**Children’s work and wages in Britain, 1280-1860**

**Jane Humphries and Sara Horrell**

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Abstract:

Child workers are commonplace in historical sources but rarely feature in the grand narratives of economic history. Recently, however, new theories have identified changes in children’s economic value as key to economic and demographic trends in Britain but there has been little data with which to examine these putative effects. Prompted by these ideas, we present data on payments, both in cash and in kind, made to 3873 children from 1280 to 1860. Children’s wages show some similarities in their trajectories to those found for adults. Real wages increased after the Black Death and stayed at a high level through the C16th; but they then suffered a decline which was only checked in the mid-C18th and not reversed even when industrialisation was underway. Indeed, remuneration for child workers progressively fell away from that of unskilled adult males from the C16th. Until the late C17th, children working on annual contracts suffered the same disadvantage compared with day labourers as found for adults. Regression analysis controls for variation in our sample over time and reveals predictable relationships with key variables such as age, industry, sector and region. Children were an integral part of historic labour markets and their wages reflected economic factors. Knowledge of children’s work and wages helps illuminate aspects of recent theories on Britain’s historical growth.

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Introduction

Child labour remains a global problem in the world today. According to both UNICEF and the ILO, in 2013, an estimated 168 million children aged 5-17 were employed in work that deprived them of childhood, interfered with schooling and was mentally, physically, socially and morally dangerous. Historians have sought to deepen understanding of the persistence of child employment by exploring its extent, causes and consequences in different times and places (Lavalette, 1999; Lieten and Van Nederveen Meerkerk, 2011). But while children historically have been identified as key workers in the transition to the factory system (Tuttle, 1999; Honeyman, 2007; Humphries, 2010), as major contributors to family incomes (Horrell and Humphries, 1995; Boter, 2018), and as longstanding sources of labour in both agriculture and protoindustry (Claridge and Langdon, 2017; Horrell and Humphries, 1995), and while some historians have argued that in these roles they contributed to the macro economy, child workers rarely appeared in mainstream accounts of growth. Until recently, blinkered and biased as such a perspective is, child workers were viewed as peripheral and unimportant. This is changing. Children have been pulled from the wings of economic history not by the growing volume of empirical evidence on their economic roles but by the emergence of new grand narratives, such as the Industrious Revolution, the North European Marriage Pattern, the High Wage Economy and Unified Growth Theory. In these theories children *serendipitously* have star parts.

Although these theories elevate the importance of child employment, the empirical evidence needed to test the ideas remains piecemeal and patchy. Researchers regularly glimpse child workers in manorial and farm accounts, estate records, wage assessments, household accounts, wage books and poor law documents, but it is difficult to envisage a coherent account of children’s work from such fragmentary records. Studies of particular times and places cast light on the nature of children’s work and its relationship to the family economy but those which seek a more comprehensive picture are usually broad brush and even if empirically based are not systematically quantitative (Kirby, 2003; Rahikainen, 2004; Heywood, 2001, ch.8; Heywood, 2018). Historians remain in the dark even on such a basic issue as child remuneration and how it evolved alongside the pay of adult men and women: a crucial concern in the meta narratives mentioned above. A serious study of child wages is long overdue.

This paper presents a first attempt to sketch the long run evolution of child remuneration. We have compiled data on children’s work and wages in Britain from 1280 to 1860, looking separately by gender and recording where possible age, the sector of employment, the nature of the job and whether work was for casual day wages or on an annual contract, which came with room and board provided. The result is the first long-run wage series for child workers which we can then relate to trends in the cost of living as well as in the wages of adult men and women. While we stand on the shoulders of other economic historians who have assembled data for particular times and places (e.g. Claridge and Langdon, 2017), we have uncovered many new primary and printed primary sources and use 3873 observations spread over nearly 600 years to generate this first long run series. While evidence on occupations and wages cannot compensate for our ignorance about the size of the child labour force they can provide the basis for careful inferences about how child labour related to long run growth and structural change.

These data speak to the grand narratives that incorporate child labour. Jan de Vries’ ‘industrious revolution’ identified an early modern increase in market work, a rise in industriousness, motivated by a desire for new market goods, such as tropical groceries and attractive fabrics, that propelled Britain and the Dutch republic into a period of sustained economic growth. Often building on existing proto-industrial activities conducted within the household, children, alongside women, were explicitly identified as at the forefront of this industriousness. More recent theories take up this theme. Broadberry et al’s recent (2015) survey of British long-run economic growth in European perspective demonstrated divergent trends in GDP per capita and (men’s) real wages. Macroeconomic accounting requires such discrepancies to be explained by shifts in factor shares, or in the relative prices of workers’ consumer goods, or an early modern growth in labour supply per capita (Angeles, 2008). The latter explanation appears feasible and industriousness again draws into the frame the children who often bore the brunt of drudgery and graft (Broadberry, et al, 2015, pp.263-7, Humphries, 2013a). Our data indicate a small fillip in children’s real remuneration in the early C18th indicative that child labour was both in demand and that increased earnings were available to those who worked.

Children also feature obliquely in the dominant explanation of why the first industrial revolution occurred in England which focusses on its ‘High Wage Economy’ (HWE). Robert Allen has identified high wages as prompting the substitution of capital for labour and so propelling England onto a superior growth trajectory. Since he includes the spinning jenny as one of the three macro inventions of the era (alongside the steam engine and smelting with coal) the high wage economy must extend to hand spinners who were almost exclusively women and children. An alternative interpretation reaches back to Berg’s *Age of Manufactures*. It suggests that mechanization by narrowing the productivity differential between adults and children, as explained in Basu and Van’s (1999) model of labour markets with child labour, influential within development economics but neglected by economic historians, created the opportunity to make super profits by employing children. Perhaps this prospect was enhanced by the demographic and labour market conditions of early industrial Britain (Humphries, 2010; 2013b). Again, new and exciting meta narratives incidentally incorporate children workers, here by asking questions about their wages relative to adults and to the cost of capital and fuel in both the Smithian and factory phases of industrialization. Our data show stasis in children’s remuneration over the industrial revolution. Moreover, they fall ever behind those of unskilled males, instead more closely reflecting the remuneration of adult female day labourers. Women and children both offered relatively cheap labour, suggesting an alternative route to industrialisation that avoided high wages for many industries.

The long-run narratives extend to take in the post-Black Death shift of the economy from arable to pastoral agriculture, which encouraged nascent secondary sector production and developed related skills. This offered women, particularly, opportunities for lucrative employment which had consequences for age at marriage and resultant fertility and enabled an escape from the Malthusian trap (Broadberry et al 2015, De Moor and van Zanden 2010, Voitländer and Voth 2013). Relatedly Unified Growth Theory which links the demographic transition and economic growth, centres on household decision making and parental decisions over quantity of offspring and investment in children’s human capital

(Diebolt and Perrin, 2017). Historical testing has proved difficult but most hypotheses relate to shifting roles for children within families and economies (Galor and Weil, 1996; Iyigun and Walsh, 2007; Strulik and Weisdorf, 2008; Doepke and Tertilt, 2009; Largerlöf, 2003; Doepke and Zilliboti, 2019).

The data on children’s remuneration reported here cannot speak directly to the demographic elements of these theories, but they do show children sharing in the ‘Golden Age’ of labour heralded by the misery of the Black Death. Improved remuneration would have enabled the extension and expansion of diet identified from agricultural accounting (Broadberry et al 2015) with concomitant effects on human capital acquisition, both physical and, very possibly, intellectual (Kelly, O’Grada and Mokyr 2013). The data offer support to theories positing an early improvement in national ability even if they can cast only dim light on the underlying mechanisms.

The paper is organised as follows. The first section describes our sources and data in more detail and explains how we have dealt with the various problems which arise when putting together such a series from different, patchy and often difficult sources. We pay particular attention to issues arising from shifts in sample composition. The second section explains how we reduced annual and weekly remuneration to rates per day, accounted for variation in the organization of children’s work, for example whether a child worked alongside an adult, and, most importantly, imputed a value to the perquisites that were for long periods a vital part of the compensation package. The third section provides perspective by relating child wages to the cost of living, and particularly the subsistence standards of working people and so begins to chart the evolution of children’s real wages and trace the extent to which they were self-supporting at different points in time. We also look at how much children could earn relative to adults. However, since the data is so fragmentary and child workers so heterogeneous, trends over time can only be detected by regression analyses controlling for age, gender, location and other independent variables. The fourth section presents the results of several such analyses. Children’s wages are shown to be systematically conditioned by factors logically associated with their productivity suggesting that they were not occasional workers paid haphazard amounts but an accepted component of the labour force with recognised jobs and pay levels. We use the regression coefficients and new econometric techniques to estimate trends in the wages earned by children in various sectors of the economy and so to check the findings from the raw data. We also draw on recent research on the length of the working year to explore the implications of likely changes in working time on children’s living standards. We close with some still necessarily speculative comments as to the importance of children’s earnings to their families of origin and whether our evidence supports mainstream accounts of the long-run development of the British economy.

I.

The Data

*Sources and shifts in sample composition*

We have collected 3873 observations of children’s work and pay from 207 different sources over the period 1280-1860. Over two thirds (70.5%) are from primary or printed primary sources, such as manorial, estate, or household accounts from medieval to Victorian times. These sources often refer to wages paid on farms, in households, and on construction sites. But other sources detail the employment and pay given to poor children, partly *in lieu* of relief, such as the churchwarden’s accounts of Ashburton, Devon 1479-1580 (Hanham ed., 1970), churchwarden’s books in Cambridgeshire 1496-1540 (Dymond ed., 2004), and workhouse records from Walthamstow, 1727-32 (Walthamstow Vestry Museum, W.59.2). Other sources of children’s wages include settlement examinations which detail the prior employment of claimants (or likely claimants) for relief (for example, Baxter ed., 1985; Pratt ed., 2011), schools which taught manufacturing skills but also paid children for work (for example, the spinning school at Nettleham, Lincolnshire documented in Sheffield City Archives, (EM/985) and philanthropic but nevertheless commercial enterprises such as the textile manufacturing, which was based on the Newbury workhouse whose accounts have been transcribed by Christine Jackson (Jackson ed., 2004). We also have accounts of children employed in wool spinning at the Duke Street factory in Trowbridge, Wiltshire in 1833, and children employed in the Quaker Workhouse at Clerkenwell 1711-37 (Hitchcock, 1987). Surveys of the poor provide evidence on the pay and employment of children living in families on the margins of poverty in Elizabethan Norwich (Pound, 1962), Elizabethan Ipswich (Webb ed., 1966), Stuart Salisbury (Slack ed., 1975), Dorset in 1790 (Hutchins, 1796), and Lancashire in the nineteenth century (Tottington, Lancashire 1817; Bedford, Lancashire 1835-6). These sources are the backbone of our dataset, but they are supplemented by the Parliamentary Papers, 1824 to 1845, (10.9% of cases),[[1]](#footnote-1) and by various secondary sources (16.8 % of cases), including Arthur Young’s observations on his tours round England in the 1770s, J.E.T. Rogers’ compendious history of prices and wages from 1259, Jane Humphries’ collection of working-class’ autobiographies (Humphries 2010) and John Langdon’s (2011) analysis of wages in medieval Oxfordshire. Finally, we have collected some wage assessment data (1.8% of cases) which we use as a check on the wages we have obtained from other sources and for information on the value of in-kind payments. (See appendix for full detail on all data sources).

In most decades we have information on children’s wages from a number of sources; the range is 1 – 21 per decade with a median value of 6. In four decades we rely on only one source but, even here, the source itself compiles evidence from several different locations and employments, as for example with Thorold Rogers’ collection of price and wage data (Rogers 1867, 1882, 1887)

Our data refers to children’s waged work. We are unable to value children’s work in producing goods for direct consumption or assisting in the production of goods which were eventually sold on a product market such as foodstuffs from a family farm or domestic manufactures from a protoindustrial household. Consequently, we omit many productive contributions made by children, meaning that our evidence provides a conservative picture of their economic role. [[2]](#footnote-2)

The sources themselves involve systematic differences in the economic status of the children we observe. Settlement examinations are biased towards those who had been apprenticed or worked as annual servants since a completed apprenticeship or a year of service provided entitlement to relief, but such records are relatively unimportant overall and observations from them relate to time periods that are well documented from other sources. From the 1500s, poverty and destitution were increasingly recognised as social problems, causing various censuses of the poor to be taken. These have the advantages that they record the earnings of children in families, not at a place of work, and so cover types of work missed in other sources, for example, girls’ work, intermittent work and work in the home. But they do represent a shift in the constitution of the sample as does the inclusion of the wages paid to child participants in work creation schemes set up by philanthropists or the poor law authorities where the pay recorded might have been below market rates. In the subsequent analysis, we control for any compositional shifts in sources using dummy variables.

*Age and Gender*

Many of the children in the data set are individually identifiable. For 37.6% of the children we have their name recorded, for 30.6% we know their exact age and for a further 15.2% we know that they were in their teenage years, that is, older children. For only 5.5% is the child’s sex unknown, although a further 7.9% are joint observations of children and assumptions are made about their sex. For the remainder 71% are male and 29% female, the lower representation of girls is attributed to difficulties with identification in the sources. Females are often described as ‘maid’ or ‘mayde’, which may refer to occupation or marital status leaving age uncertain. Boys are variously referred to as ‘x’s boy’, ‘lad’, ‘page’ and so are easier to identify. The data set reflects the relative prevalence of the sexes in the sources, and although we do not think that this involves any systematic bias in the work and remuneration of the girls we observe, the paucity of evidence makes it harder to provide reliable estimates of their wages. Where sex is not explicitly stated, each case has been scrutinised to determine whether it might reasonably be inferred from the occupational gender stereotype, so children in building trades were classified as male, those in textile work as female. In cases where both boys and girls were observed doing the job, we recorded one of each sex in the dataset. A few cases reported ‘children’ working. Again where all the other incumbents of the job were male, we recorded two males, and so on. Boys predominated in the final data set comprising 68.4% of observations.

*Children’s occupations*

Although, not surprisingly, agriculture predominates throughout the period, children are observed doing many different tasks in all sectors of the economy, with visible gender segmentation, as shown in the tables 1a and 1b below.

*Table 1a. Boys’ occupations (% in half century)*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Agri-culture | Mining | Cottage  Industry | Manu-  facturing | Service | Dist-  ribution | Con-  struction | Other/  unknown | Total (number) |
| 1250-99 | 56 |  |  |  | 21 |  | 24 |  | 63 |
| 1300-49 | 82 |  |  |  | 7 | 3 | 9 |  | 210 |
| 1350-99 | 58 |  |  | 1 | 32 | 1 | 7 |  | 74 |
| 1400-49 | 26 |  |  |  | 44 | 4 | 6 | 19 | 99 |
| 1450-99 | 30 |  |  |  | 17 | 10 | 33 | 10 | 30 |
| 1500-49 | 6 |  | 2 |  | 48 |  | 39 | 5 | 96 |
| 1550-99 | 12 |  | 3 | 2 | 20 | 6 | 40 | 16 | 123 |
| 1600-49 | 36 | 1 | 8 | 13 | 18 | 2 | 10 | 12 | 314 |
| 1650-99 | 49 |  | 3 |  | 29 | 4 | 7 | 9 | 160 |
| 1700-49 | 33 |  | 50 |  | 7 | 3 | 4 | 3 | 260 |
| 1750-99 | 44 | 4 | 14 | 10 | 2 | 5 | 13 | 9 | 451 |
| 1800-49 | 46 | 4 | 18 | 21 | 4 | 4 | 1 | 3 | 720 |
| 1850-69 | 67 | 2 | 4 | 8 | 12 |  | 4 |  | 51 |

*Table 1b. Girls’ occupations (% in half century)*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Agriculture | Mining | Cottage  Industry | Manu-  facturing | Service | Dist-  ribution | Constr-  uction | Other/  unknown | Total  (number) |
| 1250-99 | 80 |  |  |  | 10 |  | 10 |  | 10 |
| 1300-49 | 93 |  |  |  | 7 |  |  |  | 44 |
| 1350-99 | 100 |  |  |  |  |  |  |  | 14 |
| 1400-49 | 100 |  |  |  |  |  |  |  | 1 |
| 1450-99 | 67 |  |  |  |  |  |  | 33 | 3 |
| 1500-49 |  |  |  |  | 100 |  |  |  | 2 |
| 1550-99 | 22 |  | 76 |  | 2 |  |  |  | 49 |
| 1600-49 | 8 |  | 66 | 13 | 11 |  |  | 3 | 80 |
| 1650-99 | 58 |  | 16 |  | 12 | 5 |  | 9 | 43 |
| 1700-49 | 9 |  | 76 |  | 9 | 5 |  | 1 | 216 |
| 1750-99 | 11 | 0 | 67 | 9 | 9 | 1 |  | 4 | 318 |
| 1800-49 | 39 | 1 | 33 | 15 | 10 | 0 |  | 3 | 431 |
| 1850-69 |  |  | 27 | 73 |  |  |  |  | 11 |

*Temporal and regional composition*

Not surprisingly, the sources do not yield a uniform flow of information over time. 16.7% of the data relate to the time period 1250-1549, 32.1% to 1550-1749, and 51.3% to 1750-1860. The observations cover 50 counties, the majority in England but a few from Scotland and Wales and we have classified them into broad regions as in Table 2 below:

*Table 2. Regional composition*

|  |  |
| --- | --- |
| **Region** | **% of observations** |
| South East | 58.2 |
| South West | 17.5 |
| North East | 9.4 |
| North West | 13.5 |
| Scotland, South | 0.3 |
| Wales | 0.8 |
| Unknown | 0.3 |

Subsequent analysis takes into account the well-documented differential development of these regions with the early and continuing prosperity of the South East, the nascent industrial development of the South West and its subsequent relative decline as manufacturing moved North, and the persistent backwardness of the periphery (Jones, 2010).

*Repeat observations*

When a child is repeatedly found in the accounts but is doing the same task and pay remains unaltered the entry is made only once in the dataset with the number of days worked aggregated across the different recordings. However, 266 children in the dataset are observed on more than one occasion either doing different tasks or over a number of years. When the child was doing different jobs / tasks during the year, the days worked, task and rate of pay have been recorded as separate observations. In 198 cases, the child appears in different years and here an observation has been recorded for each year separately, even if pay remained unaltered. Repeat observations of the same child across years are flagged up and controlled for in subsequent regression analysis.

*Estimating the age of children*

One of the main factors we expect to affect children’s pay is their age. Actual age is recorded in only 31% of cases, though in many others the sources indicate whether the worker was a teenager or younger child. For the former we attribute an approximate age of 14, for the latter 11. In cases of multiple appearances, where we have an indication of age, if initially a child is suggested, we start at age 10 and add years to age according to the calendar year of subsequent observations. We adopt a similar solution for those known to be teenagers, starting at age 13.[[3]](#footnote-3) This yields approximate ages of children as shown in Table 3:

Table 3: *Distribution by approximate age,* %

|  |  |
| --- | --- |
| Age | Frequency (%) |
| 5 | 0.1 |
| 6 | 0.4 |
| 7 | 0.8 |
| 8 | 1.4 |
| 9 | 1.8 |
| 10 | 2.6 |
| 11 | 46.9 |
| 12 | 5.8 |
| 13 | 4.4 |
| 14 | 21.5 |
| 15 | 5.3 |
| 16 | 3.7 |
| 17 | 1.9 |
| 18 | 2.0 |
| 19 | 0.7 |
| 20 | 0.3 |
| 21 | 0.2 |
| 22 | 0.1 |
| 23 | 0.1 |
| 24 | 0.1 |

For each child we recorded when and where they were employed, their age, the job they did, the type of contract they had (that is whether the pay was annual, weekly, daily or paid by some other period, including task work) the number of days they were employed and the amount and form their remuneration took, in particular whether ‘diet’, accommodation or clothing were also provided. Our intention was to capture the total value of daily remuneration received by these children. To do this we needed to calculate the daily monetary payment made to each child and add on an amount for in-kind payments.

II

Data manipulation

Four different problems occur in converting the historical data into a meaningful child wage series: the duration for which a child was paid must be identified and child workers classified by contract type; payments for different durations of work must be reduced to day rates; payments to children on task work or working alongside adults must be individuated and again reduced to day rates; and, most difficult of all, payments in kind must be valued and added to cash wages to measure total remuneration.

*Classifying child workers by contract type*

The sources enable the period for which a child was paid to be identified and child workers to be classified by contract type as in table 4. For purposes of the graphical analysis below, given the sample sizes, we combined categories to distinguish children working casually by the day and those working on longer term contracts.[[4]](#footnote-4) The sources are not always clear and there are some ambiguous cases. We included all workers paid annually, half yearly, quarterly and for terms greater than 15 weeks as long-term ‘annual’ workers. We also included named child workers whose employment record extended beyond 180 days as annually employed. As a result 969 cases, 25% of the sample, are classified consistently as ‘annual’ workers.

*Calculating the daily wage*

Periodicity of employment alongside the sums paid enabled most wages to be converted into day rates, assuming 250 days in the working year, as standard in the literature (see Allen, 2011; Broadberry et al, 2015, p.26). The tariff is shown in table 4. However, we also consider an alternative scenario for the number of days worked and discuss the consequences for our results, see Section V below.

Table 4: *Distribution by payment period*

|  |  |  |  |
| --- | --- | --- | --- |
| **Payment period** | **Assumption about days worked** | **No. of observations** | **% observations** |
| Annual | 250 | 696 | 18.0 |
| Half-year | 125 | 7 | 0.2 |
| Quarterly | 63 | 44 | 1.1 |
| Monthly | 21 | 15 | 0.4 |
| Weekly | 5 | 1486 | 38.4 |
| Day | 1 | 1505 | 38.9 |
| Casual | 1 | 4 | 0.1 |
| Task | 0 | 55 | 1.4 |
| Other (manorial accounts e.g. 16, 32 weeks) |  | 54 | 1.4 |
| Unknown |  | 7 | 0.2 |
|  |  |  |  |
| Total |  | 3873 |  |

*Daily wage for those doing task work and employed alongside parents*

In the 55 cases where children were paid for the task, additional assumptions were needed to arrive at a day rate. If the pay was less than was typical for the time period then it was assumed for the day, often involving such tasks as ‘delivering letters’; in other cases the pay and task were compared with similar recorded activities (e.g. haymaking) and a judgement made about the rate per day. In 8 cases of girls spinning flax and hemp in 1760 payment was given for the number of pounds (lbs) spun and the account book recorded the payment made over 78 or 48 days. Here an assumption had to be made about productivity to arrive at the related pay. Pay looks low, but this may not be unrealistic. Demand may have been limited, the girls may have only worked part-time, or spinning may have been poorly remunerated (Humphries and Schneider, 2018). All cases involving task work were flagged to enable the identification of systematic errors in changing rewards in the subsequent analysis.

In 114 cases fathers and sons, builders and boys, or masters and apprentices, were paid together. In most cases, we calculated boys’ wages on the basis of other information from the same source, for example the remuneration of fathers or similar workers when working alone. Where such information was missing, we assumed that sons were paid 1/3 of the team remuneration; in a few cases, similar judgements were made but, for instance, there may have been two sons working alongside their father. Again we use dummy variables to keep track of cases where these adjustments were made.

*Valuation of in-kind payments*

The ubiquity of payments in kind bedevils the construction of historical wage series (Humphries and Weisdorf, 2015). The problem looms even larger with respect to child workers for whom privileges were very common, often representing a significant proportion of the total compensation package. Many children in the sample received both cash and some form of in-kind payment. Overall, 21.3% received board, 16.6% lodging and 4.1% clothing, but these proportions varied, generally declining over time but remaining important even as late as 1850, (see table A1 in the appendix). Moreover, a few children, 3.9% of our cases, received no money, only selected perquisites. For instance, in the early eighteenth century, Elizabeth Pope aged around 13, went to serve a cheese monger, the first half of the year for ‘only victuals and clothes’ but at the rate of £1 15s for the second six months (Hembry 1990).

Ideally, such in-kind rewards should be individually valued and added to cash payments to establish overall remuneration. Unfortunately, the evidence needed to support such an exercise is rarely provided and we resort to generic methods to estimate values. We impute monetary values for perquisites in two different ways, both based on the assumption that they covered subsistence and so can be appraised through a historical consumer price index.

Robert Allen’s ‘respectability’ consumption basket (2009) provides the metric for our first imputation. The basket, which compiles the goods required to maintain a basic acceptable living standard for an adult in the past, was used by Humphries and Weisdorf (2015, 2018) to value in-kind payments when looking at women’s wages (2015) and the ‘unreal’ wages of men over the long term (2018). We use the same imputation strategy but, consistent with the proposition that just over three baskets would capture the cost of supporting a family consisting of a father, a mother and ‘some children’ (Allen, 2009, p.38.), approximate the value of a child’s perquisites by one half of an Allen basket.

However, the Allen basket perhaps overvalues what children received. As well as needing less calories and so being given less food, children would almost certainly have drunk less beer, and their lodging might have involved bedding down in the stable (or in a coffin like poor Oliver Twist!). They probably did not independently use much light or fuel (or maybe soap). Furthermore, we can see from the sources that in-kind payments were predominantly food and only occasionally explicitly included clothing so were rarely the full consumption basket even as recalibrated for child needs.

To provide a check on the Allen basket valuation and a floor to the range of potential valuations of in-kind benefits, we also impute the cost of subsistence in terms of enough bread to provide the calories needed to survive. In the absence of a sufficiently long series for bread prices, we resort to wheat prices. [[5]](#footnote-5) We assume a bare minimum subsistence for a child requires 1500 calories per day. The assumption is conservative. The 2001 FAO/WHO/UNU Expert Consultation document suggests that boys engaging in moderate physical activity, (and all our children are working), require 1575 kcal/d at age 6-7 rising to 2775 by age 13-14 and 3325 kcal/d by age 16-17. The analogous figures for girls are 1425, 2375, and 2500. Historically, children would have been smaller in size reducing requirements but nonetheless our caloric needs assumption provides a barebones diet. [[6]](#footnote-6) We reverse Claridge and Langdon’s (2017) conversion factor of grains into calories to compute the associated requirement in terms of wheat. [[7]](#footnote-7) The final step uses the wheat price to cost up the grains sufficient to provide 1500kcals.[[8]](#footnote-8) This survival diet cost from 0.29 d to 5.14 d over our time span, figures which can be thought of as minimal estimates of the value of board.[[9]](#footnote-9)

As noted above, some children also received lodging and clothing as part of their compensation package, and while such basics are included in the Allen basket, they need separate valuation in the survival diet approach. [[10]](#footnote-10) For the wheat price variant, lodging is valued at 5% of the price of subsistence, consistent with other accounts of the historical cost of living (see Allen, 2007; Feinstein, 1998) and reflecting the miserable accommodation many children experienced. Clothing is valued at 10% of the price of subsistence. The cash wage plus imputed values for the three types of perquisites gives the total remuneration received by the child in pence (d.).

However, one further serious complication arises because most children who were boarded, lodged or dressed by their employers enjoyed these benefits in days when they did not work. For example, a child who was employed as a live-in servant by the year was housed, fed and clothed for 365 and not 250 days. Support received even when not working was a significant benefit for those on traditional service contracts, providing security, which both parents and children might well crave, and its omission would seriously bias estimates of wage trends as well as any comparison of day and annual remuneration. Consequently we have to add the additional 115 days receipt of the value of perquisites to the child’s remuneration and then spread it over the 250 days of work, as Humphries and Weisdorf did when computing the daily wages of women on annual contracts (2015, p.414). To illustrate, in 1856, Thomas Lidgett was working as a live-in farm servant earning £4 5s per year plus board and lodging. Assuming he worked 250 days, his cash remuneration per day worked was 4.08d. In terms of the Allen baskets methodology, Thomas’s 4.08d in cash per workday was supplemented by the ½ basket for 365 days loaded onto his 250 days. In the 1850s the basket cost 4.82d, so his total remuneration per day worked was 7.60d (4.08d + ((2.41x365)/250)). Alternatively, the price of 1500kcals was 2.92d so with the additional 5% allowance for lodging, the daily value of his perquisites on the subsistence diet basis was 3.07d. But Thomas received these for 365 days so their value per day worked was 4.48d giving him a total remuneration of around 8½d per day worked.

These procedures provide a measure of the *‘rewards* *per day worked*’. [[11]](#footnote-11) However, rewards per day worked do not measure living standards which involves spreading earnings and the value of perquisites over non-working days during the year and so calculating rewards ‘*per average day in the year’* (see Appendix B). Estimates of living standards usually adopt this annual standard comparing annual earnings and perquisites to an annual cost of living index, as for example Allen’s welfare ratio approach. [[12]](#footnote-12) When comparing children’s remuneration to an adult equivalent, care must be taken to make sure that this is on the same basis. This point is taken up again in section III below.

Most cases involving board and lodging were associated with annual or other long-term contracts. However, sometimes apparently casual workers were in receipt of perquisites (124 cases were boarded, 69 lodged and 6 clothed) reflecting the fuzziness of the boundary between casual and longer-term employment noted above (pp.11-12). For example, some harvest workers, and some task workers such as messengers who had to travel away from home and entertainers who were hosted after their performance were often fed and lodged. In these cases, we estimated the value of board as the value of 750kcal of wheat or one quarter of the Allen consumption basket, that is half that received by annual workers with board and lodging as part of their remuneration. To illustrate, the maid who served a thatcher in Gamlingay, Cambridgeshire in 1293 worked 15 days for ½d per day but she was also fed while working. With the wheat price for 1500kcals at .37d and the Allen basket at .54d, the girl’s remuneration was computed as .685d (wheat price measure) and .635d (Allen basket computation).

*Comparison of money wages and the valuation of in-kind payments with wage assessments.*

There are 70 observations of wage assessments in the dataset. Most of these relate to young males with just a few relating to girls, but they cover various counties and trades. In Appendix A, Table A.1 these are compared with the average pay for boys in the relevant decade from the dataset (excluding the wage assessments). The comparison is reassuring. Our estimates are similar in order of magnitude to the prescribed wages and so we have included wage assessment data in the analysis. Such sources add observations, sometimes in periods when evidence is scarce, and occasionally cover female workers, specify pay for age, and extend the range of occupations. [[13]](#footnote-13)

*Children’s nominal rewards per day worked*

We begin with the evolution of the nominal pay of children working casually by the day as shown in figure 1. It should be noted that these depict decade averages from the raw data, so take no account of the heterogeneity of the sample, both by source and by type of child worker and their work, within and between decades. This heterogeneity is controlled for in the later regression analyses, see section IV. Although a few of these children were in receipt of perquisites, which we have taken care to include in our valuations of their wages, this does not make any substantial difference to their average remuneration; in essence, day workers’ cash wages represent their rewards per day worked and are used in this way in what follows.

However, for workers on longer term contracts (identified as explained above, pp.11-12), and especially annual workers, perquisites were likely to be of considerably more value. For these workers we break out cash payments from cash plus perquisites valued either by the Allen basket methodology or according to wheat prices.

Figure 1 Nominal rewards per day worked, cash and in kind, casual and annual workers (d. per day)

(decade averages from observations on individual children, without adjustment for sample composition)

This figure reveals much about the child labour market in the past. First, in cash terms annual workers did much less well per day worked than did their casually employed peers.[[14]](#footnote-14) Of course annual workers obtained perquisites which sweetened the pill of their lower money wages. But second, even our generous interpretation of the value of these perquisites and acknowledgement that they were received year round though workers only worked a fraction of the year, does not eliminate the gap in remuneration, which exists whichever method of imputation we adopt, up until circa 1600. However, from this date onwards the annual workers’ rewards per day worked converge on those of day labourers, driven by increases in both cash components and the valuation of perquisites (whichever imputation strategy is deployed). By circa 1700, workers on annual contracts are doing just as well as their casually employed peers. Third, focussing on the alternative imputation strategies, contrary to our expectation (see above p.14), the basket methodology appears less generous than the wheat valuation. This is additionally surprising given the harsh assumption about children’s caloric needs built into the latter, suggesting perhaps that children needed more resources than are provided by one half the Allen basket. The difference increases from 1500 on, possibly reflecting increasing importance of the price movements of goods other than grain in the basket valuations. But it is reassuring that both imputation strategies yield analogous trends, evidence that our findings are not driven by the way in which perquisites have been valued. Fourth, in-kind remuneration for annual workers appears to take on more importance in certain periods of time, for example 1630-1690 and 1790-1820, not surprisingly periods of economic and social dislocation and/or high food prices. These findings are all investigated further below.

Figure 2 compares our children’s wages with men and women’s nominal wages subdivided by casual day and annual contract categories and computed identically to the children’s wages but using the whole Allen basket metric to value in kinds for adults. Men’s wages refer to casual farm workers and are taken from Clark (2007), women’s from Humphries and Weisdorf (2015).

Figure 2. Comparison of children’s, women’s and men’s nominal remuneration per day worked (d. per day)

(decade averages from observations on individual children, without adjustment for sample composition)

   



The children’s wage series have much greater short-term volatility than do the adult series because of the smaller sample sizes and the heterogeneity of the population sampled, but apart from the spike in the 1560s the overall trajectories and the relationship between child and adult nominal wages and remuneration are as we would expect. Children working either casually by the day or on longer term contracts usually earned less than both men and women but the gap in comparison with the latter is much narrower and in certain periods (mid-1500s) becomes inverted. The figure also highlights that the relationship between casual day and annual remuneration per day worked found for children mirrors the relationship found for women (Humphries and Weisdorf, 2015). In the medieval period, both child and women casual workers could do better on a daily basis than their peers who had committed longer term. Perhaps this gap represents a penalty that both children and women were prepared to pay for the security of long-term maintenance. Alternatively, it might have been that young and female workers were more readily subjected to the relatively disadvantageous terms and conditions of employment on annual contracts associated with the regulatory regime imposed as a result of the Statute of Labourers, however patchily these orders were imposed (Humphries and Weisdorf, 2015, pp. 417-419). In either case, the disadvantage was eliminated for both women and children circa 1550, followed by relative improvement for workers on longer term contracts, which turned into significantly higher remuneration by the era of industrialisation. The relationship may also be altered by varying the assumption about the length of the working year. However, as we show in Section V below, an alternative scenario leaves the observations above unaffected.

In terms of trends over time, child workers appear to have shared to some extent in the extended golden age that followed the Black Death, falling back along with adult pay at the end of the 1400s. From the middle of the 1500s their nominal wages improved slowly in line with adult pay, perhaps losing ground somewhat in the late 1600s but thereafter gaining on women workers but falling behind adult males. The next step is to deflate these monetary values into real remuneration and begin to correct for the spurious compositional effects anticipated above.

III

Real remuneration and the standard of living

For comparisons over time and judgements about wellbeing, we need to consider the real value of children’s wages per day and also what standard of living the remuneration could support. First we deflate the nominal rewards to a day of work to account for changes in the cost of living. Following Allen (2009) we use the cost of an Allen basket, but in this case recalibrated as one half to reflect the lesser needs of children, as a measure of living costs when valuing the perquisites using the Allen basket methodology. Thus real daily remuneration on this definition can be interpreted as the number of children’s baskets that could be purchased from a day of work. Analogously we deflate by the cost of 1500 kcal of wheat where we have used wheat prices as a direct measure of the cost of a subsistence diet. The real daily remuneration on this definition can be interpreted as the proportion of the daily survival diet the child’s remuneration per day worked would buy.

To turn these estimates of real remuneration per day worked into estimates of the standard of living we have to transition to an annual perspective taking account of the days when we have assumed children either could not or would not work by multiplying remuneration per day worked by 250 and deflating by the annual cost of living (daily COL x 365). Essentially this involves deflating our estimates of remuneration per day worked by 250/365. In terms of Allen baskets this provides an estimate of the extent to which a child’s annual remuneration covered his/her annual cost of living analogous to the computations of adult welfare ratios (see Humphries and Weisdorf, 2015, p.406)

Figure 3. Children’s standard of living: subsistence diet and welfare ratios

(real remuneration per day in year from 250 days’ work, measured relative to cost of half Allen basket or price of 1500 kcal from wheat.)

(Decade averages from observations on individual children, without adjustment for sample composition)

Perhaps not surprisingly, given the importance of wheat prices to the cost of the Allen basket, the alternative deflators yield very similar results in terms of trends in children’s welfare and subsistence ratios. Both show clear gains in the ‘golden age’ following the Black Death and through the late 1400s and early 1500s, but then decline back to pre-plague levels. For long centuries thereafter children struggled to earn much above the cost of half an Allen basket or a basic subsistence wheat diet. The prosperous times of the mid-1700s offered some relief but the industrious revolution apparently did not match the high demands for children’s labour with consequent high wages. Indeed, early industrialisation appears consistent with ‘the exploitation of little children’ observed by the Hammonds. Improvement appears to have had to wait until the middle of the nineteenth century and was then hesitant at best.

Figure 4 recalibrates the child’s welfare ratio by dividing by a whole (not a half) Allen basket to facilitate comparison with the evolution of welfare ratios computed for male farm workers (Clark 2007) using analogous methods. Again we should bear in mind that these are just decade averages based on the raw data, without any adjustment for the inherent heterogeneity. In both cases nominal rewards to work per day are multiplied by 250 to obtain annual remuneration then divided by the annual cost of an adult’s Allen basket. The welfare ratio shows the standard of living as measured by an Allen basket for any representative day in the year.

Figure 4. Standard of living: Child and adult male farm labourers’ welfare ratios (both measure relative to whole Allen basket)

The evolution of children’s real wages appears to be in tune with findings for adult workers offering further support for our evidence and approach. The next step is to explain child wages in terms of various explanatory variables and identify changes over time while controlling for shifts in sample composition.

IV

Regression analysis of children’s remuneration

The regression analysis utilises all observations where there is remuneration data, this includes wage assessments and repeat observations.

Variables are created to reflect the approximate age of the child and dummy variables reflecting occupation (agriculture, construction, cottage industry, manufacturing, services, distribution and other occupation ( combining mining, army/navy, unknown); remuneration in kind (board, lodging, clothing); payment period (annual, weekly, task); region (south east, south west, north west, other region (combining north east, Scotland, Wales); source of data (make work scheme, census of poor, spinning wages); where there is more than one observation of the same person across years; where the child works and/ or is paid with a parent or other adult; a dummy variable where it is possible that the person is an adult; and a dummy variable for female. The regional, gender and board dummies are also interacted with time given the suggestions in the literature that regional, gender and contract type pay differential were not constant.[[15]](#footnote-15)

The key variable of interest is how real remuneration changes over time. To capture the changes, dummy variables for each decade are included with 1800-09 as base. [[16]](#footnote-16) These variables are regressed against real rewards per day of work based on both the price of 1500kcal of wheat and the Allen basket.

*Regression results*

Table 5 below shows the results of regressing these measures of real wages on a number of conditioning variables.

Table 5. Determinants of children’s real wages, real rewards to work per day worked, 1280-1860

|  |  |  |
| --- | --- | --- |
|  | Real remuneration  (price 1500kcal wheat) | Real reward to day of work  (Allen’s respectability basket (whole)) |
| Constant | -0.724  (0.158)\*\* | -0.285  (0.102)\*\* |
| Age approx. | 0.194  (0.010)\*\* | 0.124  (0.006)\*\* |
| Possibly adult | 0.850  (0.113)\*\* | 0.497  (0.073)\*\* |
| Construction | 1.616  (0.96)\*\* | 1.072  (0.062)\*\* |
| Cottage industry | -0.016  (0.097) | -0.014  (0.063) |
| Manufacturing | 0.498  (0.104)\*\* | 0.306  (0.067)\*\* |
| Service | 0.280  (0.088)\*\* | 0.253  (0.057)\*\* |
| Distribution | 0.817  (0.137)\*\* | 0.602  (0.088)\*\* |
| Other occupation | 0.159  (0.102) | 0.173  (0.066)\*\* |
| Haymaking | 0.527  (0.143)\*\* | 0.410  (0.092)\*\* |
| Female dummy | -0.264  (0.185) | -0.178  (0.119) |
| Female\*time | -0.024  (0.010)\* | -0.017  (0.007)\* |
| Female\*time2 | 0.000  (0.000)\*\* | 0.0004  (0.000)\*\* |
| Board dummy | -0.285  (0.232) | -0.780  (0.149)\*\* |
| Lodging dummy | 0.346  (0.221) | 0.460  (0.143)\*\* |
| Clothing dummy | 0.113  (0.136) | -0.066  (0.088) |
| Board\*time | 0.027  (0.006)\*\* | 0.025  (0.004)\*\* |
| Lodging\*time | -0.021  (0.005)\*\* | -0.020  (0.004)\*\* |
| Pay annual | -1.639  (0.190)\*\* | -0.819  (0.122)\*\* |
| Pay annual\*time | 0.027  (0.005)\*\* | 0.012  (0.003)\*\* |
| Pay weekly | 0.241  (0.074)\*\* | 0.151  (0.048)\*\* |
| Pay for task | -0.860  (0.145)\*\* | -0.475  (0.093)\*\* |
| Identified as working 30 days or more | -0.516  (0.075)\*\* | -0.342  (0.049)\*\* |
| Census of poor | -0.643  (0.107)\*\* | -0.417  (0.069)\*\* |
| Make work scheme | -1.296  (0.145)\*\* | -0.801  (0.093)\*\* |
| Data from spinning wages | -0.380  (0.133)\*\* | -0.273  (0.085)\*\* |
| Region South West | -1.061  (0.207)\*\* | -0.704  (0.133)\*\* |
| Region South West\*time | 0.021  (0.004)\*\* | 0.014  (0.003)\*\* |
| Region North West | -1.914  (0.438)\*\* | -1.419  (0.282)\*\* |
| Region North West\*time | 0.045  (0.009)\*\* | 0.033  (0.005)\*\* |
| Region Other | -0.107  (0.082) | -0.068  (0.053) |
| Repeat observation | 0.322  (0.065)\*\* | 0.216  (0.042)\*\* |
| Paid with father | -0.523  (0.139)\*\* | -0.295  (0.089)\*\* |
| Works with father/mother | 0.279  (0.113)\* | 0.204  (0.073)\*\* |
| Works with an adult | 0.179  (0.082)\* | 0.171  (0.053)\*\* |
| 1280 | 0.755  (0.266)\*\* | 0.311  (0.171) |
| 1290 | 0.850  (0.260)\*\* | 0.415  (0.167)\* |
| 1300 | 1.646  (0.190)\*\* | 0.780  (0.123)\*\* |
| 1310 | 1.028  (0.344)\*\* | 0.680  (0.221)\*\* |
| 1320 | 1.234  (0.260)\*\* | 0.387  (0.167)\* |
| 1330 | 2.276  (0.277)\*\* | 0.875  (0.178)\*\* |
| 1340 | 2.057  (0.297)\*\* | 0.558  (0.191)\*\* |
| 1350 | 1.976  (0.258)\*\* | 1.027  (0.166)\*\* |
| 1360 | 1.932  (0.346)\*\* | 0.796  (0.223)\*\* |
| 1370 | 2.770  (0.459)\*\* | 0.679  (0.296)\* |
| 1380 | 2.796  (0.415)\*\* | 0.908  (0.267)\*\* |
| 1390 | 4.010  (0.477)\*\* | 1.421  (0.307)\*\* |
| 1400 | 3.087  (0.242)\*\* | 1.481  (0.156)\*\* |
| 1410 | 3.153  (0.299)\*\* | 1.318  (0.192)\*\* |
| 1420 | 5.856  (0.431)\*\* | 2.425  (0.277)\*\* |
| 1430 | 2.821  (0.317)\*\* | 1.400  (0.204)\*\* |
| 1440 | 5.748  (0.577)\*\* | 3.148  (0.372)\*\* |
| 1450 | 2.581  (0.898)\*\* | 1.067  (0.578) |
| 1460 | 5.627  (0.354)\*\* | 2.412  (0.228)\*\* |
| 1470 | 4.096  (0.738)\*\* | 2.065  (0.475)\*\* |
| 1480 | 3.519  (0.526)\*\* | 1.689  (0.338)\*\* |
| 1490 | 4.565  (0.458)\*\* | 1.981  (0.295)\*\* |
| 1500 | 4.503  (0.368)\*\* | 2.488  (0.237)\*\* |
| 1510 | 3.424  (0.291)\*\* | 1.591  (0.187)\*\* |
| 1520 | 1.999  (0.360)\*\* | 1.073  (0.232)\*\* |
| 1530 | 3.225  (0.273)\*\* | 1.712  (0.176)\*\* |
| 1540 | 1.242  (0.347)\*\* | 0.291  (0.224) |
| 1550 | 2.725  (0.382)\*\* | 2.069  (0.246)\*\* |
| 1560 | 1.932  (0.314)\*\* | 1.497  (0.202)\*\* |
| 1570 | 0.880  (0.257)\*\* | 1.280  (0.166)\*\* |
| 1580 | 0.294  (0.228) | 0.333  (0.147)\* |
| 1590 | 0.246  (0.199) | 0.110  (0.128) |
| 1600 | 1.463  (0.354)\*\* | 0.991  (0.228)\*\* |
| 1610 | 0.802  (0.193)\*\* | 0.440  (0.124)\*\* |
| 1620 | 0.850  (0.158)\*\* | 0.398  (0.102)\*\* |
| 1630 | 0.518  (0.160)\*\* | 0.302  (0.103)\*\* |
| 1640 | 0.791  (0.263)\*\* | 0.429  (0.170)\* |
| 1650 | 0.699  (0.263)\*\* | 0.451  (0.169)\*\* |
| 1660 | 0.928  (0.228)\*\* | 0.702  (0.147)\*\* |
| 1670 | -0.187  (0.223) | -0.280  (0.143)\* |
| 1680 | 0.674  (0.271)\* | 0.207  (0.175) |
| 1690 | 0.535  (0.194)\*\* | 0.236  (0.125) |
| 1700 | 0.255  (0.241) | 0.050  (0.155) |
| 1710 | 1.780  (0.321)\*\* | 1.006  (0.207)\*\* |
| 1720 | 1.637  (0.213)\*\* | 0.902  (0.137)\*\* |
| 1730 | 1.270  (0.184)\*\* | 0.569  (0.118)\*\* |
| 1740 | 3.038  (0.180)\*\* | 1.499  (0.116)\*\* |
| 1750 | 0.737  (0.194)\*\* | 0.275  (0.125)\* |
| 1760 | 0.909  (0.174)\*\* | 0.376  (0.112)\*\* |
| 1770 | 0.518  (0.170)\*\* | 0.192  (0.110) |
| 1780 | 0.249  (0.143) | 0.138  (0.092) |
| 1790 | 0.233  (0.131) | 0.113  (0.084) |
| 1810 | 0.268  (0.147) | 0.271  (0.095)\*\* |
| 1820 | 0.647  (0.175)\*\* | 0.346  (0.113)\*\* |
| 1830 | 0.401  (0.125)\*\* | 0.089  (0.080) |
| 1840 | 0.557  (0.149)\*\* | 0.101  (0.096) |
| 1850 | 1.738  (0.219)\*\* | 0.768  (0.141)\*\* |
| 1860 | 1.251  (0.379)\*\* | 0.064  (0.244) |
|  |  |  |
| Adjusted R squared | 0.567 | 0.531 |
| F-statistic | 56.032\*\* | 48.694\*\* |
| Sample size | 3873 | 3873 |
|  |  |  |
| \*sig. ≤ .05  \*\*sig. ≤ .01 |  |  |

Omitted categories: male, agriculture, south east, 1800-09

Standard errors in parentheses

|  |
| --- |
|  |

The model performs well particularly considering the difficult nature of the empirical evidence: over half the variation in child wages is explained and nearly all the explanatory variables are statistically significant at the 1 per cent level. The valuation of perquisites and cost of living by the Allen basket and the wheat price methodologies yield very similar results, a correspondence that justifies our focus hereon in on the basket methodology.

The signs and relative magnitudes of the coefficients are as would be predicted *a priori*. Children’s wages are positively related to their age, and to the possibility that they were actually adult. Their wages varied according to the sector in which they worked. Construction paid best while manufacturing, services, and distribution also paid better than agriculture (the omitted variable). There was no significant difference between agricultural wages and wages in cottage industry or in the rag-bag ‘other’ occupational category as might be expected given the co-location of employment opportunities in rural areas. Haymaking and harvest paid a premium for children as well as adults. Sector pay differentials remained roughly constant suggesting as far as children were concerned either that these were equilibrium phenomenon compensated by other considerations such as the regularity of employment or that movements out of agriculture into construction and trades lagged behind structural change (Williamson, 1985). Although their relative remuneration is less clearly defined, it looks like girls were paid less than boys, *ceteris paribu*s, and the juvenile gender pay gap worsened over time though at a decreasing rate.[[17]](#footnote-17) This gender gap was probably exacerbated by the distinctive occupational distributions of boys and girls discussed above (see tables 1a and b).

While there was not always an independent effect on total rewards of receiving board *per se*, suggesting that this has been reasonably valued in the wheat price variant, a ‘with maintenance’ contract did have an increasingly positive effect on remuneration over time. The provision of plentiful food may well have been an increasingly efficient employment strategy or been increasingly needed to entice people into annual contracts. The receipt of lodging similarly had no significant effect on remuneration but over time offset wage growth suggesting that our imputation algorithm undervalued shelter later in the period. There was no independent effect of receiving clothing for these children. These results have to be interpreted alongside the large negative and significant effect of being on an annual or long term contract, as yearly service and board and lodging are co-related. Children, like women, paid a price for traditional service contracts, though, as the interaction of the annual and decade dummies shows, this decreased over time, confirming the trends observed in nominal terms in figure 2. The combined effects of these variables for in kind payments and long term contracts show significant disadvantage that was gradually eroded by the 1750s. Apparently, children shared the disamenities of annual service that have been documented for adults (lower pay, less freedom and reduced autonomy), hence the well-documented resistance to such work, particularly in the medieval period (see, Humphries and Weisdorf, 2015, and literature cited therein). Alternatively, of course, it could be that day wages paid a premium to workers who shouldered employment insecurity (Hatcher, 2011). The discount associated with annual service faded over time as reflected in the positive and significant trend consistent with suggestions that it was particularly burdensome in the medieval period. Convergence in remuneration in the two sectors of the juvenile labour market testifies to the fading ability of wage assessments to regulate remuneration even in annual service as well as perhaps to the reluctance of young workers to prioritise security when the poor law had come to provide a barrier to actual starvation.

Wages recorded in censuses of the poor or paid in make work schemes were relatively low reflecting the subsidiary tiers within the juvenile labour market. Children whose parents or guardians were unable or unwilling to identify and help secure a decent entry-level job were at a disadvantage, drafted into marginal and poorly paid work by the poor law authorities. Wages from spinning were also relatively poor, perhaps reflecting shorter working time, a gender penalty or simply overcrowding in this segment of the market (Sharpe, 1996; Valenze, 1995, Humphries and Schneider, 2017).

The regional dummies confirm the initial prosperity of the South, particularly the South East (and London), the persistent disadvantage of Wales and other peripheral regions, the growing buoyancy of the North West and some turnaround in fortunes of the South West, all of which is consistent with historians’ accounts of regional development (Jones, 2010). Repeated observations were associated with higher remuneration presumably because the child acquired skills, and seniority in the workplace as well as growing older. Working alongside a parent or another adult had a positive influence on children’s pay, maybe reflecting productivity-enhancing supervision along with on-the-job training and perhaps a more skilled occupation within a sector. However, some of these benefits to pay were offset where the adult and child received joint payment. Perhaps we have been ungenerous towards juveniles when sharing up collective remuneration or perhaps only younger and less productive children were paid within a family pay package.

The dummy variables for each decade capture the position of a boy on day pay working in agriculture in the south east of the country. Figure 5 plots the decade coefficients from the Allen basket regression over time (blue line) and shows the rise in remuneration in the late medieval period and the fall through Tudor times. It hints at a short-lived improvement in the first half of the eighteenth century but generally there were low levels of pay from the early C17th through industrialisation. Clearly though the regression analysis suffers from the use of decade averages for the cost-of-living variable and does not remove all the heterogeneity present in the original data. Although 45 out of the 58 decade coefficients are significantly different from zero, that is relative to the omitted decade 1800-09, further work is required to capture the trend. STAMP (Structural Times Series Analyser, Modeller and Predictor)[[18]](#footnote-18) uses state space methods and Kalman filtering to decompose time series data into trend, cycle and irregular components. The trend is now clearly discernible (red line, Figure 5) and significantly different from zero (see the confidence intervals at +/- 2 s.e.) for most of the period under study.[[19]](#footnote-19) Our observation of a trend rise in the medieval period followed by much reduced circumstances, punctuated only briefly during the ‘industrious revolution’ remains robust.

Figure 5. Real reward to a day of work: decade coefficients from regression with estimated trend and confidence intervals, 250 days worked per year.

Figure 6 computes trends using the same STAMP methodology on the regression coefficients to trace the baseline real remuneration for a day of work evaluated for 14 year-old boys working in different economic sectors and inhabiting different regions of the country. It is clear that a representative farm boy working in the South East shared in the golden age of high wages that followed the Black Death, the long-term slide from around 1470 and the subsequent plateau that industrialisation did little to alleviate.

Figure 6. Trend values of real reward to a day of work, boy age 14. (measured relative to the whole Allen basket).

For long periods of time our child agricultural day labourer could purchase an Allen basket or even two, especially if he was able to work for a month in the harvest season. In the golden age he was able to purchase a much expanded standard of living. But this is, of course, assuming that he enjoyed the day rates with regularity, that is was sure of employment for at least the 250 days presupposed, something that medievalists have doubted (Hatcher, 2011). The experience of boys in other occupational groups is also depicted in figure 6 to provide a comparative perspective, and shows that some fared even better than our agricultural worker, though again security of day labour would be an issue. The figure highlights various permanent premia such as those enjoyed by adolescents in construction, alongside the shifting relative standing of children in other groups such as boys in manufacturing in the initially poor but later emerging North West. Unsurprisingly, those in the industrial sector were the ones who gained with industrialisation. On the other hand, as the regression coefficients suggest, girls, children in annual service, impoverished children employed through the poor law and those living in the peripheral regions of the north, in Scotland or in Wales fared much worse. They were regularly unable to support themselves even at the subsistence level. Even if resident in a prosperous part of the country, a boy in annual service struggled to earn the subsistence diet in the early decades though his relative terms and conditions improved in the eighteenth century.

V

Varying the length of working year assumption

Many of the observations we have made about children’s rewards to a day of work and their related living standards are crucially dependent on the number of days they are assumed to have worked in a year. So far we have used the standard assumption of 250 days throughout, but evidence on and estimates of adults’ annual days of work over the years 1270-1860 can be used to re-evaluate the rewards to children’s work if we continue with the assumption that they worked the same number of days as adults. [[20]](#footnote-20) Figure 7 illustrates the estimates of working days in the year for unskilled males from some of the available sources and shows our chosen estimate of working days for children.[[21]](#footnote-21) These range from 200 days in the quarter century 1251-75 to a low of 130 in 1326-50, rising to around 250 in the seventeenth century and then peaking at 320 in the first half of the nineteenth century.

Figure 7. Estimates of length of working year, various sources, and scenario selected for children.

Notes: Voth from Allen and Weisdorf (2011), B = Blanchard from Allen and Weisdorf (2011), C vd W = Clark and van der Werf (1998), A&W = Allen and Weisdorf (2011), solid black line H&W = Humphries and Weisdorf (2018)

Recalculating the rewards to a day of work and the standard of living variables to reflect this variable working year for the Allen basket variant and repeating our regression analysis reinforces many of the earlier observations (see appendix C). The resulting decade coefficients are again used to identify the trends and these are shown graphically in figure 8 below.

Figure 8.

Trends in remuneration per day worked and standard of living per day in the year for boy aged 14 working in agriculture in the south east (measured in whole Allen baskets)

Maybe unsurprisingly, the trajectory of the real reward to a day of work over time is relatively little affected by the assumption about the number of days worked. For casual workers, the majority of our sample, a day wage, paid daily, would be unaffected by a change in the length of the working year and any perquisites received were typically only given on working days. The effect of assuming a variable working year is largely seen at the beginning of our period when we observe proportionately more workers on annual contracts. Predictably these workers received higher rewards per day worked when fewer days were actually worked. Importantly, our key observations of higher levels of pay for children in the Golden Age and, to a much lesser extent, in the industrious revolution, are still apparent. Further subdivision, not illustrated here, shows the lower remuneration of annual workers when compared with casual workers is also maintained, although the magnitude of the difference is obviously reduced. The gap between annual and casual pay diminishes from 1580 and workers on the two types of contract are remunerated similarly by mid-eighteenth century. Our earlier story remains robust to significant change in the assumption about the length of the working year.

Conversely the effect of a variable length of working year assumption on children’s standard of living is more dramatic. While improvements remain evident and largely persistent from the post-plague years until the late-sixteenth century these improvements are of smaller magnitude than observed previously and, subsequently, children’s material welfare from working bumps along at a steady ‘respectable’ level until given a small boost by the industrious revolution in the early modern period. But these gains soon dissipate with Allen’s ‘Engels’ pause’ in living conditions over early industrialisation being clearly evident. Here annual workers’ standard of living per day in the year is unaffected by the actual number of days worked, pay is annual and perquisites are received every day regardless. But casual workers had a considerably lower standard of living from their work than previously estimated up until 1620 as they could find fewer than the earlier assumed 250 days of work per year. It is changes to the total earnings in a year for this group that drives the overall picture.

Figure 8 reveals the standard of living measured by the welfare ratio, the number of Allen baskets available to a representative child on any day in the year, over time. Taking the more conservative estimate based on a variable number of days worked in the year over time and utilising the 2500 kcal nutrition afforded by the respectability basket shows that boys’ remuneration in agriculture was generally able to supply the 2775 kcal per day for a boy of 13-14 years old doing moderate physical activity as recommended by FAO (table 6). The years preceding and around the Black Death supplied less, but from the 1380s onwards our data suggest a quite significant shift in children’s remuneration which would have enabled then to eat better, much better, than previously. One of the metanarratives for Britain’s early precocious growth has emphasised the gains to human capital, both physical and cognitive, afforded by an adequate and protein-rich diet. The greater productivity and enhanced skills thus engendered fostered future economic growth (Kelly, O’Grada and Mokyr 2013). The lack of labour and surplus land occasioned by the plague led to animal-intensive agriculture that not only provided this nutritious diet, but also required skills for the processing of related products: milk, cheese, leather, soap, candles, wool and clothing: and made technical demands on the industries supplying other required inputs, such as tools and machinery (Broadberry et al 2015). Indeed, we should note that children alone could gain in physical stature from these nutritionally propitious times; they were still in their phases of growth and development. Furthermore, under the assumptions used here, they were working fewer days to achieve these better conditions, so their welfare was improved on a number of fronts.

Table 6. Standard of living for a working child over the year, based on the variable working year assumption.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1280-1389 | 1390-1589 | 1590-1699 | 1700-1789 | 1790-1869 |
| Whole Allen baskets purchased per day in year | 0.932 | 1.486 | 1.212 | 1.483 | 1.307 |
| Calories afforded per day  (Kcal) | 2330 | 3715 | 3030 | 3708 | 3268 |

Notes: The number of Allen baskets that can be purchased per day are based on the coefficients from the regression of standard of living with a variable length of working year. They are calculated for a boy, aged 14, employed in south east agriculture, with no perquisites. The decade coefficients are averaged over the relevant time period [[22]](#footnote-22)

Of course children could have seen benefits from the higher adult wages these conditions also fostered without themselves having to work. But without doubt, those children who worked shared in the ‘golden age’ for labour heralded by the horrors of the Black Death. All agree that labour shortage enabled the peasantry to bargain for better remuneration, even if official edicts, such as the Statute of Labourers 1351, expressly forbade it. Children, or parents on their behalf, bargained hard too. Of course, we only view wages, not participation, and the effect of a reduction in the latter would also be visible on remuneration. But it seems improbable in a period when England was so underpopulated, in an environment where many children were orphaned and all adults, both male and female, as demanded by the Statute of Labourers, were required to work, that children were withholding their labour.

The Tudor period saw a steady decline in the fortunes of working children. Adult casual workers too saw a reduction in the remuneration they could expect from their labour, but children, as maybe the group most on the margins of the labour market, suffered disproportionately (see figure 2).[[23]](#footnote-23) Indeed, by the end of this period, children were sometimes only just able to meet their basic subsistence needs through working, a situation that, with a brief exception, pertained through to the nineteenth century. The exception is the period from the late seventeenth through to the prosperous mid-eighteenth century. While the heady heights of remuneration in late medieval times were not quite recouped, there is evidence that children shared briefly in the High Wage Economy. However, children’s remuneration was progressively lagging behind that of adult male workers and, ironically perhaps, their substitution for more expensive adults was one channel whereby employers sought to restrain labour costs (Humphries, 2013; Allen, 2014), a channel made more accessible by a phase of child-intensive technological change (Humphries, 2016). But this involvement was to be short lived. As industrialisation gathered momentum it appears to have eroded these opportunities. Continued mechanisation saved even children’s labour while the growth of some industries (metals and mining) involved labour beyond children’s physical competence. Children’s remuneration remained static, at best, and their participation began to decline (Horrell and Humphries 1995), while improvements in men’s wages gathered pace (Feinstein 1998). Labour market premia for skills and strength increased, the situation of those with poor bargaining positions weakened, while the opportunity cost of schooling lessened and the gains to be had from education improved. A shift in the composition of the labour force was underway.

Conclusions

Our data-based window on child labour in history suggests three important findings. First, the sheer scale of material uncovered argues that children were common in Britain’s historical labour markets, for while they were undoubtedly less important than adults and so more likely to be overlooked in written records and formal accounts, nonetheless they feature regularly and commonly. Moreover, their pay, as we have shown, was not haphazard but systematically related to individual characteristics and local conditions. They were integrated into a market and paid according to features that reflected perceived productivity. Their contribution, and the extent to which it varied over time and space, must then be integrated into any account of labour inputs, productivity and evolving occupational structure.

A second important finding concerns the ways in which the evolution of children’s pay runs alongside secular trends in the wages of adult men and adult women. The repetition of patterns in the early centuries that are now familiar from research on male and female wages serves to both support our own approach and evidence and confirm trends already uncovered for adults: the significant and sustained boom in wages that followed the Black Death and the slow decline from these halcyon days which plateaued through the industrial era. Many of these findings depend on the assumption of an unchanging working year of 250 days. Our evidence makes clear that once we integrate a changing work year into the analysis, based on conjectures that are supported historically, findings change. If working time varied, as has recently been posited, from very low levels in the medieval period to an industrious crescendo in the seventeenth and eighteenth centuries, then children’s labour incomes could have grown probably in line with GDP per capita (Broadberry et al, 2015). Nor is our evidence only confirmatory of overall trends in adult wages. It also illustrates the gap between day rates and annual remuneration recently uncovered for adult workers of both genders, a divergence which, while providing interesting insight into the workings of historical labour markets, calls for further investigation as to its causes. Moreover, comparison of day rates and annual earnings, including the imputation of values for perquisites, might provide the key to unlocking estimates of the length of the working year as Humphries and Weisdorf (2018) have recently argued. Our demonstration that alternative imputation strategies generate similar findings provides reassurance that our results are not the construct of a particular approach. However, children’s remuneration diverged from that of adult males during early industrialisation probably as a result of shifts in both the demand for skills and the supply of child workers.

Finally, the findings should not be read through rose-tinted spectacles. Although there is scope in the historical record for children to have been self-supporting, and to have contributed to family incomes, indeed to have helped to improve family incomes, absent an increase in labour inputs this is no Whig history. Some children, as evidenced by the pay penalties for gender, annual service, employment mediated by the poor law, or simply location, did much less well. Further exploration of this patchwork of possibilities and the extraction, if not of a representative account of children’s contributions to their families of origin, then a series of stylized accounts of children in different circumstances, remains a task for the future.

Bibliography

Allen, R.C. (2007) ‘Engels’ Pause: A Pessimist’s Guide to the Industrial Revolution’, Working Paper 314, Department of Economics, Oxford.

Allen, R.C. (2009) *The British Industrial Revolution in Global Perspective*, CUP, Cambridge.

Allen, R. C. (2011) *Global Economic History: a very short introduction*, Oxford University Press

Allen, R. C. (2014) ‘The high wage economy and the industrial revolution: a restatement’, *Economic History Review*, 68, pp.1-22

Allen, R.C. and Weisdorf, Jacob (2011) ‘Was there an ‘Industrious Revolution’ before the Industrial Revolution? An Empirical Exercise for England, c. 1300-1830’, *Economic History Review*, 64, pp. 715-29.

Angeles, L. (2008) ‘GDP per capita or real wages? Making sense of conflicting views on pre-industrial Europe’, *Explorations in Economic History,* 65, pp.147-63

Basu, K. and Van, P. H. (1998), ‘The economics of child labor’, *American Economic Review*, 88, pp.412-27

Baxter, Jack, ed. (1985) ‘Settlement Examinations. 1720-1844. Rawreth & Rayleigh, Essex’, *Essex Society for Family History*, Benfleet.

Berg, M (1985) The *Age of Manufactures: Industry, innovation and work in Britain, 1700-1820*, Oxford

Boter, Corinne (2018) ‘Household Income Composition and Living Standards in the Netherlands, ca. 1910: Building upon Robert Allen’s Welfare Ration method’, paper presented at the XVIII World Economic History Conference, Boston.

Broadberry, Stephen, Campbell, Bruce M.S., Klein Alexander, Overton, Mark and van Leeuwen, Bas (2015) *British Economic Growth*, CUP, Cambridge.

Claridge, Jordan and Langdon, John (2017) ‘The Composition of Famuli Labour on English Demesnes c.1300’, *Agricultural History Review*, 63, pp.187-220.

Clark, Greg, (2007) ‘The Long March of History: Farm Wages, Population and Economic Growth, England, 1209-1869’, *Economic History Review*, 60, pp. 97-136.

Clark G. and Y. van der Werf (1998), ‘Work in progress? The industrious revolution’, *Journal of Economic History*, 58, pp. 830-43

De Moor, Tine, and van Zanden, Jan Luiten (2010) ‘Girl Power: The European marriage Pattern and Labour Markets in the North Sea Region in the Late Medieval and Early Modern Period,’ *Economic History Review*, 63, pp. 1-33.

De Vries, Jan (2008) *The Industrious Revolution: consumer behaviour and the household economy, 1650 to the present*, Cambridge University Press

Diebolt, Claude, and Perrin, Faustine, eds. (2017) *Handbook of Cliometrics,* Springer Reference.

Döepke, M. and Tertilt, M. (2009) ’Women’s Liberation: What’s in it for Men?,’ *Quarterly Journal of Economics*, 124 (4), pp.1541-1591.

Doepke, M. and Zilliboti (2019) *Love, money and parenting: how economics explains the way we raise our kids*, Princeton University Press (forthcoming)

Dymond, David, ed. (2004) ‘The Churchwarden’s Book of Bassingbourn, Cambridgeshire, 1496-1540’, *Cambridgeshire Record Society*, 1 .

Feinstein, C. E. (1998) ‘Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution’, *Journal of Economic History*, 58, pp. 625-58.

Galor, O. and Weil, O. (1996) ‘The Gender Gap, Fertility and Growth’, *American Economic Review*, 86, pp. 374-387.

Hanham, Alison, ed. (1970) *Churchwarden’s accounts of Ashburton 1479-1580*. Devon and Cornwall Record Society, new series 15.

Harvey, A. C. (1989) *Forecasting structural time series models and the Kalman filter*, Cambridge University Press

Hatcher, John (2011) ‘Unreal Wages: Long-Run Living Standards and the ‘Golden Age’ of the Fifteenth Century’ in *Commercial Activity, Markets and Entrepreneurs in the Middle Ages*, edited by Ben Dodds and Christian D. Liddy, Boydell, Woodbridge.

Hembry, Phyllis, ed. (199 0) ‘Calendar of Bradford-on-Avon Settlement Examinations and Removal Orders, 1725-98’, *Wiltshire Record Society*, XLVI.

Heywood, Colin (2001) *A History of Childhood: Children and Childhood in the West from Medieval to Modern Times*, Polity, Cambridge.

Heywood, Colin (2018) *Childhood in modern Europe*, Cambridge University Press

Hitchcock, Timothy V. (1987) Richard Hutton’s Complaints book. The notebook of the Steward of the Quaker Workhouse at Clerkenwell 1711-37. London Record Society Publications, vol. XXIV (126)

Honeyman, Katrina (2007) *Child Workers in England, 1780-1820: Parish Apprentices and the Making of the Early Industrial Labour Force*, Ashgate, Aldershot.

Horrell, Sara and Humphries, Jane (1995) ‘”The Exploitation of Little Children”: Children’s Work and the Family Economy in the British Industrial Revolution’, *Explorations in Economic History*, 32, pp. 485–516.

Humphries, Jane (2010) *Childhood and Child Labour in the British Industrial Revolution*, CUP, Cambridge.

Humphries, Jane (2013a) ‘Child labour and the British industrial revolution’, *Economic History Review*, 66, pp. 395-418

Humphries, Jane (2013b) ‘The lure of aggregates and the pitfalls of the patriarchal perspective: A critique of the high wage economy interpretation of the British industrial revolution,’ *Economic History Review*, 66, pp. 693–714.

Humphries, Jane (2016) ‘Rent seeking or skill creating? Apprenticeship in early industrial Britain’, in Perry Gauci ed. *Regulating the British Economy, 16060-1850*, pp.235-58, Routledge, Farnham

Humphries, Jane and Schneider, Benjamin (2018) ‘Spinning the Industrial Revolution’, *Economic History Review*, forthcoming.

Humphries, Jane,and Weisdorf, Jacob (2015) ‘The Wages of Women in England, 1260-1850’, *Journal of Economic History*, 75, pp. 405-445.

Humphries, Jane and Weisdorf, Jacob (2018) ‘Unreal Wages? Real Income and Economic Growth in England, 1260-1850’, *Economic Journal* (forthcoming)

Hutchins, J. (1796) *The History and the Antiquities of the County of Dorset*, 2nd edition. Transcribed by Kim Parker <http://www.opcdorset.org/CorfecastleFiles/CorfeCastleCensus1790html>

Iyigun, M.F. and Walsh, R.P. (2007) ‘Endogenous Gender Power, household Labour Supply and the Demographic Transition’, Journal of Development Economics, 82, pp. 138-155.

Jackson, Christine (2004) ‘Newbury Kendrick Workhouse Records’, *Berkshire Record Society*, 8.

Jones, E.L. (2010) *Locating the Industrial Revolution. Inducement and Response*, World Scientific, Singapore.

Kelly, M., C. O’Grada and J. Mokyr (2013) ‘Precocious Albion: a new interpretation of the British Industrial Revolution’, working paper, University College Dublin, UCD WP13/11

Kirby, Peter (2003) *Child Labour in Britain, 1750-1870*, Palgrave, London.

Koopman, S. J., A. C. Harvey, J. A. Doornik and N. Shepherd (2009) *STAMP 8.2: Structural Time Series Analysis Modellerand Predictor*, Timberlake Consultants Ltd, London

Langdon, John (2011) ‘Minimum Wages and Unemployment Rates in Medieval England: The Case of Old Woodstock, Oxfordshire, 1256-1357’ in *Commercial Activity, Markets and Entrepreneurs in the Middle Ages*, edited by Ben Dodds and Christian D. Liddy, Boydell, Woodbridge.

Largerlöf, N.P. (2003) ‘Gender Equality and Long-run Growth’, *Journal of Economic Growth*, 8, pp. 404-426.

Lavalette, Michael ed. (1999) *A Thing of the Past? Child labour in Britain in the nineteenth and twentieth centuries*, Liverpool University Press.

Leiten, Kristoffel and Elise van Nederveen Meerkerk eds (2011) *Child labour’s global past, 1650-2000*, Peter Lang, Bern

Mitchell, B.R. (1988) *Abstract of British Historical Statistics*, CUP, Cambridge.

Pound, J. F. (1962) “An Elizabethan census of the Poor”, *University of Birmingham Historical Journal*, vol III, no. 2 pp.135-61. Also Census of the Poor Norwich 1570-1580 [www.welbank.net/norwich/1570/1570data.html](http://www.welbank.net/norwich/1570/1570data.html)

Pratt, Malcolm, ed. (2011) ‘Winchelsea Poor Law Records’, *Sussex Record Society*, 94.

Rahikainen, Marjatta (2004) *Centuries of Child Labour. European Experiences from the Seventeenth to the Twentieth Century*, Ashgate, Aldershot.

Rogers, J.E.T. (1866, 1886, 1887) *A History of Agriculture and Prices in England*, Clarendon, Oxford.

Sarasua, Carmen (2018) ‘Women’s work and structural change. Occupational structure in 18th century Spain’, *Economic History Review*, forthcoming.

Shammas, Carole (1990) *The Preindustrial Consumer*, Oxford University Press, Oxford.

Sharpe, Pamela (1996) *Adapting to capitalism: working women in the English economy 1700-1850*, Basingstoke

Slack, Paul (1975) ‘Poverty in Early Stuart Salisbury’, *Wiltshire Record Society*, XXXI.

Strulik, H. and Weisdorf, J. (2008) ‘Population, Food and Knowledge: A Simple Unified Growth Theory’, *Journal of Economic Growth*, 13, pp. 195-216.

Tuttle, Caroline (1999) *Hard at work in factories and mines: the economics of child labor during the British industrial revolution,* Boulder, Westview Press

Valenze, Deborah (1995) *The First Industrial Woman*, Oxford University Press

Voitländer, Nico and Voth, Hans-Joachim (2013) ‘How the West ‘Invented’ Fertility Restrictions’, *American Economic Review*, 103, pp. 2227-64.

Voth, Hans-Joachim (1998) ‘Time and work in eighteenth century London’, *Journal of Economic History*, 58, pp.29-58

Voth, Hans-Joachim (2001) ‘The longest years: new estimates of labour input in England, 1760-1830’, *Journal of Economic History*, 61, pp.1065-82

Webb, John ed. (1966) *Poor relief in Elizabethan Ipswich*, Ipswich, Suffolk Records Society. A census of the poor 1597, pp.119-141.

Williamson, Jeffrey, G. (1985) *Did British capitalism Breed Inequality*? Allen and Unwin,

Wray Vamplew, (1979) A Grain of Truth: the nineteenth-century corn averages, *Agricultural History Review*, pp.1-17.

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Appendix A

Table A1: *Proportion of child wage-earners in receipt of perquisites, by half century*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Half century** | **% board** | **% lodging** | **% clothing** | **Sample size** |
| 1250- | 56 | 29 | 4 | 73 |
| 1300- | 61 | 50 | 4 | 254 |
| 1350- | 33 | 25 | 19 | 88 |
| 1400- | 42 | 40 | 4 | 100 |
| 1450- | 30 | 12 | 6 | 33 |
| 1500- | 33 | 30 | 0 | 98 |
| 1550- | 13 | 10 | 9 | 172 |
| 1600- | 23 | 19 | 7 | 394 |
| 1650- | 43 | 38 | 5 | 203 |
| 1700- | 15 | 12 | 2 | 476 |
| 1750- | 16 | 12 | 2 | 769 |
| 1800- | 10 | 7 | 3 | 1151 |
| 1850- | 13 | 11 | 5 | 62 |

*Wage assessments as a check on sample estimates*

Table A.2 Estimated wages compared with wage assessments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Decade** | **Wage**  **(d. per day)**  **Dataset** | **Total remuneration**  **(d. per day)**  **Dataset\*** | **Sample**  **Dataset** | **Wage assessment**  **(details)** |
| 1430-9 | 0.96 | 1.19 | 18 | 1445, Norfolk agriculture  0.23d wage and board -> 0.64d |
| 1450-9 | 1.12 | 1.12 | 2 | As above |
| 1560-9 | 6.43 | 6.52 | 8 | Devon, construction 3d +board, 6 d without  Kent, unknown occupation, 0.77d no board, 1.32d when board included  Lincoln, trades, 0.37d+board -> 1.47d |
| 1580-9 | 2.76\* | 2.27 | 34 | Yorkshire, textiles 1.5-2d  Construction, Devon, 6d without board, 3d with board |
| 1616-19 | 2.40 | 2.78 | 53 | Norfolk, construction, 8-12d, no board |
| 1630-9 | 3.90 | 4.11 | 93 | Suffolk, construction, 6-8d, no board  Suffolk, agriculture, 1.03d-1.28d, no board |
| 1670-9 | 1.66 | 2.18 | 32 | Durham, service, 1.54d valued at 3.96d per day with board |
| 1680-9 | 3.17 | 3.88 | 6 | Yorkshire, textiles, 1.5d-2d  Bedfordshire, construction, 4-9d no board  Bucks, service, 0.77d-2.31d per day aged 14 or 18, with board and lodging -> 2.62d to 4.16d per day |
| 1690-9 | 3.19\* | 3.74 | 20 | Bucks, service, 1.03d-2.31d + board and lodging, aged 14 and 18, with board 3.38d-4.66d per day |
| 1750-9 | 4.35 | 4.42 | 40 | Dorset, agriculture, 1.92d+board -> 3.95d |
|  |  |  |  |  |

\*averaged across all boys with observations in decade. We have excluded those who may possibly be adult. The wage per day is assuming 250 days per year worked for annual workers. The total remuneration adds one half of the Allen basket where board is provided, if an annual worker, one quarter of the Allen basket if a casual worker. This is added to the daily wage, no allowance is made for board provided on non-working days, as used in our ‘rewards to a day of work’ comparison earlier, as this seems the more suitable comparator with wage assessments.

\* those who are paid a monetary wage only

APPENDIX Table A.3

*Values of children’s pay and remuneration by decade*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| decade | cash wage (d per day) | | Rewards per day worked (i.e. food for work and non-work days) | | Real rewards per day worked | |
|  | all children, with cash pay only | sample size | Allen basket (nominal) | wheat (nominal) | Allen basket and cost-of-living | wheat price and p1500kcal |
|  |  |  |  |  |  |  |
| 1280 | 0.7411 | 31 | 0.8701 | 0.9253 | 1.7402 | 2.7223 |
| 1290 | 0.7569 | 41 | 0.6753 | 0.8651 | 1.2508 | 2.3587 |
| 1300 | 0.4988 | 158 | 0.6349 | 0.8834 | 1.1337 | 2.3219 |
| 1310 | 0.8091 | 16 | 0.9566 | 0.9765 | 1.4068 | 2.1161 |
| 1320 | 1.0353 | 29 | 1.1185 | 1.1345 | 1.8336 | 3.2276 |
| 1330 | 1.0538 | 28 | 1.0713 | 1.1431 | 2.0603 | 3.9271 |
| 1340 | 1.2792 | 24 | 1.3852 | 1.4044 | 2.5652 | 5.0797 |
| 1350 | 1.5463 | 38 | 1.6374 | 1.6873 | 2.519 | 4.3133 |
| 1360 | 0.8093 | 20 | 1.0269 | 1.2908 | 1.4464 | 2.8527 |
| 1370 | 1.6852 | 9 | 1.6877 | 1.6852 | 2.6789 | 5.6173 |
| 1380 | 1.5273 | 11 | 1.5658 | 1.5671 | 2.6097 | 5.2238 |
| 1390 | 2.1146 | 8 | 2.114 | 2.1146 | 3.583 | 7.1143 |
| 1400 | 1.1533 | 47 | 1.3556 | 1.3947 | 2.1865 | 3.9581 |
| 1410 | 1.6636 | 22 | 1.8123 | 1.8379 | 2.8317 | 5.2952 |
| 1420 | 2.5556 | 9 | 2.5556 | 2.5588 | 4.122 | 8.1337 |
| 1430 | 1.1242 | 19 | 1.4424 | 1.5138 | 2.0904 | 3.762 |
| 1440 | 2.5153 | 5 | 2.6993 | 2.7552 | 4.2844 | 7.5501 |
| 1450 | 1.12 | 2 | 1.12 | 1.12 | 1.8065 | 3.1678 |
| 1460 | 2.7143 | 14 | 2.4615 | 2.7242 | 3.9707 | 7.8511 |
| 1470 | 2.336 | 3 | 1.8591 | 1.909 | 2.9985 | 5.6541 |
| 1480 | 2.025 | 6 | 2.2131 | 2.2494 | 3.353 | 5.9773 |
| 1490 | 2.024 | 8 | 2.1371 | 2.1496 | 3.4472 | 6.5577 |
| 1500 | 2.9231 | 13 | 2.9481 | 2.9537 | 4.5355 | 7.4214 |
| 1510 | 1.2645 | 27 | 1.6607 | 1.7163 | 2.4787 | 4.6312 |
| 1520 | 2.0213 | 14 | 2.1714 | 2.2276 | 3.0161 | 4.7296 |
| 1530 | 2.3012 | 27 | 2.4241 | 2.4793 | 3.2758 | 5.3504 |
| 1540 | 2.7059 | 17 | 2.7059 | 2.7059 | 2.8786 | 4.7993 |
| 1550 | 5.5692 | 12 | 5.5692 | 5.5692 | 4.1873 | 5.6201 |
| 1560 | 4.3032 | 19 | 4.5426 | 4.6808 | 3.1766 | 4.3236 |
| 1570 | 4.4273 | 30 | 3.9869 | 4.1045 | 2.5889 | 2.6325 |
| 1580 | 2.9388 | 42 | 2.5823 | 2.7761 | 1.5279 | 1.9449 |
| 1590 | 2.2454 | 69 | 2.3419 | 2.4042 | 1.0272 | 1.442 |
| 1600 | 3.3014 | 15 | 3.7334 | 4.6008 | 1.7205 | 2.6834 |
| 1610 | 3.2986 | 65 | 3.7683 | 4.0204 | 1.5321 | 2.2771 |
| 1620 | 3.0111 | 161 | 3.2823 | 3.3883 | 1.1893 | 1.8467 |
| 1630 | 3.4301 | 125 | 3.6657 | 3.8188 | 1.2463 | 1.7443 |
| 1640 | 2.4931 | 28 | 4.5135 | 5.6803 | 1.3197 | 2.3023 |
| 1650 | 2.854 | 27 | 4.2351 | 5.1556 | 1.4117 | 2.1835 |
| 1660 | 5.3897 | 39 | 5.9672 | 6.3685 | 2.0297 | 2.8418 |
| 1670 | 1.6637 | 50 | 2.1837 | 2.4097 | 0.6954 | 1.143 |
| 1680 | 2.7991 | 26 | 3.8357 | 4.1753 | 1.3506 | 2.3683 |
| 1690 | 3.0081 | 61 | 4.3191 | 4.8592 | 1.3049 | 2.1662 |
| 1700 | 4.0646 | 37 | 3.955 | 4.0505 | 1.3452 | 2.1086 |
| 1710 | 4.1011 | 18 | 4.5699 | 4.7539 | 1.5813 | 2.4807 |
| 1720 | 4.4154 | 54 | 4.5095 | 4.783 | 1.555 | 2.497 |
| 1730 | 2.0178 | 294 | 2.1217 | 2.1455 | 0.7316 | 1.3009 |
| 1740 | 7.7477 | 73 | 7.8167 | 7.9701 | 2.752 | 4.8164 |
| 1750 | 4.3364 | 59 | 4.7552 | 4.8658 | 1.5489 | 2.523 |
| 1760 | 5.0626 | 81 | 5.2303 | 5.391 | 1.5802 | 2.5717 |
| 1770 | 4.5481 | 89 | 5.2736 | 5.6002 | 1.41 | 2.2892 |
| 1780 | 4.7079 | 216 | 4.9504 | 5.2348 | 1.3637 | 1.9869 |
| 1790 | 5.8227 | 324 | 6.0556 | 6.1827 | 1.3136 | 1.8602 |
| 1800 | 6.8741 | 179 | 7.331 | 7.673 | 1.2383 | 1.7212 |
| 1810 | 10.187 | 236 | 10.637 | 11.1006 | 1.6466 | 2.1595 |
| 1820 | 8.4449 | 81 | 8.7122 | 9.292 | 1.7494 | 2.6883 |
| 1830 | 7.7658 | 486 | 7.8646 | 7.9237 | 1.6283 | 2.5482 |
| 1840 | 8.8377 | 174 | 8.9555 | 9.0013 | 1.8165 | 2.9415 |
| 1850 | 11.7053 | 45 | 12.2034 | 12.367 | 2.5288 | 4.2324 |
| 1860 | 7 | 12 | 7.3016 | 7.2799 | 1.4123 | 3.0344 |

Appendix B

Comparison of the computation of reward per day worked with reward per day over a year is explained in the panels below. The reward per day worked represents 365/250 of the reward per day over a year.

|  |  |
| --- | --- |
| Reward per day worked | |
| Day worker | Daily remuneration = day wage + value of any perquisites received by the day (valued in terms of either the cost of an Allen basket or the price of wheat) |
| Annual worker | Daily remuneration = annual wage/250 + daily value of perquisites (valued in terms of either the cost of an Allen basket or the price of wheat) x 365 /250 |
| Reward per day over a year: standard of living | |
| Day worker | Daily remuneration = [day wage + value of any perquisites received by the day (valued in terms of either the cost of an Allen basket or the price of wheat)] x 250/365 |
| Annual worker | Daily remuneration = [annual wage + daily value of perquisites (valued in terms of either the cost of an Allen basket or price of wheat)x 365] /365 |

Appendix C.

*Regression results:*  Determinants of children’s real wages, real rewards to work per day worked and standard of living per day in the year, 250 day and variable working day assumptions, 1280-1860

|  |  |  |  |
| --- | --- | --- | --- |
|  | Real reward to day of work,  Variable number of days worked in year  (Allen’s respectability basket (whole)) | Standard of living per day in year, 250 days worked in year  (Allen’s respectability basket (whole)) | Standard of living per day in year, variable number of days worked in year  (Allen’s respectability basket (whole)) |
| Constant | -0.0.55  (0.099) | -0.196  (0.070)\*\* | 0.028  (0.069) |
| Age approx. | 0.099  (0.006)\*\* | 0.085  (0.004)\*\* | 0.079  (0.004)\*\* |
| Possibly adult | 0.619  (0.070)\*\* | 0.341  (0.050)\*\* | 0.265  (0.049)\*\* |
| Construction | 1.022  (0.060)\*\* | 0.734  (0.042)\*\* | 0.722  (0.042)\*\* |
| Cottage industry | 0.001  (0.061) | -0.009  (0.043) | -0.011  (0.042) |
| Manufacturing | 0.249  (0.065)\*\* | 0.210  (0.046)\*\* | 0.210  (0.045)\*\* |
| Service | 0.279  (0.055)\*\* | 0.173  (0.039)\*\* | 0.226  (0.038)\*\* |
| Distribution | 0.523  (0.086)\*\* | 0.413  (0.061)\*\* | 0.434  (0.060)\*\* |
| Other occupation | 0.160  (0.064)\* | 0.119  (0.045)\*\* | 0.137  (0.045)\*\* |
| Haymaking | 0.409  (0.090)\*\* | 0.281  (0.063)\*\* | 0.390  (0.063)\*\* |
| Female dummy | -0.240  (0.115)\* | -0.122  (0.081) | -0.048  (0.081) |
| Female\*time | -0.015  (0.006)\* | -0.012  (0.005)\* | -0.013  (0.005)\*\* |
| Female\*time2 | 0.000  (0.000)\*\* | 0.0004  (0.000)\*\* | 0.000  (0.000)\*\* |
| Board dummy | -0.391  (0.145)\*\* | -0.534  (0.102)\*\* | -0.114  (0.101) |
| Lodging dummy | 0.626  (0.138)\*\* | 0.315  (0.098)\*\* | 0.267  (0.097)\*\* |
| Clothing dummy | 0.056  (0.085) | -0.045  (0.060) | -0.010  (0.059) |
| Board\*time | 0.016  (0.004)\*\* | 0.017  (0.004)\*\* | 0.009  (0.003)\*\* |
| Lodging\*time | -0.022  (0.003)\*\* | -0.013  (0.002)\*\* | -0.013  (0.002)\*\* |
| Pay annual | -0.808  (0.119)\*\* | -0.561  (0.084)\*\* | -0.352  (0.083)\*\* |
| Pay annual\*time | 0.008  (0.003)\* | 0.008  (0.002)\*\* | 0.000  (0.002) |
| Pay weekly | -0.033  (0.046) | 0.104  (0.033)\*\* | -0.034  (0.032) |
| Pay for task | -0.586  (0.090)\*\* | -0.326  (0.064)\*\* | -0.322  (0.063)\*\* |
| Identified as working 30 days or more | -0.277  (0.047)\*\* | -0.234  (0.033)\*\* | -0.171  (0.033)\*\* |
| Census of poor | -0.350  (0.067)\*\* | -0.286  (0.047)\*\* | -0.250  (0.047)\*\* |
| Make work scheme | -0.739  (0.090)\*\* | -0.548  (0.064)\*\* | -0.528  (0.063)\*\* |
| Data from spinning wages | -0.212  (0.083)\*\* | -0.187  (0.059)\*\* | -0.203  (0.058)\*\* |
| Region South West | -0.705  (0.129)\*\* | -0.482  (0.091)\*\* | -0.395  (0.090)\*\* |
| Region South West\*time | 0.014  (0.003)\*\* | 0.010  (0.002)\*\* | 0.008  (0.002)\*\* |
| Region North West | -1.093  (0.273)\*\* | -0.972  (0.193)\*\* | -0.942  (0.191)\*\* |
| Region North West\*time | 0.024  (0.005)\*\* | 0.022  (0.004)\*\* | 0.021  (0.004)\*\* |
| Region Other | -0.090  (0.051) | -0.047  (0.036) | -0.067  (0.036) |
| Repeat observation | 0.185  (0.041)\*\* | 0.148  (0.029)\*\* | 0.152  (0.028)\*\* |
| Paid with father | -0.114  (0.087) | -0.202  (0.061)\*\* | -0.090  (0.061) |
| Works with father/mother | 0.202  (0.070)\*\* | 0.139  (0.050)\*\* | 0.080  (0.049) |
| Works with an adult | 0.133  (0.051)\*\* | 0.117  (0.036)\*\* | 0.067  (0.036) |
| 1280 | 0.382  (0.166)\* | 0.213  (0.117) | -0.286  (0.116)\* |
| 1290 | 0.307  (0.162) | 0.284  (0.115)\* | -0.294  (0.113)\*\* |
| 1300 | 0.714  (0.119)\*\* | 0.534  (0.084)\*\* | -0.103  (0.083) |
| 1310 | 0.769  (0.214)\*\* | 0.466  (0.151)\*\* | -0.174  (0.150) |
| 1320 | 0.735  (0.162)\*\* | 0.265  (0.115)\* | -0.346  (0.113)\* |
| 1330 | 1.294  (0.173)\*\* | 0.599  (0.122)\*\* | 0.007  (0.120) |
| 1340 | 1.180  (0.185)\*\* | 0.382  (0.131)\*\* | -0.365  (0.129)\*\* |
| 1350 | 1.767  (0.161)\*\* | 0.703  (0.114)\*\* | -0.006  (0.112) |
| 1360 | 1.065  (0.216)\*\* | 0.545  (0.152)\*\* | -0.065  (0.151) |
| 1370 | 0.866  (0.287)\*\* | 0.465  (0.202)\* | -0.366  (0.200) |
| 1380 | 1.101  (0.259)\*\* | 0.622  (0.183)\*\* | -0.224  (0.181) |
| 1390 | 1.641  (0.298)\*\* | 0.973  (0.210)\*\* | 0.028  (0.208) |
| 1400 | 2.069  (0.151)\*\* | 1.014  (0.107)\*\* | 0.315  (0.106)\*\* |
| 1410 | 2.158  (0.187)\*\* | 0.903  (0.132)\*\* | 0.281  (0.130)\* |
| 1420 | 2.541  (0.269)\*\* | 1.661  (0.190)\*\* | 0.425  (0.188)\* |
| 1430 | 1.671  (0.198)\*\* | 0.959  (0.140)\*\* | 0.144  (0.138) |
| 1440 | 3.399  (0.360)\*\* | 2.156  (0.255)\*\* | 0.802  (0.252)\*\* |
| 1450 | 2.327  (0.560)\*\* | 0.731  (0.396) | 0.422  (0.392) |
| 1460 | 2.734  (0.221)\*\* | 1.652  (0.156)\*\* | 0.509  (0.154)\*\* |
| 1470 | 2.429  (0.460)\*\* | 1.414  (0.325)\*\* | 0.486  (0.322) |
| 1480 | 1.869  (0.328)\*\* | 1.157  (0.232)\*\* | 0.171  (0.229) |
| 1490 | 2.134  (0.286)\*\* | 1.357  (0.202)\*\* | 0.367  (0.200) |
| 1500 | 2.578  (0.230)\*\* | 1.704  (0.162)\*\* | 0.575  (0.160)\*\* |
| 1510 | 2.111  (0.181)\*\* | 1.090  (0.128)\*\* | 0.527  (0.127)\*\* |
| 1520 | 1.236  (0.225)\*\* | 0.735  (0.159)\*\* | -0.018  (0.157) |
| 1530 | 2.136  (0.170)\*\* | 1.173  (0.120)\*\* | 0.530  (0.119)\*\* |
| 1540 | 0.491  (0.217)\* | 0.199  (0.153) | -0.422  (0.151)\*\* |
| 1550 | 2.137  (0.238)\*\* | 1.417  (0.168)\*\* | 0.824  (0.167)\*\* |
| 1560 | 1.635  (0.196)\*\* | 1.026  (0.139)\*\* | 0.558  (0.137)\*\* |
| 1570 | 1.344  (0.161)\*\* | 0.877  (0.114)\*\* | 0.499  (0.112)\*\* |
| 1580 | 0.322  (0.142)\* | 0.228  (0.101)\* | -0.007  (0.099) |
| 1590 | 0.244  (0.124)\* | 0.076  (0.088) | -0.041  (0.087) |
| 1600 | 0.903  (0.221)\*\* | 0.679  (0.156)\*\* | 0.402  (0.154)\*\* |
| 1610 | 0.537  (0.121)\*\* | 0.302  (0.085)\*\* | 0.119  (0.084) |
| 1620 | 0.489  (0.099)\*\* | 0.272  (0.070)\*\* | 0.104  (0.069) |
| 1630 | 0.444  (0.100)\*\* | 0.207  (0.071)\*\* | 0.065  (0.070) |
| 1640 | 0.453  (0.164)\*\* | 0.294  (0.116)\*\* | 0.066  (0.115) |
| 1650 | 0.548  (0.164)\*\* | 0.309  (0.116)\*\* | 0.127  (0.115) |
| 1660 | 0.729  (0.142)\*\* | 0.481  (0.100)\*\* | 0.322  (0.099)\*\* |
| 1670 | -0.205  (0.139) | -0.192  (0.098)\* | -0.353  (0.097)\*\* |
| 1680 | 0.262  (0.169) | 0.142  (0.120) | 0.008  (0.118) |
| 1690 | 0.322  (0.121)\*\* | 0.162  (0.086) | 0.036  (0.085) |
| 1700 | 0.054  (0.151) | 0.034  (0.106) | -0.049  (0.105) |
| 1710 | 1.039  (0.201)\*\* | 0.689  (0.142)\*\* | 0.610  (0.140)\*\* |
| 1720 | 0.903  (0.133)\*\* | 0.618  (0.094)\*\* | 0.534  (0.093)\*\* |
| 1730 | 0.577  (0.115)\*\* | 0.390  (0.081)\*\* | 0.350  (0.080)\*\* |
| 1740 | 1.481  (0.112)\*\* | 1.026  (0.079)\*\* | 0.991  (0.079)\*\* |
| 1750 | 0.347  (0.121)\*\* | 0.188  (0.085)\* | 0.170  (0.084)\* |
| 1760 | 0.406  (0.109)\*\* | 0.258  (0.077)\*\* | 0.273  (0.076)\*\* |
| 1770 | 0.203  (0.106) | 0.132  (0.075) | 0.124  (0.074) |
| 1780 | 0.099  (0.089) | 0.094  (0.063) | 0.142  (0.062)\* |
| 1790 | 0.078  (0.082) | 0.077  (0.058) | 0.074  (0.057) |
| 1810 | 0.220  (0.092)\* | 0.185  (0.065)\*\* | 0.191  (0.064)\*\* |
| 1820 | 0.223  (0.110)\* | 0.237  (0.077)\*\* | 0.227  (0.076)\*\* |
| 1830 | 0.066  (0.078) | 0.061  (0.055) | 0.095  (0.054) |
| 1840 | 0.070  (0.093) | 0.069  (0.066) | 0.154  (0.065)\* |
| 1850 | 0.590  (0.136)\*\* | 0.526  (0.096)\*\* | 0.560  (0.095)\*\* |
| 1860 | 0.070  (0.236) | 0.044  (0.167) | 0.083  (0.165) |
|  |  |  |  |
| Adjusted R squared | 0.564 | 0.531 | 0.454 |
| F-statistic | 55.523\*\* | 48.694\*\* | 35.982\*\* |
| Sample size | 3873 | 3873 | 3873 |
|  |  |  |  |
| \*sig. ≤ .05  \*\*sig. ≤ .01 |  |  |  |

Omitted categories: male, agriculture, south east, 1800-09

Standard errors in parentheses

1. We only include evidence relating to specific children in household accounts and exclude reported wage *rates* from factory inquiries and Royal Commissions. [↑](#footnote-ref-1)
2. See Sarasua (2018) for discussion of the same limitations of measures of women’s market work. [↑](#footnote-ref-2)
3. While workers aged over 18 should perhaps not be counted as children, they are retained in the dataset as these are typically cases where we have multiple observations over time and so evidence on age-earnings trajectories. [↑](#footnote-ref-3)
4. The actual classification of the payment period, as in table 4 above, is used in the regression analysis. [↑](#footnote-ref-4)
5. The price of a 4lb loaf is only available from 1545-1925 (Mitchell, pp.769-70), so omitting the important early years of our survey. Wheat prices are available for most of the entire period and have the advantage of fitting closely with payments made in grains in the medieval period and being of consistent quality through time (Mitchell, 1988, pp.752-755, Wheat prices, shillings per Winchester quarter, Exeter 1316-1820; Wray Vamplew (1979, Table 2, p.9). We have calculated decade averages, and have chosen to ignore years, rather than interpolate between years, where data is missing. Unfortunately, this does not provide a valuation for the 1270 – 1310 decades, which we cover by projecting later prices backwards according to the metric of the Allen basket CPI. Thus we have calculated the ratio of the cost of the basket 1270-80/ 1310-1320 (0.52/ 0.68) and applied it to the cost of wheat in shillings Winchester bushel from Mitchell for 1310-19 (8.42 shillings), to get approximate cost in 1270-79 (6.44 shillings). Using the same method for the subsequent decades gives values of 6.19 s in 1280-89; 6.69 s in 1290-99; and 6.93 s in 1300-09. [↑](#footnote-ref-5)
6. FAO/WHO/UNU Expert Consultation, Rome, 17-24 October, 2001, tables 4.5 and 4.6. 1500 kcal per day would fall considerably under the calorie requirements for today’s children if they were engaged in substantial physical labour. However, some of the additional requirement will be offset by the smaller stature of children in the past. Furthermore, both the Allen basket and the wheat valuation use wheat cost as a key component. In the earlier years of our study oats or mixed grains were often consumed, the same money that would afford 1500 kcals wheat would allow nearly double the amount of oats or barley, thus offsetting any understatement of needs in these years. We have also assumed a constant extraction rate from wheat of 58% throughout. As milling technology improved more consumable wheat would have been gained from the grains purchased, thus raised the calories consumed above 1500 towards the latter years of our study. The calories supplied under these conditions supports around 50% more of children’s needs than generic assumptions. [↑](#footnote-ref-6)
7. Jordan Claridge and John Langdon (2017) suggest a conversion factor for grains into calories. They consider 1 bushel of mixed barley and oats yields 63,564 calories, 1 bushel of rye yields 77,520 calories. We assume wheat lies half way between these, yielding 70,542 calories per bushel. There are 8 bushels in a quarter, giving 564,336 calories per quarter of wheat. We adopt the suggested extraction rate of 58%, giving 327,315 consumable calories per quarter of wheat. Multiplying the price per quarter in shillings by 12 gives price in d. for 327,315 calories, from which we can work out the cost per calorie. [↑](#footnote-ref-7)
8. In brief, conversion of wheat price per quarter to cost of 1500 calories per day is

   ((price in s.x12)/327315) \*1500, i.e. wheat price \*0.0549. [↑](#footnote-ref-8)
9. There are a number of observations in the medieval period where the grain wage paid is stated, that is, we know how many bushels are paid and over what period. Here the value of this grain wage per day is included rather than the notional cost of 1500 calories. The grain is valued at the cost of a quarter of wheat without adjustment for wastage, thus reflecting the amount of wheat the equivalent wage might buy. This value is included in remuneration in the wheat variant of our approach to in-kinds but we retain the imputation from a half the Allen basket in the alternative approach. [↑](#footnote-ref-9)
10. In 5 cases clothing alone is provided and in these cases we have assumed this is equivalent to 0.25 of the respectability basket. [↑](#footnote-ref-10)
11. Rewards per day worked also indicate the cost of a day of labour. [↑](#footnote-ref-11)
12. See Allen (2009; 2011). [↑](#footnote-ref-12)
13. The latter is particularly useful in decades when our sources are concentrated on specific occupations, for instance in 1560-9 when our estimates seem high as they are in line with pay in construction; here inclusion of the wage assessment data gives a better balance of occupations and pay. [↑](#footnote-ref-13)
14. This assumes that they worked 250 days per year. It might be conjectured that annual workers could be made to work longer which would reduce their relative pay even more. [↑](#footnote-ref-14)
15. Explanatory variables were interacted with time to identify changing relationships and where significant included in the final regression and reported. [↑](#footnote-ref-15)
16. 1800-09 is selected as a decade that contains a large number of observations from a variety of sources, with children of various ages doing different types of work across a number of regions and where remuneration can be verified against other reliable sources. [↑](#footnote-ref-16)
17. Any narrowing of the gap is outside the period. [↑](#footnote-ref-17)
18. Oxmetrics: S.J.Koopman, R. Lit and A.C Harvey 1995-2018. [↑](#footnote-ref-18)
19. The diagnostics indicate only three outliers in the data and no significant break in trend. The residuals show normality (value 1.7899 compared to ꭓ2value with 2 d.f.) and the Q statistic (q, q-p), based on the Ljung-Box Q test, at 6.8191, rejects significant autocorrelations and asserts overall randomness of the data. For full descriptions of the methods employed see Harvey (1989) and Koopman, Harvey, Doornik and Shepherd (2009). [↑](#footnote-ref-19)
20. This is probably not too unrealistic as many children worked alongside adults, often as their apprentices. [↑](#footnote-ref-20)
21. The sources we use to derive an estimate of children’s working days are: Voth (1998, 2001), Allen and Weisdorf (2011), Clark and van der Werf (1998), Humphries and Weisdorf (2018). [↑](#footnote-ref-21)
22. Performing the regression analysis on the sample subdivided by age of children (aged 6-11, aged 12 and over) reassures that shifts in the underlying age sample with no adjustment made for different calorie requirements by age in the in-kind payments is not driving the results. Very similar results to those for the whole sample are found. However, the decade dummies reveal that teenagers’ real wage gains are greater than those for younger children in the high labour demand periods of the fifteenth and eighteenth centuries and indicate that teenage labour was more comparable to that of adult labour and was subject to the same forces. [↑](#footnote-ref-22)
23. The same divergence between male and child remuneration from the C17th is observed if we use welfare ratios rather than the nominal wage. [↑](#footnote-ref-23)