Children, Young Persons, and Women in Agriculture, stating that 'the agricultural labourer as understood in England, viz. as a man providing his own food and that of his family and dependent altogether on wages he received from his employer, is comparatively rare over a large part of Wales' and added that this remained the norm in 1893 (quoted in Richardson 2016).

The same economic changes that discouraged farm service also undermined living-in for journeymen and apprentices in trade and industry. Yet the proportion of households with servants and trade assistants in fourteen sub-districts from the published Census Report of 1851 suggests that co-residence with employers was still widespread (Armstrong 1972: table 6.12; Humphries 2004: Table 9.2). For much of the extended time period with which we are concerned, annual service, often with co-residence or board, flourished in all sectors of the economy, its neglect in the construction of wage indices a glaring omission.

Attention to payments for annual work not only remedies this oversight but also has further benefits. The first and obvious advantage is that annual incomes can be read directly from historical accounts, which eliminates the need for ancillary assumptions about the number of days worked in the past (e.g. 250 or 260 days). The second advantage is that payments for annual work provide a good proxy for the annual earning possibilities in day work, where labour market arbitrage existed, i.e. where workers could move between the two contractual forms and employers could also mix and match according to relative costs, so as to equilibrate the terms and conditions in the two sectors of the market. Of course, there are complicating factors: annual workers had more security and lower travel costs, and so might accept a lower implied day wage, or they might be better and more reliable workers, and so receive a higher wage, selection effects which pull in opposite directions. However, as we will argue below, so long as these effects remained roughly stable over time, payments from annual employment will serve as a good proxy for annual income in day work, and moreover we can use the pay ratios to estimate the length of the working year.

The assumption of labour market arbitrage might seem historically contentious, at least for the medieval and early modern periods when the state attempted to regulate the labour market and force workers, particularly young workers, into annual service. However, there is evidence both that employers continuously sought to construct their labour force to minimise

costs and also that workers pursued their own advantages in whichever sector of the market offered the best deal. There were obstacles to mobility. For example, the co-residence associated with annual service constituted a barrier to entry for married people, especially women (Humphries and Weisdorf 2015). As a result, servants were frequently young and unmarried (Kussmaul 1981: 6-7; Goldberg 1986:21; Poos 1991: ch.9). But annual contracts alongside the receipt of non-cash perquisites were not always and everywhere limited to a life-cycle stage. Medieval *famuli* were full-time employees on long term contracts who performed basic tasks on the demesne. They could be domiciled in the manor and eat at the lord's table, but they might also live elsewhere and receive their livery in grains, like for example the full-time workers on the Berkeley Estate documented by Bridget Wells-Furby (2012). Their specific terms and conditions of employment and the balance between *famuli* and other types of labour could vary suggesting that their masters were alive to the possibilities of substitution and alert to any opportunity to cut costs. Beveridge is insistent that medieval employers were willing to try different ways of organising production, which most definitely included experimenting with different combinations of labour contract: 'In any one manor the offices concerned are seen repeatedly trying new methods; making reaping and binding contracts sometimes for each grain separately, sometimes for all together; passing from task-work to day-wages and back again; passing away on the whole from engagement carrying food at the lord's table to engagement for money only without food, but back again in times of stress….' (Beveridge 1955: 3).

Similarly, R.A. Lomas's (1982) study of the organisation of Eventhall in Durham in the late Middle Ages also suggests flexibility in the composition of the labour force. Here, by the late 1400s tenure services were no longer available and the manor relied on a combination of resident *famuli* and the occasional work of local people. For most of the period, the *famuli* in Lomas's study were always seven in number, a reeve and six other men, but in 1514 the group

was increased to nine, and their tasks and the division of tasks between them and the occasional labour varied. Youngs' work on Sir Humphrey Newton's accounts for a slightly later period also suggests the importance of a group of full-time resident workers recruited by offering customised contracts designed to meet employer and workers' needs (Youngs 1999: 149).

The scarcity of labour after the Black Death pushed wages up in both sectors of the labour market despite the authorities' attempts to enforce traditional terms and conditions of employment. Employers were caught between the desperate shortage of labour and the provisions of the Ordinance and Statute of Labourers, as can be seen in the frequency with which they feature in court records for paying excessive wages, employing runaways or eloigning workers. The same tension can also be detected in some estate accounts. Thus, on the Berkeley Estate, where the *famuli* had previously been remunerated by a generous food livery and small cash payments varying between 3s 6d and 4s 6d, the Black Death saw increases in the stipends. These were firmly disallowed by the auditors until the 1360s when they started to make concessions. By the mid-1370s, the *famuli* were receiving 7s per year (Wells-Furby 2012). In view of this delay, it is interesting that our evidence presented below suggests that annual pay responded sluggishly to market conditions compared with day rates, perhaps restrained by the kind of mechanism in evidence in the Berkeley records.

Although neither sector of the labour market could be untouched by the demographic catastrophe of 1348, it appears that employers, backed by the state, were more successful in holding down wages in annual service. Both contemporaries and historians claim that workers preferred employment on a daily or weekly basis since it offered the possibility of accumulating higher wages and more leisure (Bailey 1994: 162; Penn and Dyer 1990: 367-9; McIntosh 1986:161). The fact that workers were able to exploit the day wage bonanza post 1348 and so enjoy a 'Golden Age' despite the state's attempts through the Statute of Labourers

to enforce annual service at specific rates of pay on certain categories of the population suggests that labour was indeed mobile between the sectors. Employers had to be responsive to the terms and conditions that prevailed in the casual labour market in making their bargains for longer term help. In the end the *famuli* on the Berkeley Estate secured higher wages.

Humphrey Newton's accounts provide a rare insight into the turnover of servant labour in the late fifteenth century. He managed to retain a significant proportion of his male servants, over half of the 12 men recorded as servants between 1498-1505, renewing their contracts for a second year and one, John Aleyn, working for at least six years on the estate (Youngs 1999: 149). Such stability is testimony to Newton's ability to recruit, tailoring his contracts to both his own needs and significantly to his servants' aspirations.[2]

Early-modern employers also sought to economise their wage bill by shifting between annual servants and day labourers, carefully taking into account the additional costs of board and lodging that the former imposed. Robert Loder, a methodical and business-like farmer, calculated the average cost of maintaining his annual servants and though he often complained about these expenses, he acknowledged that some permanent staff were essential: 'I iudge it were good, to keep as few servants as a man cane' (Fussell 1936: 108; see also Henry Best's assessment of the need for balance in a similar time period, Woodward 1984). Both Loder and Best echo Newton, the earlier employer, in describing the need to customise bargains struck with individuals and provide ample evidence suggesting that it was far from easy to retain permanent servants. Henry Best hired 5-9 servants annually; most did not stay a second term (Woodward 1984: xxxviii).

[2] Humphrey Newton was less successful in retaining women servants, which in earlier work we have explained by the extent to which the customary and legally prescribed terms of service for female servants were out of synch with casual opportunities, itself a product of a patriarchal dimension to the state's reaction (Humphries and Weisdorf 2015).

Although some servants stayed with their employers for many years, the turnover documented in these and other accounts suggests a mobility that, however dampened by the Statute of Labourers and its extension into the early-modern period via the vagrancy laws, remained robust. Like employers, working men were not slow to compare opportunities and seek out the best terms and conditions whether this took the form of annual or day labour. Working-men's autobiographies give ample illustration of a restless search for greener grass either by changing employer or by changing the nature of the contract (Mayett n.d.; Bill H----- 1862). We build on the argument that there was sufficient mobility between the two sectors of the labour market to provide at least an approximate convergence in what follows.

While payments for annual service eliminate the need for ancillary assumptions about the number of days worked, they introduce a practical obstacle, possibly explaining why they have been overlooked in previous real-wage analyses, namely that annual workers usually received non-pecuniary benefits in addition to their cash payments in the form of board and lodging. Even those who resided elsewhere, some *famuli* for example in the medieval period, enjoyed perquisites in the form of grain liveries, other food supplements, and the use of manorial equipment and draft animals on their own smallholdings (Poos 1991; Hilton 1975; Hanawalt 1986; Dyer 1988,1989). Ideally, such in-kind rewards should be valued and added to cash payments to determine overall remuneration. Unfortunately the evidence needed to support such an exercise is rarely provided. An alternative way to 'monetise' in-kinds is to assume that they covered a worker's subsistence and so can be valued by a historical consumer price index as in Humphries and Weisdorf (2015). Robert Allen's 'respectability' consumption basket provides a practical tool for capturing and valuing the commodities usually consumed by a representative person historically (Allen 2009). Table 1 lists the commodities included and their quantities. The average daily cost of a 'respectability' basket

between 1260 and 1850, taken from Allen's website,[3] is reproduced in Table A1 in our Appendix. The basket's annual worth for each specific year can then be added to the workers' cash remuneration of that year, and the resulting income estimates transformed into real wages in the standardised way, as explained below.

**Table 1**
Allen's 'respectability' consumption basket (for one adult person)

| Good | Quantities per year | Calories per day |
|---|---|---|
| Bread | 234 kg | 1,571 |
| Beans/peas | 52 L | 370 |
| Meat | 26 kg | 178 |
| Butter | 5.2 kg | 104 |
| Cheese | 5.2 kg | 54 |
| Eggs | 52 each | 11 |
| Beer | 182 L | 212 |
| Soap | 2.6 kg | --- |
| Linen | 5 m | --- |
| Candles | 2.6 kg | --- |
| Lamp oil | 2.6 L | --- |
| Fuel | 5.0 M BTU | --- |
| Rent | 5% allowance | --- |
| Total | | 2,500 |

*Source*: Allen (2009).

Furthermore, as Clark and Van Der Werf (1998) have pointed out, with labour market arbitrage and mobility between sectors, annual workers could only be made to work the number of days it would take for those casually employed to accumulate the going yearly stipend, and so the relationship between day and annual wages implies the length of the working year, that is, in equilibrium:

[3] https://www.nuffield.ox.ac.uk/People/sites/Allen/SitePages/Biography.aspx.

days worked per year = annual wage/day wage

David Farmer has argued that the *famuli* on medieval estates, while employed year round, were not full-time workers since they held farmland of their own on which they would simultaneously have worked (Farmer 1996: 228-9). On the basis of this evidence, Clark and Van Der Werf reject the use of such workers' annual wages to impute the length of the working year. If *famuli* were only paid for part of the year, division by the day wage would underestimate the length of the working year. To the extent that our wage series, in the early years when famuli were more common, relies on the annual wages of workers in fact employed less than year round, they will be an underestimate. We have corrected for this in the data collection as much as possible by paying careful attention to those instances when workers were paid by the term, often in differing cash amounts, aggregating up to the annual wage rather than simply multiplying out. It should also be noted that any land held by *famuli* was probably worked not by the male head of the household but by other family members and further that annual workers continued to supplement their wages with work done in evenings and on days off even as late as the nineteenth century (see Humphries 2010, for apprentices: 276; for adult farm workers: 94, 115) exploiting opportunities that might, too, have been open to casual day labourers. Last but not least, even for the medieval period our estimates of days worked per year presented below are far from entirely reliant on the wages of *famuli*, but include many other types of workers such as diverse estate workers and many types of domestic servants.

## Data

We began by assembling material from secondary sources based on particular bodies of primary data and classic collections of printed primary material, such as the compendious volumes of James Edwin Thorold Rogers and classic articles of William Beveridge. We searched older and less known secondary sources for fragmentary data as listed in the bibliography. We put considerable effort into generating additional evidence from diverse primary sources, both archival and printed primary, including manorial accounts, estate accounts, farm accounts, settlement examinations, diaries, and memoirs. Our sources cover provincial and occasionally peripheral areas making it comparable in coverage to the authoritative series for unskilled male farm day labourers provided by Clark (2007), whose sources we systematically revisited, the findings combined with other rich depositories, many uncovered in our analogous work on women's wages in the very long run (Humphries and Weisdorf 2015). Our present male series include 5,519 annual payments in total. Figure 2 shows how they distribute across nearly six centuries, from 1260 to 1850, with a minimum of ten observations per decade and nearly one hundred observations on average.

Building a wage series from such heterogeneous sources, as scholars engaging in comparable endeavours have previous noted, requires care and consistency. Geographically, seasonally, and occupationally diverse evidence must be treated with attention to avoid the introduction of misleading trends associated with compositional shifts. We adopted three main strategies to curb such dangers.

**Figure 2**
Number of payments per decade, 1260-1850

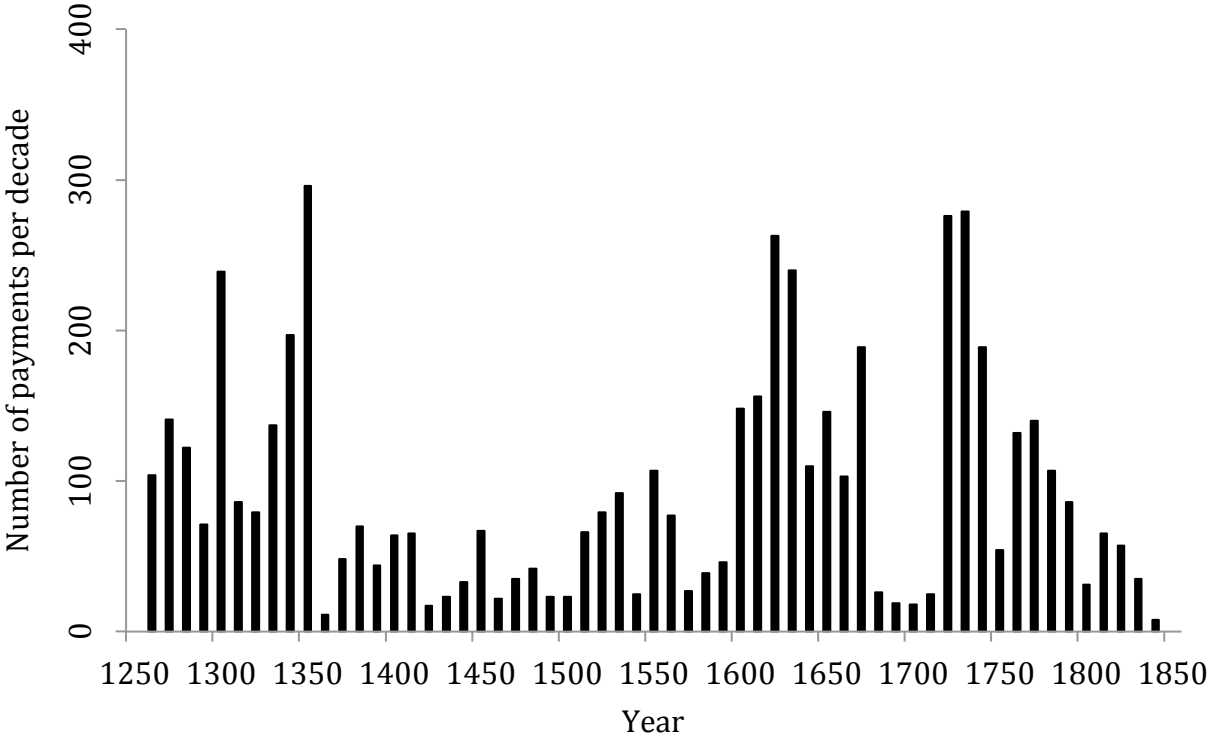
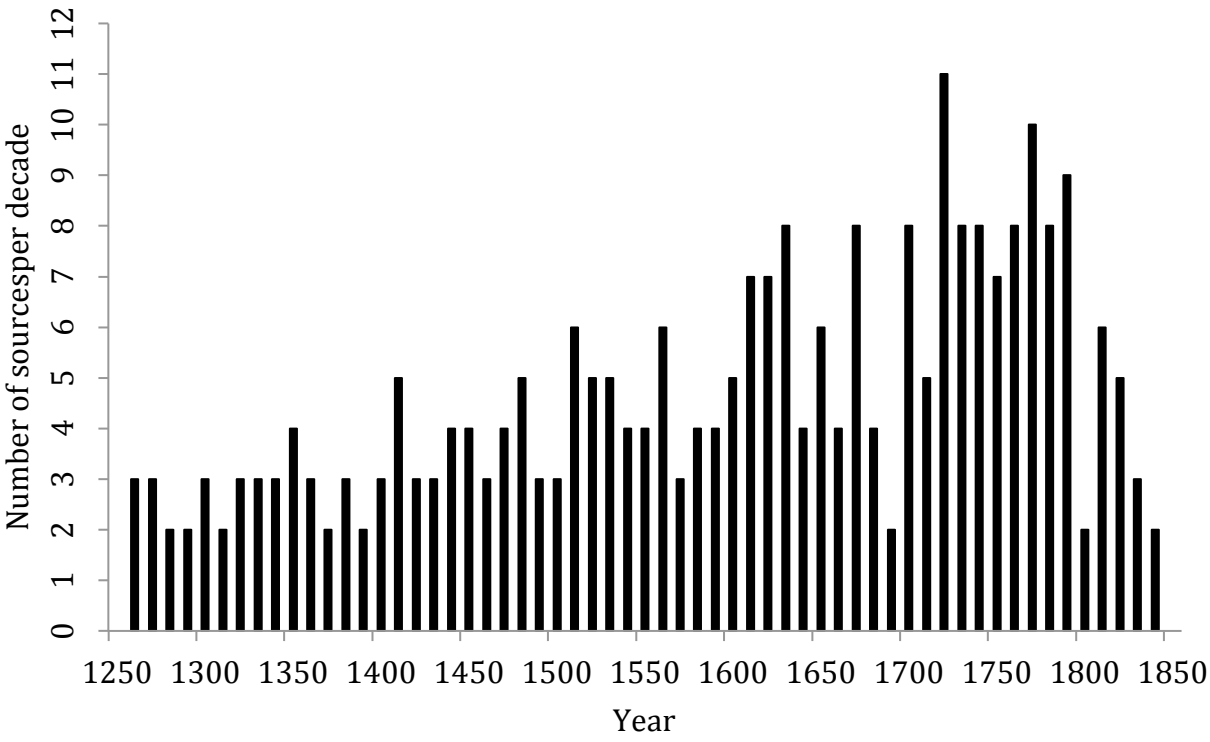



**Figure 3**
Number of sources per decade, 1260-1850



First, we excluded London where labour was at a premium.[4] Second, we limited our data collection to unskilled workers as defined by the so-called HISCO-HISCLASS system. HISCO categorises more than one thousand historical occupations by the type of work performed (van Leeuwen and Maas 2011). We use this HISCLASS taxonomy to ensure that all wages in our database were paid to men with homogeneous occupational statuses and skills. We have therefore excluded observations related to workers with managerial or financial responsibility, ignoring also skilled domestic manufacturers, and agricultural workers whose job titles implied specialist training. To illustrate: the Shuttleworth household in 1597 included 14 full-time male employees (Harland, 1856; Harland, 1857; Foster, 2002). The four highest paid were the butler and brewer, cook, miller and steward, who all earned over £2 per annum and were excluded. The shepherd and gardener, with less status and skill, earned £1 13s 4d and £1 12s 0d, close to the wage of £1 6s 8d received by the top two farm workers, all of whom were included. Four of the remaining farm workers, earning between £1 3s 4d and £1 0s 0d, were also included while the two poorest paid (on 16s and 12s) were shown by their wage trajectories to be not yet adults and so excluded. Third, we endeavoured to avoid reliance on any single source in any specific decade, which also usually ensured that no particular period was dominated by a specific location. The frequency chart in Figure 3 shows the number of sources drawn on for each ten year period, with many secondary and printed primary sources drawing on material from multiple locations. Of course, these stratagems are unlikely to mean the series is free from compositional problems, but they represent best practice in a context where evidence is rare, patchy and problematic.

[4] So clusters of London-based observations would have the effect of introducing spurious improvements in the index.

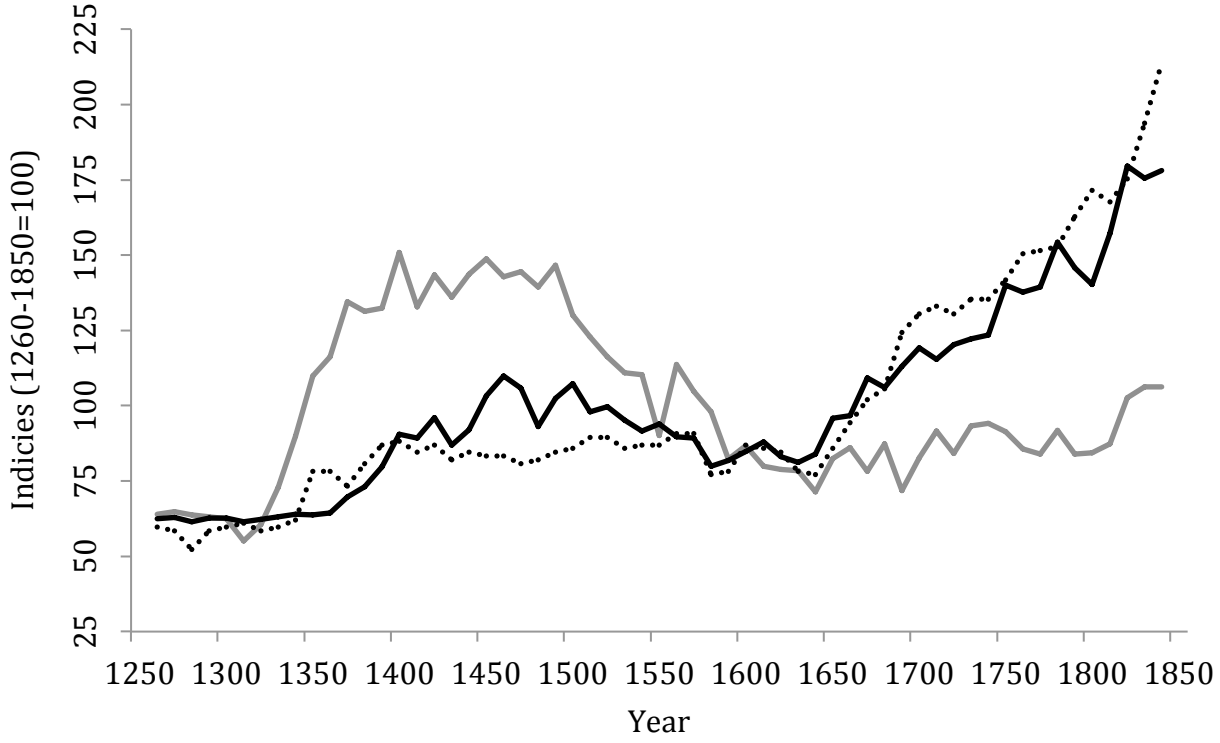
## Results

The nominal annual wages, i.e. the cash component and the monetised benefits, are reported in Table A1 in the Appendix. These were transformed into real wages by dividing them by the annual cost of living, which in turn were obtained by multiplying the daily consumer prices of Allen's 'respectability' basket described above by 365 days. The resulting (indexed) real wages are illustrated in Figure 4. The new estimates, captured by the black line, differ remarkably from previous real-wage estimates, which were obtained (as explained earlier) by multiplying day rates by 250 days of work and are shown by the grey line (Clark 2007).

Three major findings follow from an inspection of Figure 4. First, our new annual real-wage estimates exhibit systematic and large divergences from the older series. If income from casual and annual work was roughly identical, arbitraged into convergence by the mobility of workers and flexibility of employers as argued above, this suggests strongly that annual incomes inferred from day work (grey line) are heavily burdened by a misrepresentation of day workers' annual labour input (i.e. the 250 days) and therefore grossly misreport historical living standards. This conclusion is consistent with speculations expressed in Broadberry et al (2015) and Campbell (2016). At the same time, our new estimates show a considerably better (though not perfect) fit with the overall trends in per capita GDP (dotted line) than do earlier series.

**Figure 4**

Indices of real wages in casual and annual work and GDP-per-capita, 1260-1850




*Note:* The real wages are constructed by dividing the implied annual income of casual workers by 365 days multiplied by the daily consumer price index (see Table A1). Casual workers' nominal annual income is computed by multiplying their daily payments by 250 days (grey line). Annual workers' income is the sum of their annual cash payment and the implied value of their in-kind benefits (black line). Real wages and GDP per capita (dotted line) are indexed using their respective averages of the period 1260 to 1850. *Sources*: Annual wages: see text. Casual wages: Clark (2007). CPI per day: Allen (2009). Per capita GDP: Broadberry et al (2015).

The second main finding is that the post-Black Death 'Golden Age' glittered much less than income estimates based on day payments and 250 working days have suggested. The 'Golden Age' real-wage peak happened at a much lower level and was surpassed much earlier than other authors have proposed, and 'golden' wage levels were outshone already by the mid-seventeenth century, rather than after 1850 as posited by Clark (2007) for example. The evidence confirms Hatcher (2011)'s intuition that day workers' annual incomes during the long fifteenth century were much smaller than those inferred from multiplying their day rates by 250.

The third and perhaps most crucial finding is that the real wages derived from annual employment rise continuously from the early seventeenth century on, in stark contrast to the widespread view that England did not escape its 'Malthusian trap' until after 1800 (e.g. Clark 2008). Our conclusions speak directly to the mounting dissatisfaction with the Malthusian model of the early modern period (e.g. Persson 2008) by showing that the transition from so-called 'Malthusian stagnation' to modern economic growth was a gradual process rather than a sudden ('hockey-stick') event (as McCloskey (2010) termed it). Gradually rising real wages also fit with the idea of an early-modern 'consumer revolution' visible in the novel commodities that appear in seventeenth- and eighteenth-century probate inventories (e.g. McKendrick et al 1982; Thirsk 1978; De Vries 2004).

Rising real wages beginning in the seventeenth century, and their better correspondence with trends in per capita GDP than previous estimates, also raises doubts about the so-called 'Engels' Pause'. Engels (1945) reconciled the huge increases in output associated with the industrial revolution with the deleterious social and economic consequences for working people that he observed in northern England by arguing that the gains from economic development accrued overwhelmingly to capitalists. Indeed, the mounting gap after 1650 between the real wage estimates based on day rates and per capita GDP prompted Robert Allen to suggest that the surge in inequality was intrinsic to the growth process: technical change increased the demand for capital and thus raised the profit rate and capital's share (Allen 2009). The rise in profits, Allen proposed, sustained the industrial revolution by financing investment, which eventually but only after 1899 led workers' pay to rise. The closer fit between the trends in our real-wage series and per capita GDP as displayed in Figure 4 presents a challenge to the hypothesis that inequality between workers and capitalists was a driving force in the industrial revolution.

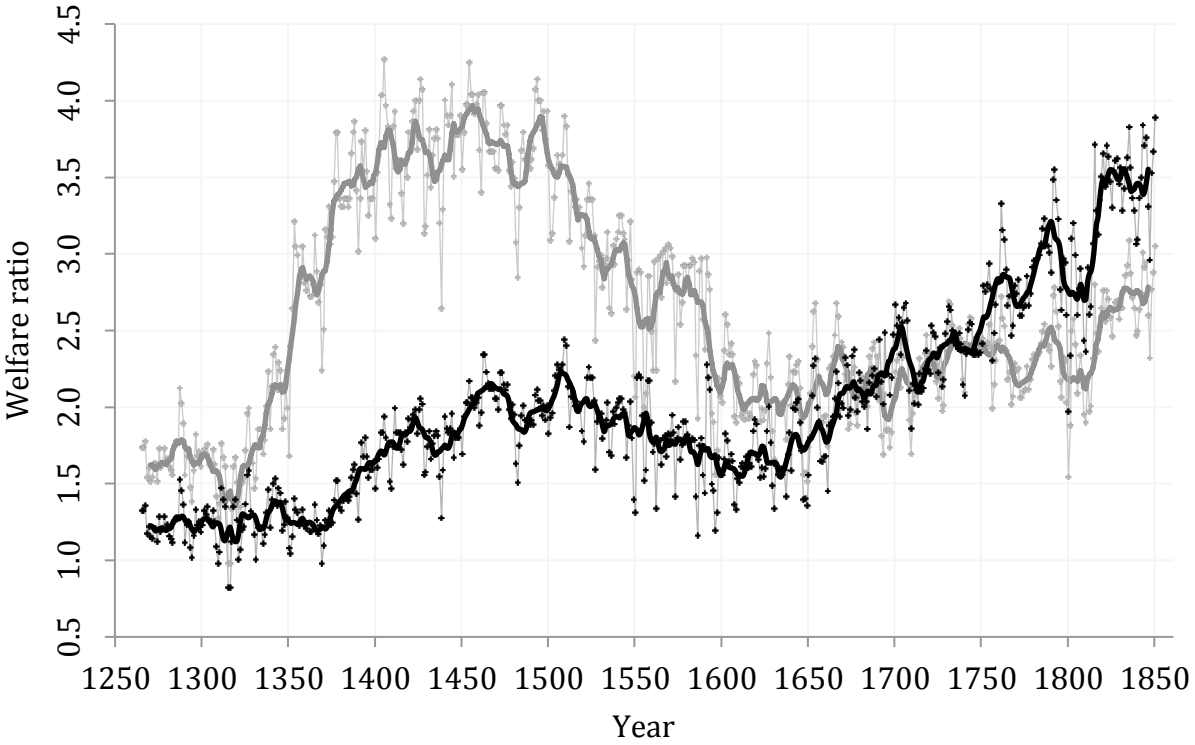
**Figure 5**
Labour's shares in casual and annual work, 1260-1850


*Note*: The graph shows the indexed evolution in the share of real wages to GDP per capita. *Sources*: Annual wages (black line): see text. Casual wages (grey line): Clark (2007). CPI per day: Allen (2009). Per capita GDP: Broadberry et al (2015).

The correspondence between the real wages from annual work and per capita GDP invites further criticism of existing real-wage estimates. Previous evidence based on twentieth-century data has showed that labour's share in national income stays relatively constant over time, fluctuating between 60 and 80 per cent of total output (Gollin 2002). Figure 5 illustrates the long run evolution of labour's share. When estimating labour incomes by day rates multiplied by 250, medieval developments in labour's share look dubious. In contrast, the factor proportion computed using our revised real wages fluctuate neatly between 60 and 80 per cent of total output, with a modest advantage for workers manifest during the fifteenth and sixteenth centuries.

**Figure 6**

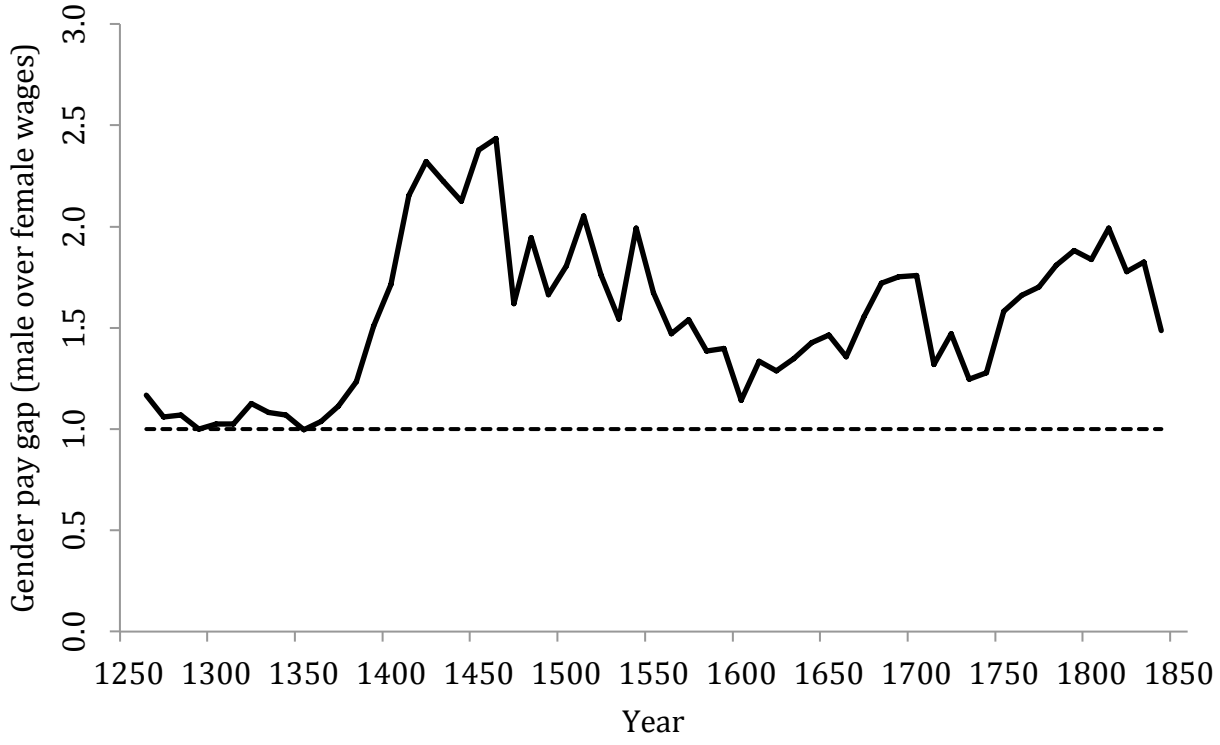
The welfare ratio of annual workers (black) and casual workers (grey), 1260-1850




*Note*: The welfare ratios are computed by dividing the implied income in annual work by 365 days multiplied by the CPI per day (see Table A2). Annual incomes in casual work are obtained by multiplying the day rate by 250 working days. The bold graph shows the 10-year moving averages. *Sources*: Annual wages: see text. Casual wages: Clark (2007). CPI per day: Allen (2009).

Figure 6 presents the real wages from annual and casual work in the form of so-called welfare ratios. The welfare ratio reports the number of Allen's 'respectability' baskets (Allen 2009) that the annual income of a worker could buy. The dots show the size of the actual yearly payments, and the solid lines the 10-year moving averages. On the assumption that casual and annual workers earn largely the same over the course of a year, the black line in Figure 6, which is based on incomes of annual workers, presents a dramatically different trend in living standards than does the grey line inferred from day rates and the assumption of 250 working days per year. The continuous rise in real wages starting after 1600 is evidence that early modern growth took off more than two centuries earlier than previous studies have shown (e.g. Clark 2008).

**Figure 7**
The gender gap in pay, 1260-1850




*Sources*: Male wages: see text. Female wages from Humphries and Weisdorf (2015, Table A1) multiplied by 260 days.

Figure 6 also shows that, although our revised estimates of living standards improved significantly in the aftermath of the Black Death, some ground was lost after 1500 and it was not until the late seventeenth century that an unskilled man's annual income was able to obtain more than two consumption baskets, i.e. to support more than two adults. Moreover, in spite of rising real wages after c. 1600, it was not until the early nineteenth century that the annual income of an unskilled male worker was able to provide a 'respectable' living for a contemporaneously average family comprising two adults and three children (equivalent to 3.25 adults when children count as half an adult, as Allen assumes). The evidence presented in Figure 6 therefore raises doubt about the relevance of the male breadwinner model before the nineteenth century and instead suggests that women and children had to supplement the family income to make ends meet in pre-industrial times.

The male breadwinner model naturally raises the question about the gender wage gap in annual employment. Annual wages for female labour, provided in our earlier work (Humphries and Weisdorf 2015), in combination with the male wages provided in this study, enable us to compute how much more men earned compared to women over the long run. Figure 7 shows that the gender gap between male and female payments varied considerably: from a virtually zero pay gap before the Black Death to several episodes (c. 1450, and c. 1800) where men were paid twice as much (or more) as women. These episodes appear to coincide with periods of tight labour markets when men in particular were in short supply, but further work is needed to confirm this hypothesis.

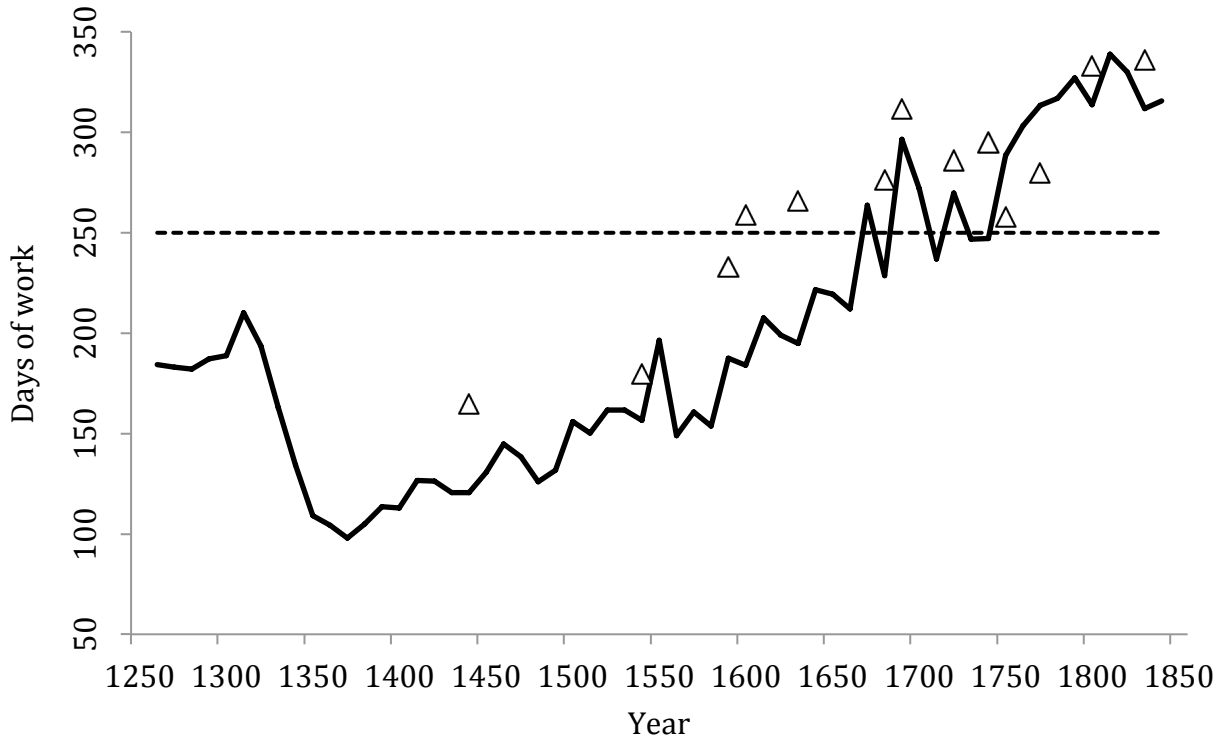
## The Industrious Revolution

Nearly two decades ago, Clark and Van der Werf (1998) pointed out that day rates in combination with annual rates facilitate the computation of the working year needed in day labour in order to obtain the income of annual workers. Under certain assumptions (see above) these computations represent labour supply per head. Based on wage assessments and estate records Clark and Van der Werf found that the average working week grew modestly, from five to six days between the late sixteenth century and the late nineteenth century.

Our new annual rates in combination with the existing day rates provided by Clark (2007) enable the replication of Clark and Van der Werf's exercise for an extended time period. The evidence illustrated in Figure 8 reveals a remarkable change in labour input between the pre-Black Death period and the end of the classical years of industrial revolution. While some 175-200 days of casual work per year would provide the same income as that enjoyed by an annual worker before the plague, the steeply rising day rates combined with the more modestly growing yearly rates in the aftermath of the plague meant that as few as

100 days of casual work were sufficient to match an annual worker's stipend plus perquisites. Once more, the discrepancy illustrated in Figure 1 between existing real wages and per capita GDP emerges as an unintended consequence of the assumption that day labour was employed for about 250 days per year, as foreseen by Campbell (2016) and Hatcher (2011).

**Figure 8**
The implied working year of day workers, 1260-1850




*Note*: The black line shows the number of days in casual (daily) work needed to earn an annual worker's yearly income including non-pecuniary benefits. The triangles report the pre-existing estimates of annual days worked per person. *Sources*: Annual wages: see text. Day wages: Clark (2007). CPI per day: Allen (2009). Working days: extract from Broadberry et al (2015, Table 6.02).

In particular, the short working year after c. 1350 agrees with Hatcher (2011)'s supposition that the post-Black Death labour market did not gild the peasantry's world to the extent previously thought, either because day workers could not find enough work or because they decided to work less in response to improvement in their real wages. The latter conclusion, to which Figure 8 gives numerical expression, also accords with Dyer's plausible

reconstruction of workers' *mentalities* in the period 1349-1520, that is that 'they set themselves goals in cash or consumption needs, and worked until they had achieved their aims. Then they ceased to work' (Dyer 1989, p. 224).

Furthermore, Figure 8 chimes with the view that the simplifying but crude assumption of 250 days of work overlooks the possibility of a 'preference switch' in workers' evaluation of the labour-leisure trade-off as described in De Vries' (1994; 1998) 'Industrious Revolution' and supported by Voth's (2000, 2001) distillation of time use from eighteenth- and nineteenth-century court records. Overall, the implied working year is well in agreement with the trend in the scattered, independent estimates of annual days worked per person (the triangles) found in the literature (Allen and Weisdorf 2011; Broadberry et al 2015). Perhaps more than anything, Figure 8 supports the argument that the two conflicting views about long-run economic development described in the opening paragraph of this article can be reconciled by solving the problem of ignorance about the length of the working year in the past, as anticipated by Campbell (2016).

## Conclusion

The leading theory about long-run welfare developments in Western Europe, known as the 'little divergence' hypothesis, declares that the North Sea region, exemplified by England and the Low Countries, diverged from the rest of Europe, in terms of real wages, between 1500 and 1750 (Allen 2001). The wage estimates used to sustain the 'little divergence' hypothesis, also have a central role in the 'great divergence' debate, where they feature as illustrations of Western European advancement in comparison with real wages from Africa, Asia, and the Americas (e.g. Allen et al 2011, 2012; Broadberry and Gupta 2006; Frankema and van Waijenburg 2012). Furthermore, real wages virtually similar to those provided by Allen (2001) and Clark (2007) are the central pillars in the Malthusian model used to describe

economic development in pre-industrial societies (e.g. Clark 2008), which in turn frames unified growth theory (Galor 2011). If the real wages supporting these theories are subject to measurement error of the kind and extent described here, then the entire house of theoretical cards informing long run local and global economic developments is built on shaky empirical foundations. At risk here are not just core theories, such as the Malthusian model and the little and great divergence hypotheses, but also the findings of a large number of studies in economic, social, and demographic history, which rest on misleading accounts of the evolution of wages.

Moreover, in a discipline increasingly captured by the idea that the industrial revolution was a product of scientific advancement or inventive genius, the post-1600 continuous increase in the length of the working year and the intensification of this growth in the run-up to industrialisation, provides a salutary reminder of the relevance of other factors. Whether this increase was voluntary as workers gave up leisure for material goods, or whether it was also a consequence of structural changes in employment, the erosion of alternatives to wage labour, and shifts in bargaining power remains unclear. Nonetheless, whether there was an upsurge in industriousness or an imposition of drudgery, the data we have presented here suggests that early modern growth began more than two centuries earlier than previously thought and moreover that England grew rich on the unprecedented days of toil by working people.

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# Appendix

## Table A1

The wages, in pence or real terms, of unskilled male workers, by decade, 1260-1850

| Years in decades | Annual wages | | | | Casual wages | | | Other variables | |
|---|---|---|---|---|---|---|---|---|---|
| | Cash payment | Implied benefits | Implied income | Welfare ratio | Day payment | Implied income | Welfare ratio | CPI per day | GDP per capita |
| **1260-70** | 44 | 195 | 239 | 1.23 | 1.30 | 325 | 1.66 | 0.54 | 48 |
| **1270-80** | 46 | 195 | 241 | 1.24 | 1.32 | 330 | 1.69 | 0.54 | 47 |
| **1280-90** | 41 | 199 | 240 | 1.21 | 1.32 | 330 | 1.66 | 0.55 | 42 |
| **1290-1300** | 46 | 199 | 245 | 1.23 | 1.31 | 328 | 1.64 | 0.55 | 47 |
| **1300-10** | 48 | 211 | 259 | 1.23 | 1.37 | 343 | 1.62 | 0.58 | 48 |
| **1310-20** | 52 | 253 | 305 | 1.21 | 1.45 | 363 | 1.43 | 0.69 | 49 |
| **1320-30** | 55 | 249 | 304 | 1.22 | 1.57 | 393 | 1.58 | 0.68 | 47 |
| **1330-40** | 47 | 199 | 246 | 1.24 | 1.51 | 378 | 1.89 | 0.55 | 48 |
| **1340-50** | 54 | 211 | 265 | 1.26 | 1.97 | 493 | 2.34 | 0.58 | 50 |
| **1350-60** | 60 | 241 | 301 | 1.25 | 2.76 | 690 | 2.86 | 0.66 | 63 |
| **1360-70** | 66 | 253 | 319 | 1.26 | 3.06 | 765 | 3.02 | 0.69 | 63 |
| **1370-80** | 86 | 234 | 320 | 1.37 | 3.27 | 818 | 3.50 | 0.64 | 59 |
| **1380-90** | 100 | 230 | 330 | 1.43 | 3.14 | 785 | 3.41 | 0.63 | 65 |
| **1390-1400** | 132 | 234 | 366 | 1.56 | 3.22 | 805 | 3.44 | 0.64 | 70 |
| **1400-10** | 172 | 222 | 394 | 1.77 | 3.49 | 873 | 3.93 | 0.61 | 71 |
| **1410-20** | 187 | 249 | 436 | 1.75 | 3.44 | 860 | 3.45 | 0.68 | 68 |
| **1420-30** | 207 | 234 | 441 | 1.89 | 3.49 | 873 | 3.73 | 0.64 | 70 |
| **1430-40** | 184 | 261 | 445 | 1.71 | 3.69 | 923 | 3.54 | 0.71 | 66 |
| **1440-50** | 194 | 241 | 435 | 1.80 | 3.61 | 903 | 3.74 | 0.66 | 68 |
| **1450-60** | 244 | 238 | 482 | 2.03 | 3.68 | 920 | 3.87 | 0.65 | 67 |
| **1460-70** | 274 | 238 | 512 | 2.15 | 3.53 | 883 | 3.71 | 0.65 | 67 |
| **1470-80** | 256 | 238 | 494 | 2.08 | 3.57 | 893 | 3.76 | 0.65 | 65 |
| **1480-90** | 209 | 253 | 462 | 1.83 | 3.67 | 918 | 3.63 | 0.69 | 66 |
| **1490-1500** | 232 | 230 | 462 | 2.01 | 3.51 | 878 | 3.82 | 0.63 | 68 |
| **1500-10** | 280 | 253 | 533 | 2.11 | 3.42 | 855 | 3.38 | 0.69 | 69 |
| **1510-20** | 251 | 272 | 523 | 1.92 | 3.48 | 870 | 3.20 | 0.75 | 72 |
| **1520-30** | 271 | 284 | 555 | 1.96 | 3.43 | 858 | 3.02 | 0.78 | 72 |
| **1530-40** | 249 | 287 | 536 | 1.87 | 3.32 | 830 | 2.89 | 0.79 | 69 |
| **1540-50** | 287 | 360 | 647 | 1.80 | 4.13 | 1033 | 2.87 | 0.99 | 70 |
| **1550-60** | 446 | 529 | 975 | 1.84 | 4.96 | 1240 | 2.34 | 1.45 | 70 |
| **1560-70** | 405 | 533 | 938 | 1.76 | 6.30 | 1575 | 2.96 | 1.46 | 73 |
| **1570-80** | 458 | 609 | 1067 | 1.75 | 6.64 | 1660 | 2.72 | 1.67 | 73 |
| **1580-90** | 371 | 655 | 1026 | 1.57 | 6.68 | 1670 | 2.55 | 1.80 | 62 |

| Table A1 cont'd | Annual wages | | | | Casual wages | | | Other variables | |
|---|---|---|---|---|---|---|---|---|---|
| | Cash payment | Implied benefits | Implied income | Welfare ratio | Day payment | Implied income | Welfare ratio | CPI per day | GDP per capita |
| **1590-1600** | 516 | 855 | 1371 | 1.60 | 7.31 | 1828 | 2.14 | 2.34 | 63 |
| **1600-10** | 530 | 801 | 1331 | 1.66 | 7.23 | 1808 | 2.26 | 2.19 | 70 |
| **1610-20** | 695 | 958 | 1653 | 1.73 | 7.96 | 1990 | 2.08 | 2.63 | 69 |
| **1620-30** | 653 | 1035 | 1688 | 1.63 | 8.48 | 2120 | 2.05 | 2.84 | 68 |
| **1630-40** | 661 | 1119 | 1780 | 1.59 | 9.14 | 2285 | 2.04 | 3.07 | 63 |
| **1640-50** | 826 | 1276 | 2102 | 1.65 | 9.48 | 2370 | 1.86 | 3.50 | 62 |
| **1650-60** | 1023 | 1161 | 2184 | 1.88 | 9.96 | 2490 | 2.14 | 3.18 | 69 |
| **1660-70** | 1044 | 1165 | 2209 | 1.90 | 10.42 | 2605 | 2.24 | 3.19 | 76 |
| **1670-80** | 1373 | 1200 | 2573 | 2.14 | 9.75 | 2438 | 2.03 | 3.29 | 82 |
| **1680-90** | 1186 | 1100 | 2286 | 2.08 | 10.00 | 2500 | 2.27 | 3.01 | 85 |
| **1690-1700** | 1582 | 1299 | 2881 | 2.22 | 9.72 | 2430 | 1.87 | 3.56 | 100 |
| **1700-10** | 1541 | 1150 | 2691 | 2.34 | 9.89 | 2473 | 2.15 | 3.15 | 105 |
| **1710-20** | 1349 | 1069 | 2418 | 2.26 | 10.20 | 2550 | 2.38 | 2.93 | 107 |
| **1720-30** | 1544 | 1134 | 2678 | 2.36 | 9.93 | 2483 | 2.19 | 3.11 | 105 |
| **1730-40** | 1540 | 1104 | 2644 | 2.40 | 10.71 | 2678 | 2.43 | 3.02 | 109 |
| **1740-50** | 1538 | 1081 | 2619 | 2.42 | 10.59 | 2648 | 2.45 | 2.96 | 109 |
| **1750-60** | 2020 | 1157 | 3177 | 2.75 | 11.01 | 2753 | 2.38 | 3.17 | 114 |
| **1760-70** | 2225 | 1307 | 3532 | 2.70 | 11.65 | 2913 | 2.23 | 3.58 | 121 |
| **1770-80** | 2478 | 1430 | 3908 | 2.73 | 12.47 | 3118 | 2.18 | 3.92 | 122 |
| **1780-90** | 2835 | 1399 | 4234 | 3.03 | 13.36 | 3340 | 2.39 | 3.83 | 123 |
| **1790-1800** | 3250 | 1748 | 4998 | 2.86 | 15.27 | 3818 | 2.18 | 4.79 | 131 |
| **1800-10** | 3920 | 2238 | 6158 | 2.75 | 19.62 | 4905 | 2.19 | 6.13 | 138 |
| **1810-20** | 5188 | 2491 | 7679 | 3.08 | 22.65 | 5663 | 2.27 | 6.83 | 135 |
| **1820-30** | 4821 | 1912 | 6733 | 3.52 | 20.41 | 5103 | 2.67 | 5.24 | 141 |
| **1830-40** | 4448 | 1820 | 6268 | 3.44 | 20.11 | 5028 | 2.76 | 4.99 | 156 |
| **1840-50** | 4736 | 1901 | 6637 | 3.49 | 21.02 | 5255 | 2.76 | 5.21 | 172 |

*Note*: The implied benefits are computed as 365 days multiplied by the CPI per day. The implied income in annual work is the sum of cash payments and the implied value of benefits. The implied income in casual work is 250 days multiplied by the daily cash payment. Welfare ratios are computed as the implied income divided by 365 days multiplied by the CPI per day. They express how many adult consumption baskets (see Table 1) that an unskilled worker's annual income could purchase. *Sources*: Cash payments for annual work: see the text. Cash payments for casual (daily) work: Clark (2007). Consumer price index (CPI) including rent: Allen (*Link*). GDP per capita index (1700=100): Broadberry et al (2015).

**Table A2**
The welfare ratios of unskilled annual male workers, 1260-1850

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1265** | 1.33 | **1300** | 1.23 | **1335** | 1.11 | **1370** | 1.10 | **1405** | 1.94 |
| **1266** | 1.33 | **1301** | 1.33 | **1336** | 1.17 | **1371** | 1.27 | **1406** | 1.80 |
| **1267** | 1.36 | **1302** | 1.30 | **1337** | 1.31 | **1372** | 1.25 | **1407** | 1.74 |
| **1268** | 1.18 | **1303** | 1.35 | **1338** | 1.46 | **1373** | 1.33 | **1408** | 1.51 |
| **1269** | 1.22 | **1304** | 1.25 | **1339** | 1.21 | **1374** | 1.23 | **1409** | 1.47 |
| **1270** | 1.15 | **1305** | 1.25 | **1340** | 1.40 | **1375** | 1.25 | **1410** | 1.74 |
| **1271** | 1.14 | **1306** | 1.33 | **1341** | 1.50 | **1376** | 1.39 | **1411** | 2.00 |
| **1272** | 1.21 | **1307** | 1.25 | **1342** | 1.54 | **1377** | 1.52 | **1412** | 1.83 |
| **1273** | 1.21 | **1308** | 1.09 | **1343** | 1.36 | **1378** | 1.52 | **1413** | 1.83 |
| **1274** | 1.12 | **1309** | 0.98 | **1344** | 1.47 | **1379** | 1.35 | **1414** | 1.83 |
| **1275** | 1.28 | **1310** | 1.06 | **1345** | 1.44 | **1380** | 1.33 | **1415** | 1.72 |
| **1276** | 1.19 | **1311** | 1.47 | **1346** | 1.19 | **1381** | 1.39 | **1416** | 1.63 |
| **1277** | 1.21 | **1312** | 1.40 | **1347** | 1.23 | **1382** | 1.41 | **1417** | 1.83 |
| **1278** | 1.28 | **1313** | 1.35 | **1348** | 1.38 | **1383** | 1.41 | **1418** | 1.78 |
| **1279** | 1.21 | **1314** | 1.17 | **1349** | 1.28 | **1384** | 1.39 | **1419** | 1.93 |
| **1280** | 1.23 | **1315** | 0.82 | **1350** | 1.08 | **1385** | 1.41 | **1420** | 1.86 |
| **1281** | 1.16 | **1316** | 0.82 | **1351** | 1.05 | **1386** | 1.54 | **1421** | 1.92 |
| **1282** | 1.14 | **1317** | 1.12 | **1352** | 1.15 | **1387** | 1.59 | **1422** | 1.95 |
| **1283** | 1.12 | **1318** | 1.35 | **1353** | 1.40 | **1388** | 1.62 | **1423** | 1.98 |
| **1284** | 1.25 | **1319** | 1.40 | **1354** | 1.33 | **1389** | 1.44 | **1424** | 1.83 |
| **1285** | 1.28 | **1320** | 1.26 | **1355** | 1.31 | **1390** | 1.27 | **1425** | 1.98 |
| **1286** | 1.28 | **1321** | 1.00 | **1356** | 1.23 | **1391** | 1.59 | **1426** | 2.05 |
| **1287** | 1.53 | **1322** | 1.07 | **1357** | 1.25 | **1392** | 1.77 | **1427** | 2.02 |
| **1288** | 1.46 | **1323** | 1.20 | **1358** | 1.33 | **1393** | 1.68 | **1428** | 1.55 |
| **1289** | 1.36 | **1324** | 1.22 | **1359** | 1.23 | **1394** | 1.80 | **1429** | 1.58 |
| **1290** | 1.12 | **1325** | 1.37 | **1360** | 1.21 | **1395** | 1.68 | **1430** | 1.74 |
| **1291** | 1.23 | **1326** | 1.56 | **1361** | 1.24 | **1396** | 1.54 | **1431** | 1.84 |
| **1292** | 1.25 | **1327** | 1.59 | **1362** | 1.19 | **1397** | 1.59 | **1432** | 1.66 |
| **1293** | 1.08 | **1328** | 1.32 | **1363** | 1.19 | **1398** | 1.59 | **1433** | 1.76 |
| **1294** | 1.01 | **1329** | 1.30 | **1364** | 1.22 | **1399** | 1.65 | **1434** | 1.81 |
| **1295** | 1.16 | **1330** | 1.17 | **1365** | 1.36 | **1400** | 1.47 | **1435** | 1.84 |
| **1296** | 1.33 | **1331** | 1.00 | **1366** | 1.26 | **1401** | 1.61 | **1436** | 1.81 |
| **1297** | 1.23 | **1332** | 1.21 | **1367** | 1.17 | **1402** | 1.66 | **1437** | 1.55 |
| **1298** | 1.25 | **1333** | 1.21 | **1368** | 1.22 | **1403** | 1.84 | **1438** | 1.28 |
| **1299** | 1.18 | **1334** | 1.21 | **1369** | 0.98 | **1404** | 1.84 | **1439** | 1.59 |

Table A2

cont'd

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1440** | 1.94 | **1475** | 2.11 | **1510** | 2.40 | **1545** | 1.67 | **1580** | 1.82 |
| **1441** | 1.86 | **1476** | 2.15 | **1511** | 2.13 | **1546** | 1.88 | **1581** | 1.77 |
| **1442** | 1.83 | **1477** | 1.98 | **1512** | 1.87 | **1547** | 2.03 | **1582** | 1.77 |
| **1443** | 1.86 | **1478** | 1.92 | **1513** | 2.07 | **1548** | 1.80 | **1583** | 1.80 |
| **1444** | 1.96 | **1479** | 2.01 | **1514** | 2.10 | **1549** | 1.40 | **1584** | 1.78 |
| **1445** | 1.67 | **1480** | 1.95 | **1515** | 2.01 | **1550** | 1.31 | **1585** | 1.42 |
| **1446** | 1.80 | **1481** | 1.63 | **1516** | 2.04 | **1551** | 2.19 | **1586** | 1.16 |
| **1447** | 1.80 | **1482** | 1.51 | **1517** | 1.98 | **1552** | 2.21 | **1587** | 1.75 |
| **1448** | 1.80 | **1483** | 1.75 | **1518** | 2.01 | **1553** | 2.19 | **1588** | 1.80 |
| **1449** | 1.86 | **1484** | 1.94 | **1519** | 1.84 | **1554** | 1.94 | **1589** | 1.56 |
| **1450** | 1.69 | **1485** | 2.01 | **1520** | 1.77 | **1555** | 1.52 | **1590** | 1.44 |
| **1451** | 1.93 | **1486** | 1.91 | **1521** | 2.04 | **1556** | 1.59 | **1591** | 2.28 |
| **1452** | 2.03 | **1487** | 1.91 | **1522** | 2.19 | **1557** | 2.17 | **1592** | 2.19 |
| **1453** | 2.03 | **1488** | 1.91 | **1523** | 2.26 | **1558** | 2.17 | **1593** | 2.12 |
| **1454** | 2.17 | **1489** | 1.88 | **1524** | 2.19 | **1559** | 1.90 | **1594** | 1.50 |
| **1455** | 2.06 | **1490** | 1.91 | **1525** | 2.19 | **1560** | 1.71 | **1595** | 1.45 |
| **1456** | 2.06 | **1491** | 1.88 | **1526** | 2.04 | **1561** | 1.76 | **1596** | 1.19 |
| **1457** | 2.00 | **1492** | 2.08 | **1527** | 1.59 | **1562** | 1.34 | **1597** | 1.32 |
| **1458** | 2.03 | **1493** | 2.11 | **1528** | 1.91 | **1563** | 1.77 | **1598** | 1.67 |
| **1459** | 2.06 | **1494** | 2.04 | **1529** | 1.93 | **1564** | 1.79 | **1599** | 1.58 |
| **1460** | 1.88 | **1495** | 2.04 | **1530** | 1.96 | **1565** | 1.62 | **1600** | 1.56 |
| **1461** | 1.96 | **1496** | 1.94 | **1531** | 1.79 | **1566** | 1.80 | **1601** | 1.66 |
| **1462** | 2.34 | **1497** | 2.01 | **1532** | 1.89 | **1567** | 1.81 | **1602** | 1.83 |
| **1463** | 2.34 | **1498** | 1.91 | **1533** | 1.92 | **1568** | 1.68 | **1603** | 1.78 |
| **1464** | 2.23 | **1499** | 2.01 | **1534** | 2.03 | **1569** | 1.83 | **1604** | 1.65 |
| **1465** | 2.15 | **1500** | 1.83 | **1535** | 1.71 | **1570** | 1.81 | **1605** | 1.69 |
| **1466** | 2.12 | **1501** | 1.93 | **1536** | 1.69 | **1571** | 1.95 | **1606** | 1.65 |
| **1467** | 2.12 | **1502** | 1.96 | **1537** | 1.97 | **1572** | 1.83 | **1607** | 1.36 |
| **1468** | 2.12 | **1503** | 2.11 | **1538** | 1.89 | **1573** | 1.41 | **1608** | 1.33 |
| **1469** | 2.06 | **1504** | 2.21 | **1539** | 2.00 | **1574** | 1.80 | **1609** | 1.54 |
| **1470** | 2.06 | **1505** | 2.28 | **1540** | 2.03 | **1575** | 1.87 | **1610** | 1.51 |
| **1471** | 1.98 | **1506** | 2.24 | **1541** | 2.06 | **1576** | 1.66 | **1611** | 1.62 |
| **1472** | 2.22 | **1507** | 2.24 | **1542** | 2.06 | **1577** | 1.75 | **1612** | 1.63 |
| **1473** | 2.22 | **1508** | 2.28 | **1543** | 1.99 | **1578** | 1.91 | **1613** | 1.60 |
| **1474** | 2.15 | **1509** | 2.44 | **1544** | 1.96 | **1579** | 1.91 | **1614** | 1.68 |

Table A2

cont'd

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1615** | 1.60 | **1650** | 1.55 | **1685** | 2.16 | **1720** | 2.22 | **1755** | 2.77 |
| **1616** | 1.63 | **1651** | 1.80 | **1686** | 2.09 | **1721** | 2.53 | **1756** | 2.30 |
| **1617** | 1.61 | **1652** | 2.07 | **1687** | 2.21 | **1722** | 2.49 | **1757** | 2.48 |
| **1618** | 1.84 | **1653** | 2.27 | **1688** | 2.25 | **1723** | 2.46 | **1758** | 2.67 |
| **1619** | 1.92 | **1654** | 2.32 | **1689** | 2.07 | **1724** | 2.34 | **1759** | 2.81 |
| **1620** | 1.89 | **1655** | 2.00 | **1690** | 2.16 | **1725** | 2.23 | **1760** | 2.82 |
| **1621** | 1.66 | **1656** | 1.91 | **1691** | 2.44 | **1726** | 2.38 | **1761** | 3.33 |
| **1622** | 1.54 | **1657** | 1.65 | **1692** | 2.17 | **1727** | 2.14 | **1762** | 3.16 |
| **1623** | 1.61 | **1658** | 1.64 | **1693** | 2.02 | **1728** | 2.18 | **1763** | 3.09 |
| **1624** | 1.55 | **1659** | 1.68 | **1694** | 2.49 | **1729** | 2.48 | **1764** | 2.90 |
| **1625** | 1.60 | **1660** | 1.68 | **1695** | 2.21 | **1730** | 2.56 | **1765** | 2.66 |
| **1626** | 1.84 | **1661** | 1.45 | **1696** | 2.22 | **1731** | 2.65 | **1766** | 2.73 |
| **1627** | 2.00 | **1662** | 1.88 | **1697** | 2.08 | **1732** | 2.63 | **1767** | 2.46 |
| **1628** | 1.77 | **1663** | 1.90 | **1698** | 2.19 | **1733** | 2.50 | **1768** | 2.53 |
| **1629** | 1.49 | **1664** | 1.94 | **1699** | 2.47 | **1734** | 2.42 | **1769** | 2.79 |
| **1630** | 1.34 | **1665** | 2.06 | **1700** | 2.67 | **1735** | 2.40 | **1770** | 2.74 |
| **1631** | 1.62 | **1666** | 2.23 | **1701** | 2.53 | **1736** | 2.38 | **1771** | 2.83 |
| **1632** | 1.56 | **1667** | 2.16 | **1702** | 2.58 | **1737** | 2.48 | **1772** | 2.59 |
| **1633** | 1.59 | **1668** | 1.94 | **1703** | 2.34 | **1738** | 2.41 | **1773** | 2.59 |
| **1634** | 1.60 | **1669** | 2.02 | **1704** | 2.55 | **1739** | 2.15 | **1774** | 2.65 |
| **1635** | 1.56 | **1670** | 1.99 | **1705** | 2.65 | **1740** | 2.07 | **1775** | 2.66 |
| **1636** | 1.59 | **1671** | 2.32 | **1706** | 2.68 | **1741** | 2.35 | **1776** | 2.86 |
| **1637** | 1.41 | **1672** | 2.28 | **1707** | 2.56 | **1742** | 2.50 | **1777** | 2.66 |
| **1638** | 1.69 | **1673** | 1.95 | **1708** | 2.11 | **1743** | 2.55 | **1778** | 2.74 |
| **1639** | 1.84 | **1674** | 1.98 | **1709** | 1.86 | **1744** | 2.54 | **1779** | 2.91 |
| **1640** | 1.59 | **1675** | 2.33 | **1710** | 2.15 | **1745** | 2.34 | **1780** | 2.96 |
| **1641** | 1.99 | **1676** | 2.37 | **1711** | 2.02 | **1746** | 2.34 | **1781** | 2.95 |
| **1642** | 1.99 | **1677** | 2.06 | **1712** | 2.11 | **1747** | 2.36 | **1782** | 2.97 |
| **1643** | 2.03 | **1678** | 1.97 | **1713** | 2.02 | **1748** | 2.34 | **1783** | 2.99 |
| **1644** | 2.05 | **1679** | 2.22 | **1714** | 2.22 | **1749** | 2.36 | **1784** | 3.07 |
| **1645** | 1.90 | **1680** | 2.17 | **1715** | 2.10 | **1750** | 2.41 | **1785** | 3.17 |
| **1646** | 1.71 | **1681** | 2.04 | **1716** | 2.12 | **1751** | 2.79 | **1786** | 3.23 |
| **1647** | 1.40 | **1682** | 2.00 | **1717** | 2.25 | **1752** | 2.75 | **1787** | 3.16 |
| **1648** | 1.41 | **1683** | 2.04 | **1718** | 2.37 | **1753** | 2.80 | **1788** | 3.05 |
| **1649** | 1.35 | **1684** | 1.86 | **1719** | 2.25 | **1754** | 2.94 | **1789** | 3.01 |

Table A2

cont'd

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1790** | 2.88 | **1803** | 3.20 | **1816** | 3.28 | **1829** | 3.46 | **1842** | 3.50 |
| **1791** | 3.49 | **1804** | 2.99 | **1817** | 3.13 | **1830** | 3.56 | **1843** | 3.84 |
| **1792** | 3.55 | **1805** | 2.60 | **1818** | 3.35 | **1831** | 3.28 | **1844** | 3.71 |
| **1793** | 3.35 | **1806** | 2.78 | **1819** | 3.50 | **1832** | 3.43 | **1845** | 3.76 |
| **1794** | 3.23 | **1807** | 2.91 | **1820** | 3.66 | **1833** | 3.55 | **1846** | 3.31 |
| **1795** | 2.77 | **1808** | 2.74 | **1821** | 3.44 | **1834** | 3.63 | **1847** | 2.96 |
| **1796** | 2.63 | **1809** | 2.43 | **1822** | 3.71 | **1835** | 3.83 | **1848** | 3.53 |
| **1797** | 2.97 | **1810** | 2.36 | **1823** | 3.64 | **1836** | 3.56 | **1849** | 3.67 |
| **1798** | 2.94 | **1811** | 2.91 | **1824** | 3.47 | **1837** | 3.37 | **1850** | 3.89 |
| **1799** | 2.60 | **1812** | 2.61 | **1825** | 3.30 | **1838** | 3.28 | | |
| **1800** | 1.97 | **1813** | 2.66 | **1826** | 3.54 | **1839** | 3.06 | | |
| **1801** | 2.34 | **1814** | 3.07 | **1827** | 3.61 | **1840** | 3.09 | | |
| **1802** | 3.10 | **1815** | 3.71 | **1828** | 3.62 | **1841** | 3.36 | | |

*Note*: Annual welfare ratios are computed as the annual income by decade (see Table A1) divided by the yearly consumer price index and express how many adult consumption baskets (see Table 1) that an unskilled worker's annual income could purchase. *Sources*: Wages: see the text. Consumer price index (CPI) including rent: Allen (*Link*).

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