Children's work and Wages, 1270-1860.

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By

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Introduction

In 1300-01, a boy was hired to help the shepherds at Biggin Grange, part of the estate of the Abbot of Peterborough. He worked for 12 weeks during lambing, and was paid 4d plus 6 skeps of mixed grains (Raban, 2011). In medieval Farnham, after the Black Death's first ravages, a boy was paid 1s for 4 days carrying 'glasterers vitreas' (Robo, 1939). In 1534, at Bassingbourne in Cambridgeshire, a boy was also paid 1s for 4 days, in his case for helping to construct the church walk (Dymond, 2004). A hundred years later, George Baxter, Sir Thomas Puckering's kitchen boy, received 15s at Michaelmas and Lady Day plus board and lodging (Merry and Richardson, 2012).   By the early eighteenth century, Elizabeth Pope, aged around 13, went to serve a cheese monger, the first half year for 'only victuals and clothes' but at the rate of £1 15s for the second six months (Hembry, 1990). By the early nineteenth century, named children can be traced in the farm labour books for Temple Grenville of Stowe working 12 days every fortnight the year round as waggoners' boys, milk boys, harvest boys, "Black Pit" boys, and shepherd boys (D104/96, Buckinghamshire Record Office). Over this whole period, Justices of the Peace throughout the land were regularly including the wages of 'infants', boys and maids in their assessments of what wages should be paid and received when working by the day or year, and with or without various perquisites (see McArthur, 1898, p.301), while overseers, whether in early Stuart Salisbury or eighteenth-century Walthamstow, were directly employing children as young as 6 to work at carding, spinning, knitting, bonelace, quilling, and hemp or renting them out to workshops, factories, construction sites or farms (Slack, 1975; Parish Workhouse Accounts, Walthamstow Vestry Museum).

Passing familiarity with manorial and farm accounts, estate records, wage assessments, household accounts, wage books or poor law documents is enough to introduce researchers to the many children who laboured on the farms and construction sites and in the households, workshops and factories of the past. Researchers regularly glimpse these little workers but it is difficult, if not impossible, to envisage a coherent account of children's work from such fragmentary records. There are studies of particular times, places, and types of worker, which cast light on the nature of children's work and its relationship to the family economy (Claridge and Langdon, 2016; Horrell and Humphries, 1995; Humphries 2010) and on the contribution made to transitions in work organisation such as the emergence of factory production (Lane, 1979; Rose, 1989; Honeyman, 2006). But studies 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). Historians remain in the dark even on such a basic issue as child remuneration and its evolution alongside the pay of adult men and women. A serious study of child wages is long overdue.

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Such a study has broader implications.   First, it would provide evidence on whether the evolution of English wages fits a Malthusian interpretation. Historians are agreed that the demographic catastrophe of the Black Death heralded almost two centuries of high wages, a 'golden age' for the English peasantry, but once population managed a hesitant   recovery, the Malthusian account sees wages as first declining then stagnating until the first quarter of the nineteenth century when they began a sustained increase, at last returning to the levels enjoyed in the fourteenth and early fifteenth centuries (Clark, 2007).   In such a scenario, fertility-driven population growth by its impact on the structure of the population, would increase the dependency rate and reduce children's wages, either because younger children would be required to work to maintain living standards or because the segmented child labour market had become overstocked. We would then expect child wages to share, indeed perhaps lead, Malthusian stagnation. The counter-position, introduced by Hajnal (1965) and subsequently developed by De Moor and van Zanden (2010) and Voitländer and Voth (2013) also begins with the Black Death but argues that the 200 year boom in wages, was a particular feature of the labour market for juveniles and young people on traditional service contracts, which involved co-residence with employers. As a result, it not only probably enhanced human capital formation but also led to the postponement of marriage and elevated celibacy, cementing a distinctive 'Northern European Marriage Pattern' (NEMP), which then lowered population pressure and enabled an escape from Malthusian stagnation. In such a scenario, the initial phase and early evolution of the NEMP should be reflected in a sustained boom in child and adolescent remuneration particularly for those working on annual contracts.

At stake here is not merely some arcane academic argument about historical trends, for how and when the great escape happened is central to unified growth theory and its attempt to build a single framework transition from Malthusian stagnation to modern economic growth while also explaining the Great Divergence and the Demographic Transition (Diebolt and Perrin, 2017).   The driver in unified growth theory is a household switch in preferences from a large number of 'low quality' children to a small number of 'high quality' children, but as it stands there is no agreement on what induces parents to invest in the quality of offspring (Galor and Weil, 1996; Iyigun and Walsh, 2007; Strulik and Weisdorf, 2008; Doepke and Tertilt, 2009; Largerlöf, 2003). The evolution of children's wages may prove inspirational.

Second, child wages are also relevant to the debate about the effects of industrialization in both its protoindustrial and factory phases. Optimists have argued that industrialization benefitted 'peripheral' workers including women and children (Pinchbeck, 1981; McKendrick, 1974). Indeed this view lies at the core of Jan de Vries (2008) influential account of an 'industrious revolution' as the precursor of the industrial revolution. De Vries argued that the early modern appearance of novel commodities such as tropical groceries and cheaper fabrics raised working people's demand for disposable income and so

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promoted a widespread substitution of wage labour for leisure and unpaid domestic work. Longer working hours and higher participation rates were the hallmarks of a heightened industriousness, which extended beyond adult males to include their wives and offspring. Since children played a major role in this consumer-driven industriousness, we might expect it to have left its mark on trends in their remuneration. Even if demand for child labour was growing, heightened industriousness would have been associated with a decline in wage *rates*, earnings only maintained by harder work and longer hours. Such a decline underpins the pessimist position on the welfare effects of industrialisation (Horrell and Humphries, 1995; Humphries, 2010). On the other hand, Robert Allen's (2009) interpretation of the origins of industrialisation identifies high wage rates, explicitly including those of women and children, as prompting the substitution of capital for labour and so propelling Britain onto a superior growth trajectory. Investigation of child remuneration should illuminate the extent and timing of this 'High Wage Economy'. Moreover, while evidence on occupations and wages cannot compensate for our ignorance about the size of the child labour force it can provide the basis for careful inferences about how child labour related to long run growth and structural change. The paper presents a first attempt to sketch the evolution of child remuneration, with these competing meta-narratives in mind.

We present evidence on the evolution of children's wages relative to those of adults both male and female and relative to their own costs of reproduction as a first stab at understanding how they contributed to the evolving economy and the welfare levels of their own households. We show how real wages varied over time and were conditional on children's age, local and regional labour markets and even family circumstances. A striking finding is that wage variation was far from random. Remuneration was related systematically to the characteristics of the children and their local economies: powerful evidence that young people did not provide sporadic labour for which they were paid *ad hoc* amounts but rather constituted a regular component of the labour force with clearly defined jobs and a hierarchy of wages. A second important result is that child wages do appear responsive to demographic trends but a Malthusian interpretation also has to take into account sensitivity to other secular forces such as regional growth and decline and changes in the sectoral structure of employment.

We have compiled data on children's work and wages from 1270 to 1860, looking separately by gender and recording where possible age, the sector of employment, the job and whether work was for casual day wages or on an annual contract, which came with room and board. The result is the first long-run wage series for child workers which we can then relate to the wages of adult men and women and trends in living costs. While we stand on the shoulders of other economic historians who have assembled data for particular times and places (e.g. Claridge and Langdon, 2016), we have uncovered many new primary and printed primary sources and use over 3800 observations spread over 600 years to generate this first long run series.

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The paper is organised as follows. The first section describes our data in more detail and explains how we have dealt with the problems that arise when putting together a series for real wages from 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, quarterly 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 often a vital part of the compensation package. The third section provides perspective by relating child wages to the cost of living, including 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. 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 this analysis. 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. In the fifth section we explicitly introduce demographics as an influence on child remuneration, arguing that by using the proportion of the population aged 5-14 as our index of population pressure we offset the problem of endogeneity. At any point in time, the share of juveniles in the population is the result of behaviour 5-14 years earlier and so, unlike synchronised birth rates, exogenous to child wages. 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 fits in with mainstream accounts of the long run development of the British economy and how they incorporate the evolution of wages (Broadberry et al, 2015).

I.

The Data

Sources and shifts in sample composition

We have collected 3814 observations of children's work and pay from 200 different sources over the period 1270-1860. Over two thirds (70.2%) 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

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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, (11.1% of cases),[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).

The figure below illustrates the distribution of the data over time and by source: the bars indicating observations per decade and the colour-coded stacks the sources drawn on. [2]

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[1] We only include evidence relating to specific children in household accounts and exclude reported wage *rates* from factory inquiries and Royal Commissions.
[2] Note that even when a single source is relied on in a particular decade, the source itself may compile evidence from a number of different locations and employments, as for example with Thorold Rogers' collections of price and wage data (Rogers, 1867, 1882, 1887).

Figure 1. The number of observations per decade, by source.
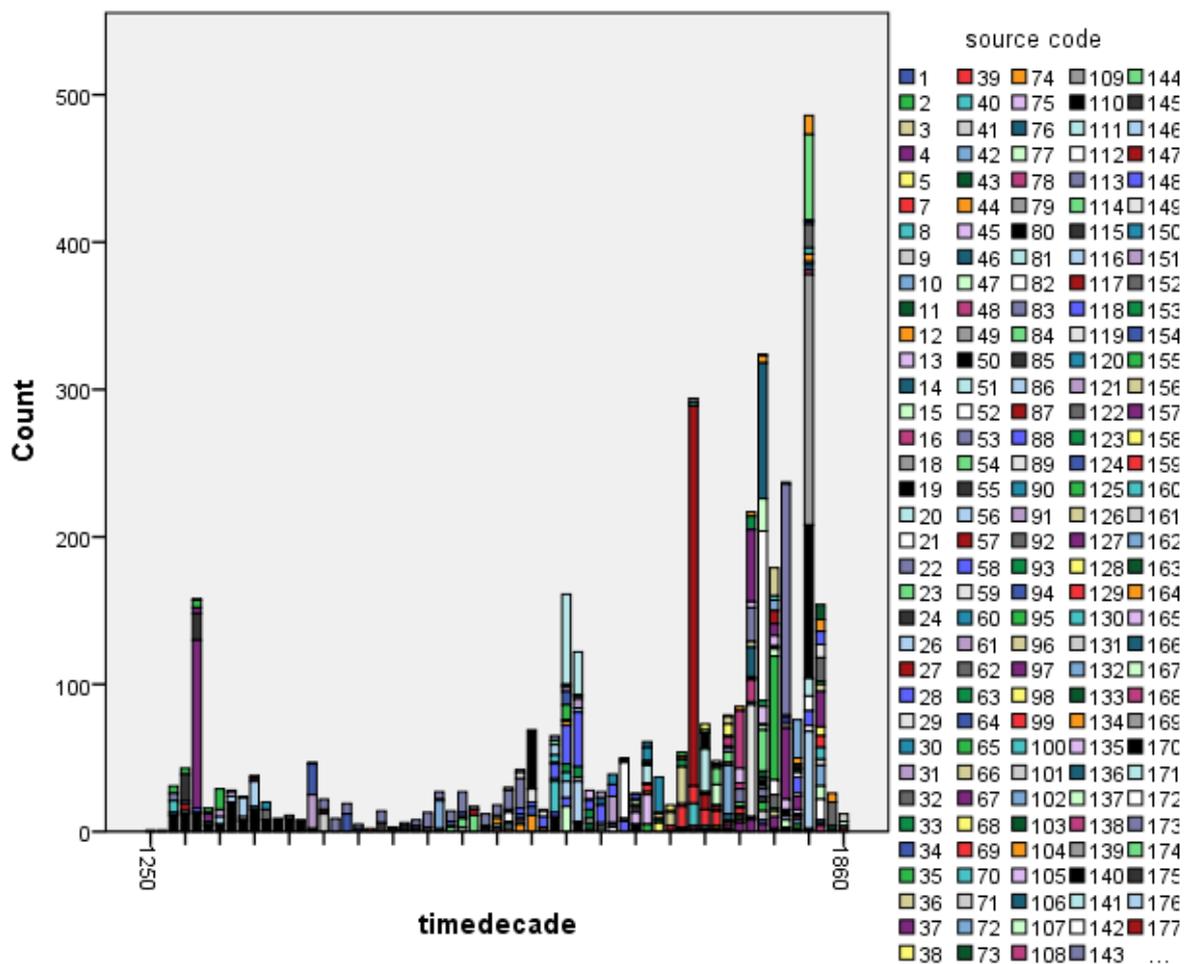
Our data refers to children's waged work. We are unable to value children's work in producing goods for direct consumption or assisting in the production of goods which were eventually sold on a product market such as foodstuffs from a family farm or domestic manufactures produced in a protoindustrial household. Consequently, we necessarily omit many productive contributions made by children, meaning that our evidence provides a conservative picture of their economic role. [3]

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

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[3] See Sarasua (2017) for discussion of the same limitations of measures of women's market work.

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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 and 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 37.7% of the children we have their name recorded, for 31.1% we know their exact age and for a further 14.0% 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 as young people. 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 the child's sex is not explicitly stated, each case has been scrutinised to determine whether it might reasonably be inferred from whether the job recorded was usually sex-stereotyped, so those in building trades were classified as male, those in some forms of 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. In a few cases the record 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 68.0% 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.

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

	Agri-culture	Mining	Cottage Industry	Manu-facturing	Service	Dist-ribution	Con-struction	Other	Total (number)
1250-99	55				23		23		66
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	3	21	6	40	16	122
1600-49	37	0	8	13	18	2	10	12	311
1650-99	49		3		29	4	7	9	160
1700-49	33		50		7	3	4	3	260
1750-99	42	4	14	10	2	5	13	10	436
1800-49	44	4	19	21	4	4	1	3	700
1850-69	44	4	7	15	22	0	7		27

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

	Agriculture	Mining	Cottage Industry	Manu-facturing	Service	Dist-ribution	Constr-uction	Other	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

Period									
1500-49					100				2
1550-99	22		76		2				49
1600-49	8		66	13	12			3	80
1650-99	58		16		12	5		9	43
1700-49	9		75		9	5		1	216
1750-99	10	0	67	9	9	1		4	317
1800-49	38	1	33	15	10	0		3	432
1850-69			27	73					11

Temporal and regional composition

Not surprisingly, the sources do not yield a uniform flow of information over time. 17.0% of the data relate to the time period 1250-1549, 32.5% to 1550-1749, and 50.4% 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	58.1
South West	17.7
North East	9.6
North West	13.2
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).

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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, 253 children in the dataset are observed on more than one occasion either doing different tasks or over a number of years. In cases 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 190 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. Unfortunately, actual age is recorded in only 31% of cases, but for many others the sources indicate whether 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 in which the child is observed subsequently. We adopt a similar solution for those known to be teenagers, starting at age 13.[4] 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	1.9
10	2.7
11	47.5
12	5.9
13	4.2
14	20.9
15	5.1
16	3.7

[4] While workers aged over 18 should perhaps not be counted as children, they are retained in the dataset as these are usually cases where we have multiple observations over time and so evidence on age-earnings trajectories.

17	2.0
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 analysis, given the sample size, we combined categories to distinguish children working casually by the day and those working on longer term contracts. 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 930 cases, 24.4% 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.

Table 4: *Distribution by payment period*

Payment period	Assumption re days worked	No. of observations	% observations
Annual	250	694	18.5
Half-year	125	7	0.2
Quarterly	63	44	1.2
Monthly	21	15	0.4
Weekly	5	1448	38.0
Day	1	1485	38.9
Casual	1	4	0.1
Task	0	55	1.4
Other (manorial accounts e.g. 16, 32 weeks)		54	1.4
Unknown		8	0.2
Total		3814	

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 the typical pay received by others in this 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 (source 68) 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, 2017). In all cases a dummy variable was introduced to indicate that the pay was for task work so that any systematic errors in changing rewards into daily pay could be identified in the subsequent analysis.

In 72 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, 21.5% received board, 16.8% lodging and 4.2% 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, 4.0% of our cases, received no money, but like Elizabeth Pope, only selected perquisites, in her case food and clothing.

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 of estimating 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, 2017) to value in-kind payments when looking at women's wages (2015) and the 'unreal' wages of men over the long term (2017). 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.

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Thus, our second imputation strategy is based on the cost of a minimal subsistence diet such as bread sufficient to supply enough calories to survive. It provides a check on the Allen basket valuation and a floor to the range of potential valuations of in-kind benefits. In the absence of a sufficiently long series for bread prices, we resort to wheat prices. [5] We assume a bare minimum subsistence for a child requires 1500 calories per day. The assumption is very 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 these modern estimated requirements but nonetheless our caloric needs assumption provides a barebones diet. [6] We reverse Claridge and Langdon's (2017) conversion factor of grains into calories to compute the associated requirement in terms of wheat. [7] The final step uses the wheat price to cost up the grains sufficient to provide 1500kcals.[8] This survival diet cost varies from 0.29 d to 5.14 d over the centuries we are considering, figures which can be thought of as minimal estimates of the value of board.[9]

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[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 calculating the ratio of the wheat price backwards 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.

[6] FAO/WHO/UNU Expert Consultation, Rome, 17-24 October, 2001, tables 4.5 and 4.6.

[7] Jordan Claridge and John Langdon (2016) 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.

[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.

[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

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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] 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 or its daily equivalent based on the assumptions about the length of the working year, quarter, week, etc. (see above p. 12) plus imputed values for the three types of perquisites gives the total daily remuneration received by the child in pence (d.) when working.

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] However, rewards per day worked do not measure living standards which involve spreading earnings and the value of perquisites over non-working days during the year and can be thought of as

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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.

[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.

[11] Rewards per day worked also indicate the cost of a day of labour.

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] 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 3 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 (121 cases were boarded, 66 lodged and 6 clothed) reflecting the fuzziness of the boundary between casual and longer term employment noted above (p. 11). [13] 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 or, 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 .635 (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 often cover female workers, specify pay for age, and extend the range of occupations. [14] [15]

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[12] See Allen (2009; 2011)

[13] Reclassifying children who worked more than 30 days as 'annual' workers reduces the number of 'casual' workers receiving perquisites but adds many with no benefits other than a cash wage into the long-term employment category, suggesting that our classification criteria (see above p. 13) produces results in line with what we would expect from the association between receipt of perquisites and longer- term employment.

[14] 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.

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 2. Although some of these children were in receipt of perquisites, which we have taken care to include in our valuations of their wages, as the figure shows this does not make any substantial difference to their remuneration; in essence, their cash wages represents their rewards per day worked and is used in this way in what follows.

Figure 2. Nominal rewards per day worked, cash and in kinds, casual workers
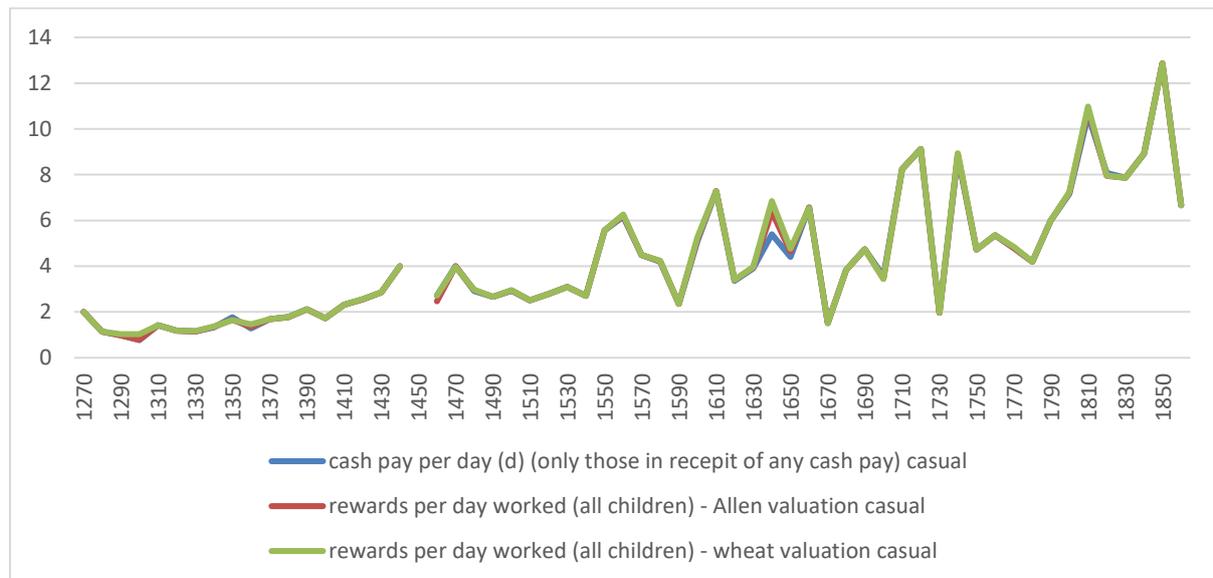
However, for workers on longer term contracts, and especially annual workers, perquisites were likely to be of considerably more value. Figure 3 compares the remuneration of casual day workers with those on longer-term contracts (identified as explained above, p.11) and breaking out cash payments from cash plus perquisites valued either by the Allen basket methodology or according to wheat prices.

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[15] Appendix A also uses the valuation of in-kind remuneration (board, lodging and clothing) explicitly or implicitly specified in wage assessments or other sources as a check on our assumptions about their valuation. These suggest patterns that merit further investigation as well as need to be born in mind with respect to child remuneration. For example, the value of board in assessments and other sources is very high in comparison with both the costs of 1500kcals of wheat and of the Allen respectability basket in the sixteenth and seventeenth centuries but declines in the early modern period suggesting particular generosity in the earlier period. Moreover, comparisons of men's assessments with estimates from other sources show that board paid as part of annual pay is much lower than board paid to day workers. Not only does this help explain workers' acknowledged preference for day labour but it perhaps suggests the need to adjust the respectability basket depending on whether labour is annual or casual.

Figure 3 Nominal rewards per day worked, cash and in kind, casual and annual workers
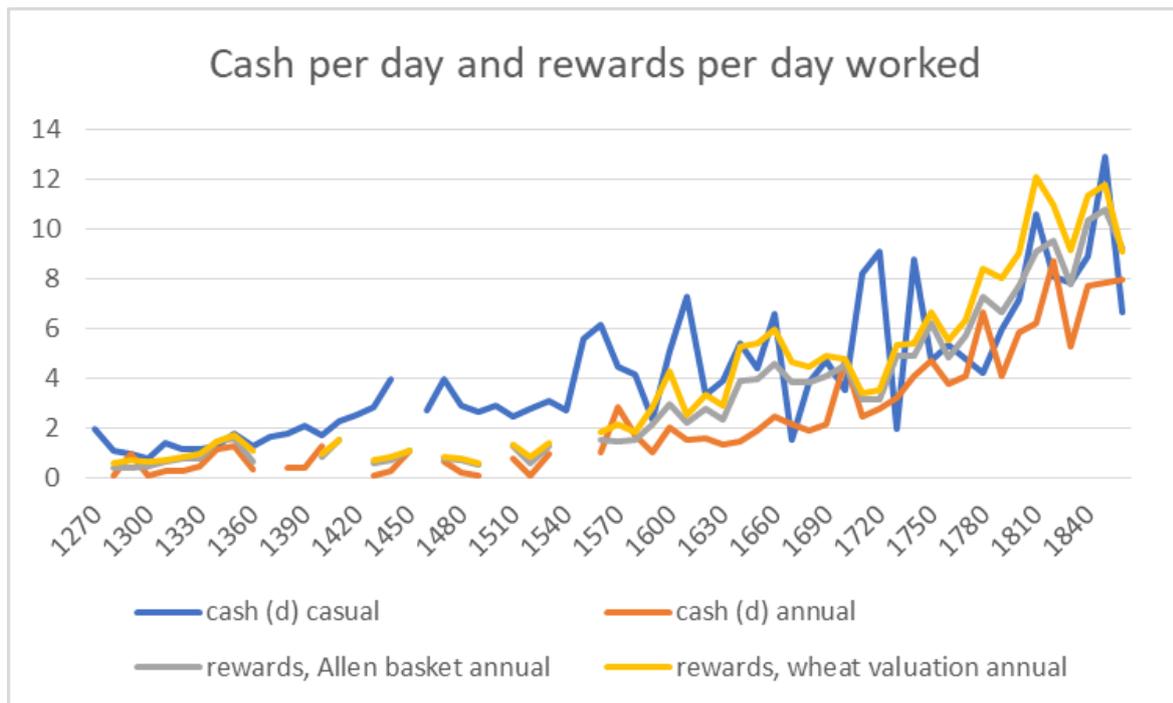

This figure reveals much about the child labour market in the past. First, in cash terms annual workers did much less well per day worked than did their casually employed peers.[16] Of course annual workers obtained perquisites which sweetened the pill of their lower money wages. But second, even our 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. But 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.13), 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 one half the basket provided. 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. Although we continue to value in kinds using both methods, we often report only one set of estimates for brevity's sake. Fourth, in-kind

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[16] 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.

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 4 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 using the Allen basket metric to value in kinds. Men's wages refer to casual farm workers and are taken from Clark (2007).

Figure 4. Comparison of children's women's and men's nominal remuneration per day worked
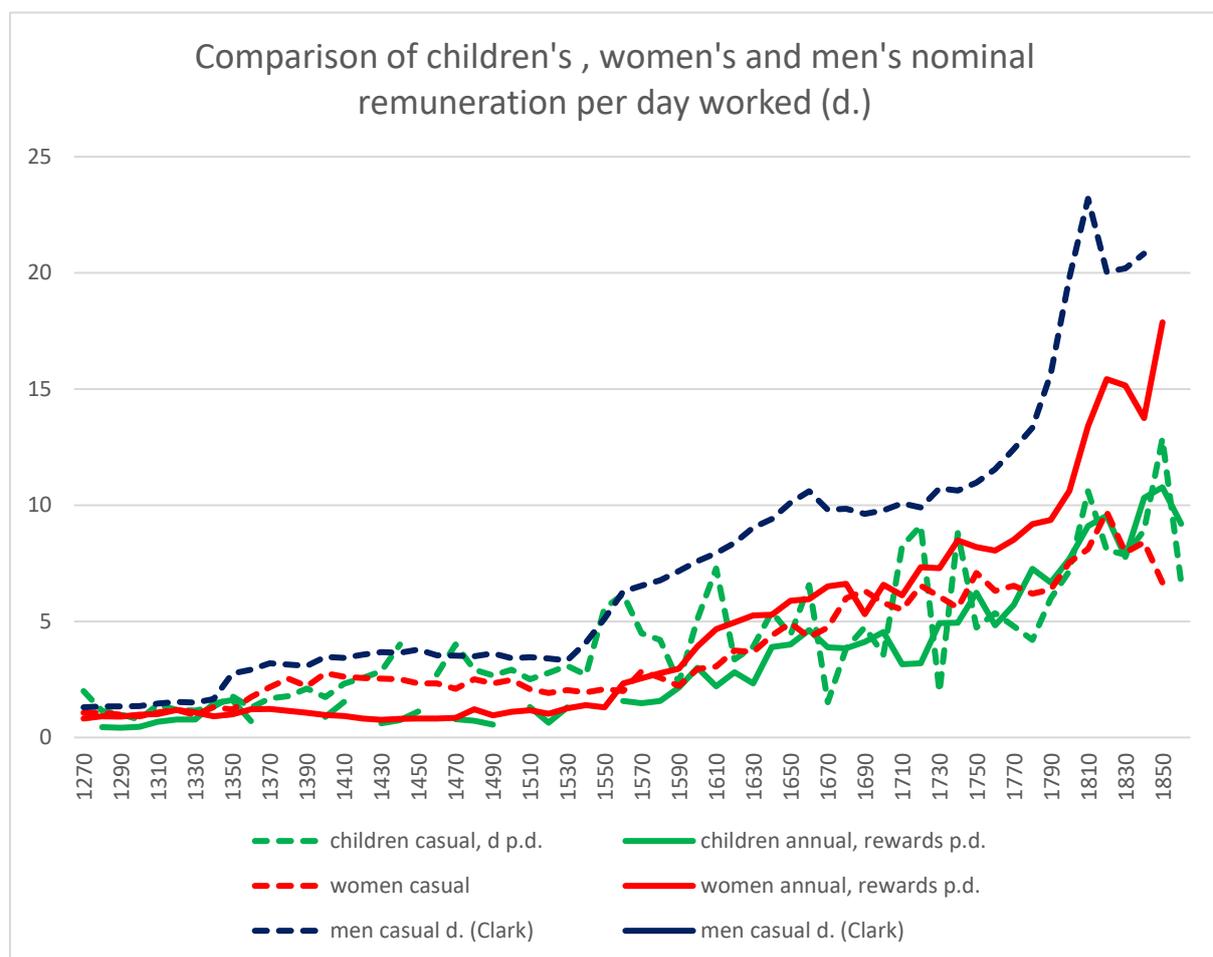
The children's wage series have much greater short term volatility than do the adult series because of the smaller sample sizes and the heterogeneity of the population sampled, but apart from the spike in the 1560s the overall trajectories and the relationship between child and adult nominal wages and remuneration are as we would expect. Children working either casually by the day or on longer term contracts usually earned less than both men

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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.

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, particularly on women workers. 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 daily remuneration

For comparisons over time and judgements about wellbeing, we need to consider the real value of children's wages that is what standard of living the remuneration could support. We need to deflate the nominal rewards per day worked to account for changes in the cost of living. Following Allen (2009) we use the cost of an Allen basket, recalibrated to reflect the lesser needs of children as a measure of living costs but supplement this as we did when imputing the values of board and lodging with wheat prices as a direct measure of the cost of a subsistence diet. In both cases, we add the valuation of in-kinds to the cash wage and then use the analogous cost of living indicator to deflate the nominal total. In the straightforward cases where children earned a day wage and no non-cash benefits, the alternative deflators provide two estimates of real rewards per day worked, one reflecting the proportion of an Allen basket, tailored (as explained above) to children's needs, that a child could buy when in work and the other the proportion of a subsistence diet. Where children received in kinds, when they were valued according to the costs of the basket, we

deflated the total value of the remuneration package using the same metric that is the cost of half an Allen basket. Thus real daily remuneration on this definition can be interpreted as the number of children's baskets that could be purchased: the welfare ratio. When perquisites were valued according to wheat prices, we deflated remuneration per day worked by the price of 1500 calories in pence in the pertinent decade. 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 5. Children's standard of living, subsistence diet and welfare ratios
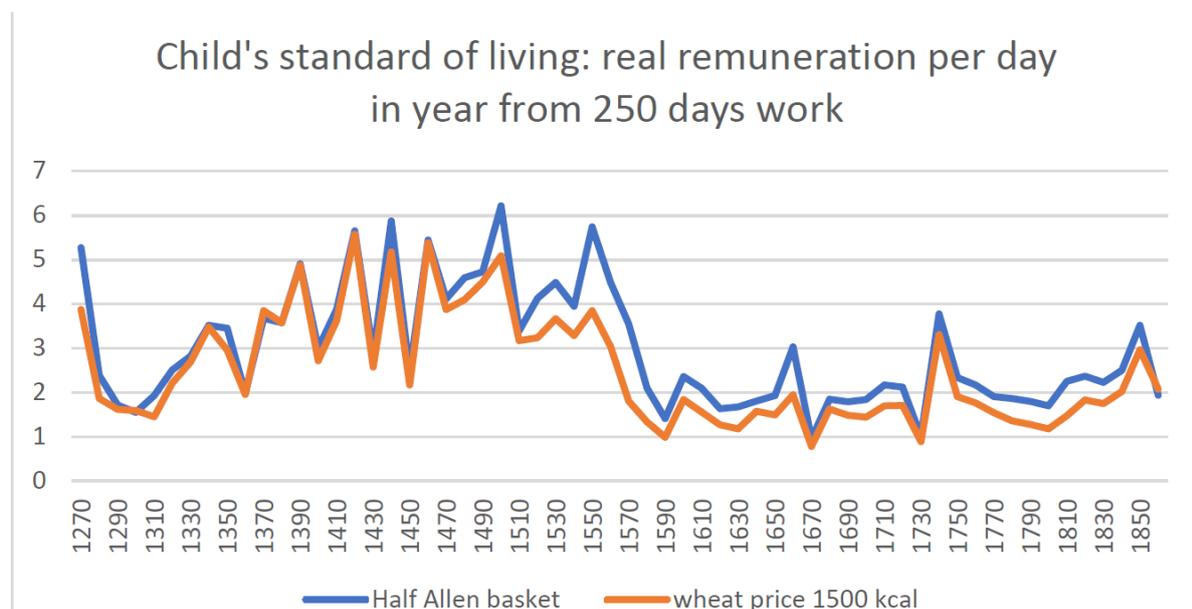
Perhaps not surprisingly, given the importance of wheat prices to the cost of the Allen basket, the alternative deflators yield very similar results in terms of trends in children's welfare and subsistence ratios. Both show clear gains in the 'golden age' following the Black Death and through the late 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 a half

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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 had to wait until the middle of the nineteenth century.

Figure 6 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. In both cases nominal rewards to work per day are multiplied by 250 and divided by 365 to obtain remuneration per day in the year then divided by the annual cost of an adult's Allen basket.

Figure 6. Child and adult male farm labourers' welfare ratios
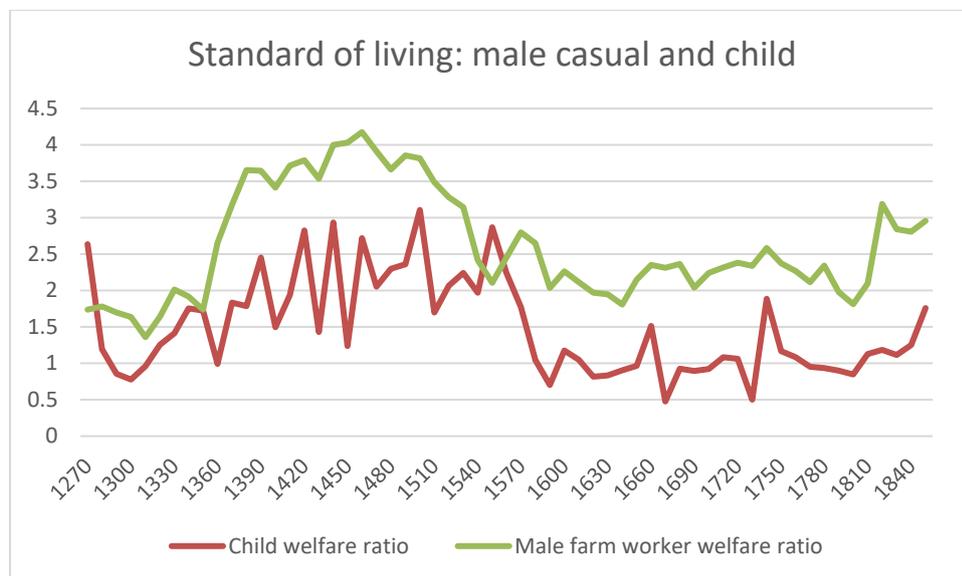
The evolution of children's real wages appears to be in tune with findings for adult workers offering further support for our evidence and approach. The next step is to explain child wages in terms of various explanatory variables and identify changes over time while controlling for shifts in sample composition.

Regression analysis of children's remuneration

The regression analysis utilises all observations where there is remuneration data, this includes wage assessments and repeat observations. Those with particularly high Allen welfare ratios (greater than 8.3) and where age is greater than 24 are excluded. One observation is lost as the payment antedated the sample period. This leaves 3809 observations in the analysis.

Variables are created to reflect the approximate age of the child and dummy variables reflecting occupation (agriculture, construction, cottage industry, manufacturing, services, distribution, other occupations are mining, army/navy, unknown); remuneration in kind (board, lodging, clothing); payment period (annual, weekly, task); region (south east, south west, north west, other regions are 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.[17]

The key variable of interest is how real remuneration changes over time. To capture the trends, dummy variables for each decade are included with 1800-09 being excluded. These variables are regressed against real rewards per day of work based on both the price of 1500kcal of wheat and half an 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, 1270-1860

	Real remuneration (price 1500kcal wheat)	Welfare ratio (Allen's respectability basket)
Constant	-0.720**	-0.284**
Age approx.	0.197**	0.126**
Possibly adult	0.870**	0.509**
Construction	1.617**	1.068**

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[17] Explanatory variables were interacted with time to identify changing relationships and where significant reported.

Cottage industry	-0.011	-0.011
Manufacturing	0.493**	0.302**
Service	0.282**	0.253**
Distribution	0.810**	0.596**
Other occupation	0.165	0.178**
Haymaking	0.462**	0.367**
Female dummy	-0.265	-0.179
Female*time	-0.024*	-0.017**
Female*time2	0.000**	0.00042**
Board dummy	-0.348	-0.818**
Lodging dummy	0.394	0.491**
Clothing dummy	0.103	-0.074
Board*time	0.029**	0.027**
Lodging*time	-0.022**	-0.020**
Pay annual	-1.642**	-0.822**
Pay annual*time	0.026**	0.011**
Pay weekly	0.199**	0.125**
Pay for task	-0.890**	-0.493**
Identified as working 30 days or more	-0.527**	-0.346**
Census of poor	-0.663**	-0.428**
Make work scheme	-1.271**	-0.785**
Data from spinning wages	-0.409**	-0.290**
Region South West	-1.089**	-0.717**
Region South West*time	0.022**	0.015**
Region North West	-1.697**	-1.285**
Region North West*time	0.043**	0.031**
Region Other	-0.078	-0.51
Repeat observation	0.295**	0.202**
Paid with father	-0.532**	-0.301**
Works with father/mother	0.275*	0.203**
Works with an adult	0.168	0.169**
1270	4.214**	2.750**
1280	0.747**	0.304
1290	0.857**	0.416*
1300	1.644**	0.776**
1310	1.024**	0.675**
1320	1.214**	0.374*
1330	2.291**	0.881**
1340	2.037**	0.544**
1350	1.962*	1.014*8
1360	1.860**	0.750**
1370	2.772**	0.677*

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1380	2.783**	0.897**
1390	4.008**	1.417**
1400	3.071**	1.469**
1410	3.115**	1.295**
1420	5.835**	2.409**
1430	2.800**	1.385**
1440	5.735**	3.138**
1450	2.598**	1.080
1460	5.604**	2.396**
1470	4.112**	2.075**
1480	3.492**	1.670**
1490	4.532**	1.960**
1500	4.467**	2.465**
1510	3.385**	1.565**
1520	1.972**	1.056**
1530	3.206**	1.700**
1540	1.233**	0.283
1550	2.696**	2.052**
1560	1.975**	1.540**
1570	0.865**	1.270**
1580	0.245	0.303*
1590	0.236	0.104
1600	1.411**	0.958**
1610	0.814**	0.448**
1620	0.853**	0.399**
1630	0.540**	0.313**
1640	0.767**	0.413*
1650	0.683**	0.441**
1660	0.907**	0.688**
1670	-0.296	-0.347*
1680	0.628*	0.180
1690	0.502**	0.216
1700	0.227	0.033
1710	1.773**	1.001**
1720	1.626**	0.894**
1730	1.282**	0.577**
1740	3.028**	1.493**
1750	1.015**	0.454**
1760	0.878**	0.357**
1770	0.491**	0.176
1780	0.247	0.136
1790	0.219	0.105
1810	0.217	0.239*
1820	0.608**	0.320**
1830	0.364**	0.068

1840	0.488**	0.061
1850	1.590**	0.693**
1860	1.224**	0.049
Adjusted R squared	0.568	0.533
F-statistic	54.905**	47.723**
Sample size	3809	3809
*sig. ≤ .05 **sig. ≤ .01		

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

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.[18] Moreover, 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 that 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.[19] This gender gap was probably

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[18] The Allen basket variant performed slightly less well (Adjusted R^2 0.533, F statistic 47.21) and only 49 of the 59 decade coefficients were significant. Otherwise the only differences were a positive effect of being in an 'other occupation' compared with the remuneration received in agriculture and a negative effect on total remuneration from receiving board. This latter effect might be attributable to half the Allen basket understating the value of in kind payments, but might also reflect the more accurate valuation of payment using wheat prices where grain payments were made. Further regressions were performed on real remuneration per day (but not adjusted for perquisites received on non-working days) computed using both wheat values and the Allen basket. This modelling performed almost exactly the same as the real rewards to work variants reported above.

[19] Any narrowing of the gap is outside the period.

exacerbated by the distinctive occupational distributions of boys and girls discussed above (see tables 1a and b).

While there was no 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 figure 5. 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, 1998; 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.

Nearly all the decade dummies (53/59) were statistically significant suggesting relatively short term volatility as well as sequentially signalling secular trends. While it is difficult to read the latter from individual coefficients, figure 7 uses the coefficients to trace the baseline remuneration of boys working in different economic sectors and inhabiting different regions of the country,   Although short term movements in wages persist, 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 1500, and the subsequent plateau that was only decisively ended after the first thirty years of the nineteenth century. [20] The parallels with the real wages of unskilled farm labourers as reproduced above are unmistakable.

Figure 7. Boys' estimated real rewards to a day's work in different economic sectors
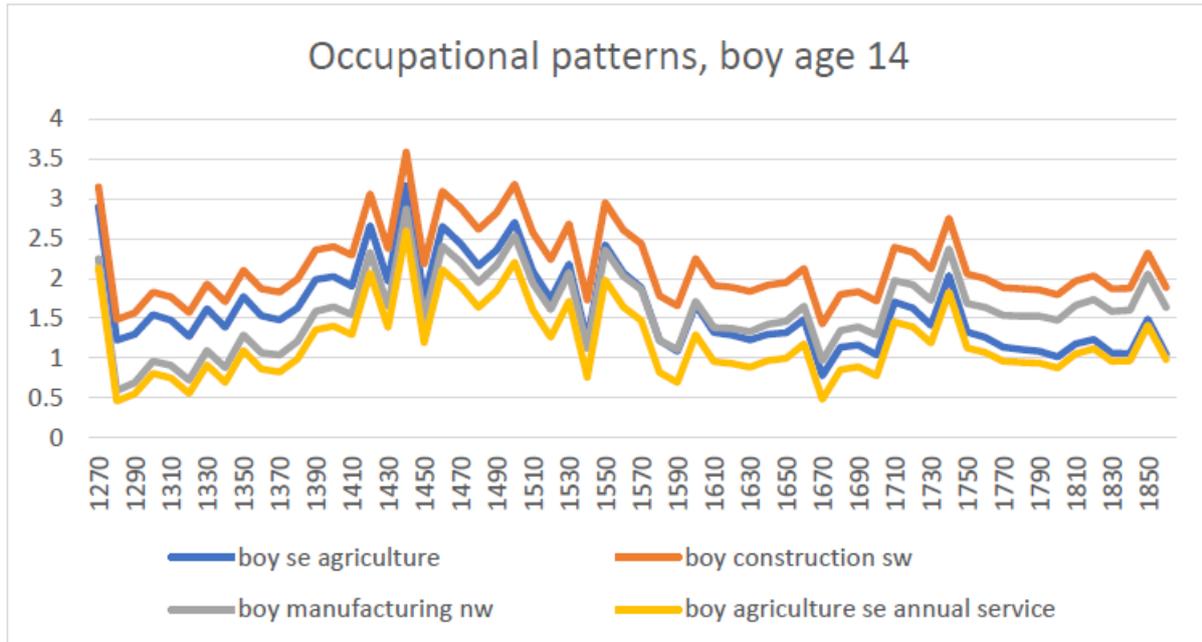
[20] The coefficients from the regression using the Allen basket to value perquisites and the cost of living show exactly the same trends although they are slightly less optimistic about the extent of the post-Black Death gains and are muted about the gains in the early 1700s. Again, these latter gains do not reach the heights of those seen earlier. See Appendix Figure A.1 and, for comparison with men's and women's wages, Figure A.2.

For long periods of time our child agricultural day labourer could purchase his subsistence diet several times over or indeed 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, 2007). The experience of boys in other occupational groups is also depicted in figure 7 to provide a comparative perspective, and shows that many 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 boys 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. 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.

Implications

In the introduction we argued that consideration of children's remuneration would offer a data-based window onto some of the large debates surrounding the effects of the Black Death on demand for labour and the emergence of the Northern European Marriage Pattern. It can also inform our understanding of the Industrious Revolution, the emergence of the High Wage Economy and the labour demand processes surrounding industrialisation. Our results offer some clear evidence with which to contribute to these debates.

The decade coefficients in Figure 7 above show a clear trajectory in the remuneration of children from the medieval period through industrialisation. Without doubt, those children who worked shared in the 'golden age' for labour heralded by the horrors of the Black Death. Children's real remuneration showed a steady increase from the middle of the 14th century to a peak after the first quarter of the 15th century and then plateaued until the C16th century when we see a steady decline. 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. However, it seems improbable in a period when England was so underpopulated and alternative activities for children so few that children were withholding their labour. However, we should be cautious in interpreting these findings as supporting recent arguments linking the Black Death to the NEMP,

assuming that higher wages led to the postponement of marriage and reduced population pressure, as our evidence is emphatic in suggesting that it was not juveniles in service, the focus of the NEMP thesis), who enjoyed the higher wages but rather those who were casually employed. The latter were more likely to be living with their families of origin and contributing to family incomes. In the absence of convincing demographic evidence for the era (on age at marriage or even fertility) it is risky to infer delayed nuptiality. Perhaps children's ability to share in the golden age might even have encouraged youthful betrothal and even larger families. Nor does our evidence support the argument that parental preferences for 'high quality' children can be traced back to this juncture. Even gaining skills at home must have been curtailed 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. If the Black Death brought about an increase in the human capital of the population, as de Moor and van Zanden argue (2010) it must have involved on-the-job acquisition of skills.   Children in this period appear to have had extended and extensive engagement with the labour market, at least judging by the frequency with which we can detect them even in formal written records. They may have started work at particularly young ages and, by necessity, may also have had to undertake adult tasks in their youth. Indeed, as figure 6 suggested, although maybe slightly behind men and women in their claims, children quickly learned to ride on the coat tails of adults and achieved wage gains commensurate with those older.[21] Children were in demand, and were maybe more available than adult men for any casual work offered.

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. 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. Again, we might expect that children's labour was in demand. The growth of the wool and other textile industry meant an expansion in spinning opportunities (Muldrew, 2012; Styles, 2015; Humphries and Schneider, 2017), while incipient early industrialisation was also evident elsewhere and it its protoindustrial phase was very child intensive. Coal mining expanded rapidly, and metal manufacturing and metal goods production grew, both sectors that had a demand for child labour. Agriculture too was seeing renewed vigour and although expansion in farm size meant cutbacks in some categories of labour, there is evidence that boys replaced women and girls (Allen, 1992).

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[21] Appendix figure A.2 shows the same trends using the Allen basket to cost perquisites but the magnitudes are muted.

Transport and distribution also grew apace in this period and notable in our dataset is the number of children, girls as well as boys, who worked as messengers, hawkers, street-sellers, and traders.

In this period children saw better remuneration and, at its peak, boys were able to earn three to four times the basic survival calories (that is around 3,500, a 'respectability' quantity). These data support the interpretation of an industrious revolution, at least in so far as engagement with the labour market brought ever better rewards. Of course, it cannot speak to whether more children were actively working and working harder, nor whether this activity was motivated by the desire for novel goods, all key elements of the industriousness thesis. While the heady heights of remuneration in late medieval times were not recouped, there is evidence that children shared in the High Wage Economy though ironically perhaps their substitution for more expensive adults was one channel whereby employers sought to restrain labour costs (Humphries, 2013; Allen, 2015), 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 gains. Continued mechanisation saved even children's labour while the growth of some industries (metals and mining) involved labour beyond children's physical competence. But if growth in demand had limits there was still a growing supply, and this may have helped contain any wage improvement.

The substantial rise in fertility, starting in the late seventeenth century, by skewing the age structure of the population necessarily entailed alterations in the ratio of dependents to people of the customary working age (Wrigley and Schofield, 1981, p.443). Over the course of the 'long eighteenth century' the population became dramatically younger. Between 1676 and 1826, the proportion of infants (aged 4 and under) rose from about 11 per cent to 15.5 per cent, while the proportion of children (ages 5-14) rose from 18 per cent to about 24 per cent. By 1826, when the population was at its youngest, almost 40 per cent were under age 15 (Wrigley and Schofield, 1981, p.217; Wrigley, et al, 1997, pp.614-5). Not surprisingly, children's participation rates increased in these early nineteenth century decades (Horrell and Humphries, 1995) and it is possible that supply exceeded demand. It is to the balance of these forces that we now turn, with the explicit introduction of demographics.

Demographic developments and children's remuneration

Economic-demographic interactions are notoriously difficult to untangle. In any simple representation of the Malthusian model (as depicted in eq. 1 and 2. below), feedback effects from wages to population make it impossible to identify the effects of labour supply on wages.

$$W_t = a - bP_t + u_t \quad \text{...(1)}$$

$$P_t = c + dW_{t-1} + v_t \quad \text{...(2)}$$

However, if we can distinguish shocks to or variables affecting one equation that do not affect the other, then we can identify the parameters of the system (Forman-Peck, 2016). [22] The juvenile dependency rate represents such a variable since it is exogenous to current wage levels.   Unlike fertility which is likely to be influenced by child wages through marriage and childbearing decisions, as well as influencing child wages through effects on the supply of child labour, the share of juveniles in the population is the result of behaviour 5-14 years earlier and so largely exogenous to current child wages. By using the proportion of the population aged 5- 14 as our index of population pressure we mitigate the problem of endogeneity associated with tests of the Malthusian model.

Wrigley et al (1997, Appendix 9, pp. 614-15) provide estimates of the percentage of the population aged 0-4 and 5-14 in quinquennial periods going back to 1540. We first replicated the baseline regression using data for the period 1540-1860. The results for the truncated regression are very similar to the model estimates for the longer period. Virtually all the variables remained significant, operate in the same direction and have a similar order of magnitude. The main differences relate to estimated secular trends, which are to be expected given the truncation of the time horizon. For example the time path of the gender pay gap is less clearly estimated, while wages in the north-west are initially lower relative to the south-east, but increase more rapidly.   However more of the decade dummies were now statistically significant but have the same order of magnitude. The results appear robust to the exclusion of the period before 1540.

We then estimated the model on the truncated time period including the proportion of the population 5-14 or under but substituting a decade trend for the decade dummies as these are likely collinear with short term movements in the juvenile dependency ratio. The results

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[22] For example, if the mortality shock associated with the Black Death can be judged exogenous, the wage response can be used to infer population (see Clark, 2007; Scheidel, 2010).

are shown in table 6. The female dummy is now negative and significant and the time trend suggests further deterioration though it remains insignificant. Only the summary variable, 'works with an adult' out of the variables that attempt to capture supervision remains significant and then only in the wheat price model, which we suggest relates to children's involvement in new forms of work organisation where oversight and control was increasingly impersonal. Most interestingly, the percentage aged 5-14 in the population is negatively and significantly related to children's wages and children's wages decline slowly over time. While this offers some support for a Malthusian interpretation, children's wages responding to the potential supply of child labour, it has to be set against the positive implications of occupational restructuring and regional growth, as children moved to work in better paid jobs and growing towns and cities

Table 6. Determinants of children's real wages, real rewards to work per day worked, 1540-1860

	Real remuneration (price 1500kcal wheat)	Welfare ratio (Allen's respectability basket)
Constant	2.105**	1.100**
Age approx.	0.186**	0.120**
Possibly adult	0.301*	0.192*
Construction	1.586**	1.079**
Cottage industry	-0.099	-0.056
Manufacturing	0.305**	0.177**
Service	0.511**	0.304**
Distribution	1.183**	0.832**
Other occupation	0.232*	0.211**
Haymaking	0.742**	0.534**
Female dummy	-0.705	-0.632*
Female*time	-0.010	-0.005
Female*time2	0.000	0.000*
Board dummy	-0.265	-0.484
Lodging dummy	0.494	0.408
Clothing dummy	0.130	-0.075
Board*time	0.029	0.021
Lodging*time	-0.024	-0.019
Pay annual	-2.036**	-1.762**
Pay annual*time	0.033*	0.029**
Pay weekly	0.290**	0.154**
Pay for task	-0.434*	-0.458**
Identified as working 30 days or more	-0.455**	-0.247**
Census of poor	-1.005**	-0.545**
Make work scheme	-0.754**	-0.552**
Data from spinning wages	-0.515**	-0.312**

Region South West	-0.748*	-0.715**
Region South West*time	0.018*	0.016**
Region North West	-6.343**	-4.106**
Region North West*time	0.132**	0.086**
Region Other	-0.082	-0.059
Repeat observation	0.254**	0.173**
Paid with father	-0.159	-0.007
Works with father/mother	0.117	0.054
Works with an adult	0.043	0.148*
Time trend	-0.017**	-0.022**
Proportion in population (5-14)	-0.083**	-0.027*
Adjusted R squared	0.407	.419
F-statistic	61.684**	64.767**
Sample size	3177	3177
*sig. ≤ .05 **sig. ≤ .01		

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

 The possibility that child remuneration may have positive feedback effects on the proportion of the population aged 5-14, means that our estimate of the coefficient on the juvenile share of the population is biased towards zero. To correct for this we searched for an instrumental variable that is (1.) exogenous to child wages and (2.) correlated with the child share in the population. The infant mortality rate is one such variable. (1) is met because infant deaths in the time period were by and large caused by infectious diseases and so independent of the standard of living; and, (2) is met because for any given birth rate the higher the infant mortality rate the lower the share of children aged 5-14 in the population within the decade. Wrigley et al (1997, table 6.1, p. 215) provide a series for infant mortality. Unfortunately the series only covers 1580- 1849, so the time period under exploration is further truncated. The two stage least squares procedure (2SLS) involves estimating the proportion of children aged 5-14 using the same period infant mortality rate as an instrumental variable (and including the variables used to explain child wages as instruments and predictors) and then using the predicted age structure outcomes in an 'as if' second stage OLS regression of child wages to obtain a consistent estimate of the

coefficient on age structure.[23] To save space only the results with respect to the Allen basket methodology are reported here.

Table 7 column 1 reports the baseline OLS regression on the further truncated time period with results which are very similar to those reported in Table 6. The minor variations are readily explained by the loss of observations at the beginning, and, with respect to for example the smaller constant term, the end of the time period. Column 2 reports the model estimated using 2SLS as described above. [24]

In general, the coefficients and significance levels in the two stage procedure are very similar to those obtained with OLS. The most important difference is that the coefficient on the instrumented age structure variable is significantly larger. An interpretation here might be that the OLS coefficient is biased towards zero by positive feedbacks from children's wages to age structure via fertility, so purging the population proportion aged 5-14 of any such interdependence via instrumentation reveals a larger (negative) effect. Interestingly too in the 2SLS model the time trend is smaller and insignificant suggesting that once the age structure of the population is correctly estimated it mops up the hitherto unexplained time variance in wages. More work is needed to confirm these initially speculative findings.

Table 7. The response of children's real wages to demographic variables, 1580-1850

	Welfare ratio (Allen's respectability basket) OLS	Welfare ratio (Allen's respectability basket) 2SLS
Constant	1.171**	3.433**
Age approx.	0.124**	0.124**
Possibly adult	0.333**	0.243**
Construction	0.936**	0.924**
Cottage industry	-0.090	-0.086
Manufacturing	0.178**	0.270**
Service	0.353**	0.339**
Distribution	0.744**	0.739**
Other occupation	0.070	0.035
Haymaking	0.518**	0.435**
Female dummy	-0.532*	-0.596*

[23] To obtain valid test statistics and standard errors the second stage is not done manually but a 2SLS procedure used.

[24] The reduced form equation is not reported as it is statistically and theoretically irrelevant except for its generation of a useful IV (Studemund, 2001, p. 480)

Female*time	-0.005	-0.008
Female*time2	0.000	0.000**
Board dummy	0.139	-0.150
Lodging dummy	-0.061	-0.131
Clothing dummy	-0.133	0.009
Board*time	0.009	0.015
Lodging*time	-0.010	-0.010
Pay annual	-1.509**	-1.241**
Pay annual*time	0.024**	0.016
Pay weekly	0.188**	0.209*
Pay for task	-0.205	-0.300**
Identified as working 30 days or more	-0.218**	-0.203**
Census of poor	-0.431**	-0.388**
Make work scheme	-0.574**	-0.860**
Data from spinning wages	-0.278**	-0.411**
Region South West	-0.658**	-0.518*
Region South West*time	0.014**	0.011*
Region North West	-3.576**	-3.897**
Region North West*time	0.075**	0.080**
Region Other	-0.058	-0.035
Repeat observation	0.188**	0.176**
Paid with father	-0.001	0.000
Works with father/mother	0.058	0.014
Works with an adult	0.265**	0.253**
Time trend	0.010**	.002
Proportion in population (5-14)	-0.047**	-0.162**

Adjusted R squared	0.407	0.406
F-statistic	59.331**	59.094**
Sample size	3064	3064
*sig. ≤ .05 **sig. ≤ .01		

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

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 familiar in 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 both adult men and women. The repetition of patterns 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, the slow decline from these halcyon days, and the spasmodic recovery in the early industrial era, only consolidated well into the nineteenth century. Of course, all these findings depend on the assumption of an unchanging working year of 250 days. Our evidence makes clear that 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, 2016). 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 suggests interesting insight into the workings of historical labour markets that, in turn, call for further

investigation. 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 (2017) 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.

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.

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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-	55	28	4	74
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	9	9	171
1600-	23	19	7	391
1650-	43	38	5	203
1700-	15	12	2	476
1750-	16	12	2	752
1800-	10	7	3	1131
1850-	16	13	8	38

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	4.70	4.89	15	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	2.15	2.37	38	Yorkshire, textiles 1.5-2d Construction, Devon, 6d without board, 3d with board
1616-19	3.37	3.67	62	Norfolk, construction, 8-12d, no board
1630-9	3.84	4.04	94	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	3.00	3.82	21	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	2.54	3.72	40	Bucks, service, 1.03d-2.31d + board and lodging, aged 14 and 18, with board 3.38d-4.66d per day
1750-9	5.55	5.72	27	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.
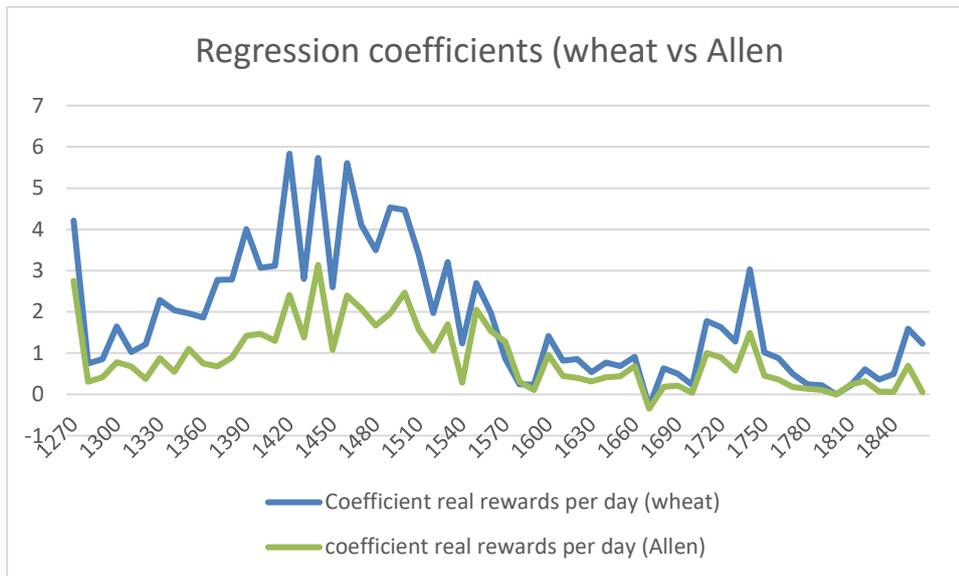
APPENDIX Table A.3

Values of children's pay and remuneration by decade (sample sizes in parentheses)

decade	cash wage (d per day) all children, with cash pay only	sample size	Rewards per day worked (i.e. food for work and non-work days) Allen basket (nominal)	wheat (nominal)	Real rewards per day worked Allen basket and cost-of-living	wheat price and p1500kcal
1270	2	1	2	2	3.8462	5.6568
1280	0.7411	31	0.8701	0.9253	1.7402	2.7223
1290	0.7569	23	0.6753	0.8651	1.2508	2.3587
1300	0.4988	110	0.6349	0.8834	1.1337	2.3219
1310	0.8091	13	0.9566	0.9765	1.4068	2.1161
1320	1.0353	29	1.1185	1.1345	1.8336	3.2276
1330	1.0538	26	1.0713	1.1431	2.0603	3.9271
1340	1.2792	24	1.3852	1.4044	2.5652	5.0797
1350	1.5463	36	1.6774	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	2	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	26	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	4.4631	18	4.676	4.7985	3.2699	4.4323
1570	4.4273	26	3.9869	4.1045	2.5889	2.6325
1580	2.9388	33	2.5823	2.7761	1.5279	1.9449
1590	2.2454	69	2.3419	2.4042	1.0272	1.442
1600	3.3014	12	3.7334	4.6008	1.7205	2.6834
1610	3.2986	65	3.7683	4.0204	1.5321	2.2771
1620	3.0192	162	3.2887	3.3941	1.1916	1.8499
1630	3.3491	121	3.5925	3.7308	1.22	1.7144

1640	2.4931	27	4.5135	5.6803	1.3197	2.3023
1650	2.854	27	4.2351	5.1556	1.4117	2.1835
1660	5.3897	38	5.9672	6.3685	2.2097	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	60	4.3191	4.8592	1.3049	2.1662
1700	4.0646	33	3.955	4.0505	1.3452	2.1086
1710	4.1011	18	4.5699	4.7539	1.5813	2.4807
1720	4.4154	47	4.5095	4.783	1.55	2.497
1730	2.0178	292	2.1217	2.1455	0.7316	1.3009
1740	7.7477	67	7.8167	7.9701	2.752	4.8164
1750	4.7236	47	5.2303	5.3664	1.7037	2.7824
1760	5.0643	75	5.2361	5.4009	1.5819	2.5766
1770	4.4829	84	5.2011	5.519	1.3907	2.256
1780	4.7079	203	4.9504	5.2348	1.3637	1.9869
1790	5.8227	322	6.0556	6.1827	1.3136	1.8602
1800	6.8741	175	7.331	7.673	1.2383	1.7212
1810	10.187	231	10.637	11.1006	1.6466	2.1595
1820	8.3188	68	8.617	9.235	1.7303	2.6718
1830	7.7658	484	7.8646	7.9237	1.6283	2.5482
1840	8.8546	154	8.9875	9.0394	1.823	2.9539
1850	11.7054	26	12.382	12.6149	2.5689	4.3224
1860	7	12	7.3016	7.2799	1.4123	3.0344

Appendix. Figure A.1

Comparison of coefficients real rewards to day of work, wheat variant with Allen variant.

Regression coefficients (wheat vs Allen

Coefficient real rewards per day (wheat)

coefficient real rewards per day (Allen)

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	
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

To illustrate: Thomas Lidgett began work scaring crows away from the corn for 2d a day with no perquisites. On the rewards to work criterion his daily remuneration was simply the 2d he earned but on a standard of living over the year criterion it was 1.37d ((2 x 250)/365). Several years later he was working as a farm servant earning £4 5s and being lodged and boarded. Assuming he worked 250 days, his cash remuneration per day was 4.08d. The price of 1500kcals was 2.92d so the daily value of his perquisites on the subsistence diet basis was 3.07d, but he received these for 365 days so their value per day worked was 4.42d giving him a total remuneration of around 8½d per day worked. But on any random day in the year Thomas was in receipt of his annual cash wage plus the annual value of perquisites divided by 365 or 5.87d ((1020+ (3.07x365))/365). In terms of the Allen baskets methodology, the day worker results remain unchanged but now when Thomas worked 250 days as an annual worker his remuneration per workday was 4.08d in cash plus ½ the value of an Allen 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). However, in any random day of the year he received 1020d/365 + 880/ 365 or around 5¼d.