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World Economic History

Chapter 12: The Industrious Revolution?

Introduction

England moved in the eighteenth century from a pre-industrial economy where technical change was slow and sporadic to a modern economy where technological advance is persistent and expected. Why this happened is one of the mysteries of economic history. Could changes in the desires and aspirations of ordinary people have triggered this change? What kind of world was pre-industrial England? Was it like the England of 1850 at the end of the Industrial Revolution, where manual workers worked long hours in a year long grind: typically 10 hours per day, 300 days per year? Or was it a world of leisure and laughter where people rested often, worked sporadically, and cared little for work and material consumption, preferring religion, festivals, love, sport and war?

Five separate lines of argument all seem to indicate that an **industrious revolution** occurred in England sometime before 1850.[1]

First many anthropologists believe that people in all hunter-gatherer and peasant societies work little compared to people in industrial societies. Marshall Sahlins and others argue that these communities are not harried worlds of constant labor to piece together subsistence, but societies with large amounts of free time: dubbed the "original affluent society" for their abundance of one commodity - leisure. Relying on the work of the Chayanov, for example, Sahlins argues that European peasant society was just such a leisured economy. Annual labor input for twenty five farms in the Volokolamsk Uezd in 1910 averaged only 132 days counting all types of work, not the 300 days of English agriculture in 1850.[2] If England evolved from a medieval peasant

[11] The term "industrious revolution" was coined by de Vries (1993).

[2] Chayanov (1986), p. 77. Chayanov notes that "In all areas investigated, farm families possess considerable stocks of unutilized time" (pp. 75-76). Chayanov argues that peasant families have limited material wants and labor only as much as is required to meet these.

society which was like pre-Revolutionary Russia, there must have been a transition from the society of "time affluence" to the industrial society of "material affluence."

Historians have detected in the medieval liturgical calendar signs of such a leisured society. Large numbers of feast days were listed by the church on which no "servile" work was to be performed. Celebrating these feasts also sometimes involved spending most of the previous day in preparation. Saturday also was for at least some partially a day of rest in preparation for Sunday. Many villeins in the thirteenth century were also allowed twelve days off at Christmas, and one or two weeks at Easter. "The abiding impression of the observer who stayed for any length of time would be how frequently men and women desisted from the major tasks of husbandry."

Secondly in England real **day** wages of artisans and laborers in the period 1400-1500 were at extraordinarily high levels. Figure 1 shows real day wages for farm workers in England from 1200 to 1849, as well as an earlier estimate of the real day wages of building craftsmen from 1260 to 1849. Wages in 1400-1500 were about one third higher than for similar workers in 1850 at the end of the Industrial Revolution. We saw above that Engel's Law implies that at high real income levels food expenditure should be a small share of income and hence the percentage of the population employed in agriculture should be smaller and the urban share of the population larger in 1400 than in 1850. Food products in the fifteenth century should have constituted no more than one third of output.[3] Yet there was so little urbanization even in sixteenth century England that it is widely believed that 75-80% of the population was employed in agriculture.[4] This creates a paradox. How could medieval English society spend only one third of its income for food products, yet need to employ most of the population in agriculture? We would escape this conundrum if annual incomes in pre-industrial England were much lower than the day wages suggest because workers worked few days per year, and few family members worked. Then a much larger share of income would be spent on food

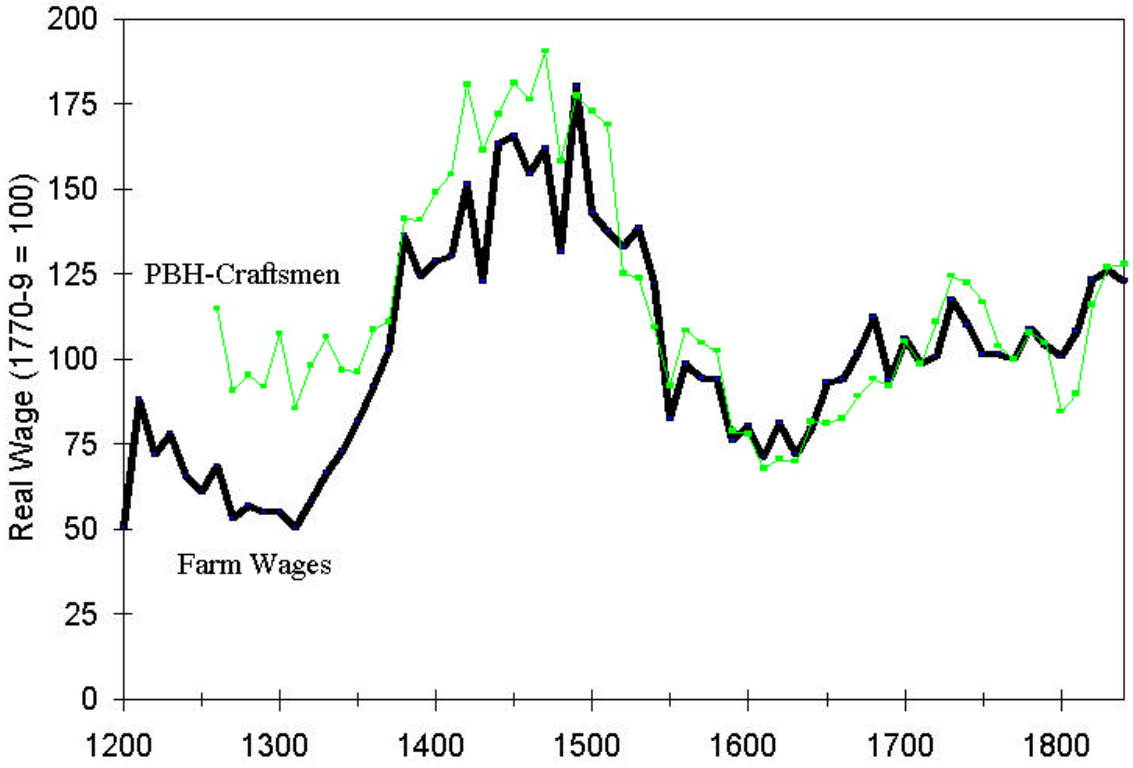
[3] Food consumption was less than 30% of total consumption in 1850, and agricultural workers were correspondingly only 25% of the labor force (though food imports by then were about 20% of consumption).

[4] See Wigley (1985), p. 700. Dyer has recently argued that the share of the population in urban areas was higher than previously estimated. But his estimates still only argue for a 20% urban share.

and a large proportion of the population would be employed in agriculture.

The same paradox appears within the agricultural sector. Little changed about the work of farm laborers between 1300 and 1850. The main tasks in 1300 - plowing, mowing grass, harvesting grain, threshing grain, spreading manure, and repairing fences and drains - were still the main tasks in 1850. They were still mainly hand tasks employing the traditional implements: only threshing had been partially mechanized by 1850. Yields per acre did increase but for most tasks the labor was dependent mainly on total output rather than the acreage cultivated. Dividing the inputs in each task into those dependent on yields and those dependent on area reveals that the doubling in yields from 1300 to 1850 would have increased output per worker by 20% only. In 1850 each male agricultural worker produced the equivalent of 250 bushels of wheat per year, thus feeding 3 families. Each full time worker in 1300 should thus have produced 210 bushels of wheat-equivalent per year, easily enough for 2.5 families at the lower real wages of 1300. In this case the share of the labor force in agriculture in 1300 should have been less than 40% of the population. This again contradicts the evidence from urbanization rates.

Figure 1: Real Agricultural Day Wages, 1200-1849



Notes: The figure shows decadal averages of real wages from 1200-9 to 1840-9.

Thirdly Jan de Vries recently posited just such an "industrious revolution" for England and the Netherlands in the seventeenth century. He argues here was a revolution in peoples' desires created by the appearance of a whole new set of consumer goods in the seventeenth century. The desire for these goods prompted families to labor more: men, women and children all worked more days per year to earn income to accumulate possessions. His argument stems from the evidence of probate inventories, which show for both England and the Netherlands that in the seventeenth century there was a steady rise in material possessions at death despite the fact that real wages increased little. This phenomenon extends all the way down the social ladder and appears from at least the mid seventeenth century. If we compare, for example, the inventories of a sample of households in England circa 1675 and 1725 we see substantial increases in the numbers of families recording various material possessions such as books, earthenware, knives and forks, mirrors, and so on. So wealth was clearly rising in the late eighteenth century even though wages were displaying no great upward trend. De Vries resolves this paradox by the "industrious revolution": annual family incomes rose because workers worked more days per year, and more members of the family worked for money.

Fourthly many historians have argued that the introduction of the factory system in the eighteenth century resulted in an increase in hours of labor through disciplining industrial workers who previously controlled their own time. Clark (1995) finds evidence that the introduction of the factory system in the late eighteenth century was associated with a rise in effective labor hours of as much as 30% for textile workers. Voth finds evidence for a significant increase in hours in London in the late eighteenth century from criminal court records (Voth (1996)).

Finally a curious phenomenon has been observed since the Industrial Revolution when we compare countries at different income levels. In high wage countries labor intensity, the amount of work delivered per worker per hour, seems to be much higher than in low wage countries. This appears in both agricultural and industrial tasks. Hand threshing, for example, was done in essentially the same way in both the rich countries of the north of the USA and Britain, and in the poor countries of Eastern Europe in the first half of the nineteenth century. Yet the number of bushels of wheat threshed per day per thresher was three times greater in the US as in Eastern Europe. Table 1 shows this variation. As can be seen the higher productivity of US threshers was associated with a higher wage (measured in the bushels of

wheat that one days wages would buy).[5] This naturally leads us to ask whether England was once like eastern Europe with a similarly leisurely work pace?

The same labor intensity disparities show up within factories in rich and poor countries in the nineteenth and twentieth centuries. These differences in labor intensity in textile work have been known since at least the 1840s when they were of interest because of debates about whether high wages in textiles in England would lead under free trade to the elimination of the English industry.

[5] We have to guard against the possibility that the higher work rate was induced by the high cost of labor, which induced employers to ask that workers do the task less carefully so losing more grain. But we can observe for Britain that even though the real wage of labor in terms of grain varied very much from year to year the threshing rate did not.

TABLE 1: BUSHELS OF WHEAT THRESHED PER DAY CIRCA 1800-1850

location	Threshing rate (bu. per day)	Wage (bu. wheat per day)
Northern US	6.8	.68
Britain	4.2	.25
Hungary	3.0	.28
Mecklenburg	2.6	.16
Bohemia	2.2	.16
Prussia	2.2	.14
Poland	2.2	.14

Source: Clark (1989), p. 982.

The phenomenon was so widely accepted that by 1866 Marx in Capital has a chapter where he explains national differences in wages as a result of differences in labor intensity, citing the example of the cotton industry.[6]

If these cross society differences in labor intensity existed by the nineteenth century it is natural to ask when they emerged. One possible picture is that each society follows a similar path to economic development where there is the establishment of the necessary pre-conditions for a "take-off" through first a change in work attitudes. An industrious revolution precedes the Industrial Revolution. Societies have simply followed this path at different stages, Britain being the first and then others following.

[6] Marx (1977), Chapter 22, "National Differences in Wages."

TESTING FOR AN INDUSTRIOUS REVOLUTION

The total work effort of each household is:

Hours worked per day ´ Days worked per year ´ Number in the household working

The surviving records from before 1800 rarely specify the number of hours worked per day, or the number of days worked per year. Nor is it recorded what percentage of women and children engaged in production.

We can, however, use straightforward economic reasoning to infer the effective hours of work per year for male workers going as far back as 1267. Consider first hours per day. Suppose we have a manual task which is unchanged over time and which produces a measurable output, such as threshing grain or sawing wood. Suppose also that the task is paid for sometimes with a day wage and sometimes through a piece rate. Then in a competitive labor market the amount of work completed per day by piece workers will be such that, approximately,

$$\textit{day wage} = \textit{work rate} \times \textit{piece rate}$$

$$\textit{work rate} = \textit{day wage/piece rate}$$

The work rate will depend both on the number of hours worked per day and on the intensity of labor per hour.[7] We can use similar logic to infer the days worked per week, and the days worked per year. Where the same workers were employed by the day or for the week then again

$$\textit{days per week} = \textit{weekly wage/day wage}$$

Where workers were employed by the year as well as by the day then in a competitive labor market the days per year similarly should be,

$$\textit{days per year} = \textit{annual wage/day wage}$$

[7] There may be a premium paid to piece rate workers as compensation for a greater risk of unemployment, or for harder work, in which case the units completed per day will be just proportional to the day wage divided by the piece rate. But as long as the premium does not change over time the relative work rate over time can be estimated from as above.

Now of course yearly workers may have much more security and thus accept a lower implied daily wage, or they may be the better workers, and so get a higher implied daily wage. But as long as the selection process is the same over time we can use these ratios to look at the movement of days worked per year over time.

There is a further way to check on the number of days worked annually. As noted above, nineteenth century budget studies of cross sections of agricultural workers suggest that there is a stable relationship between real income and real food consumption. The best fit for this relationship is a function of the form

$$(food_a) = c(wage_a)^b$$

where $food_a$ is annual real expenditure on food, $wage_a$ is the annual real income, and c and b are parameters. In this case b is the **income elasticity of demand for food**. b shows by what percentage food demand will rise when real income increases by 1%. For the poorest families in the nineteenth century b is about 0.6. For every 1% income increases food consumption increases by only 0.6%.

If N is the number of days worked per year by workers then we can rewrite this expression in terms of real food expenditure per day, $food_d$, as

$$365 \times (food_d) = c(N\, wage_d)^b$$

where $wage_d$ is the real day wage, since $wage_a = N\, wage_d$. Taking logarithms of both sides and rearranging , this gives[8]

$$ln(food_d) = ln(c/365) + bln(N) + bln(wage_d)$$

Thus if workers hired by the day typically worked small numbers of days in the years before 1700, their food consumption per day of work should be smaller than workers in the nineteenth century who typically worked 300 days per year. Figure 2 shows for 73 farm workers in England and Wales in the years 1834 to 1893 the food consumption relative to the day wages.[9] Also shown is the fitted relationship for these observations, when the expression

[8] Note that $ln(x \cdot y) = ln(x) + ln(y)$, $ln(x/y) = ln(x) - ln(y)$,and $ln(x^n) = nln(x)$.

[9] Real wages are normalized to those of the 1860s using the price index of Phelps-Brown and Hopkins.

$$Ln(food_d) = a + bln(wage_d) \quad (1)$$

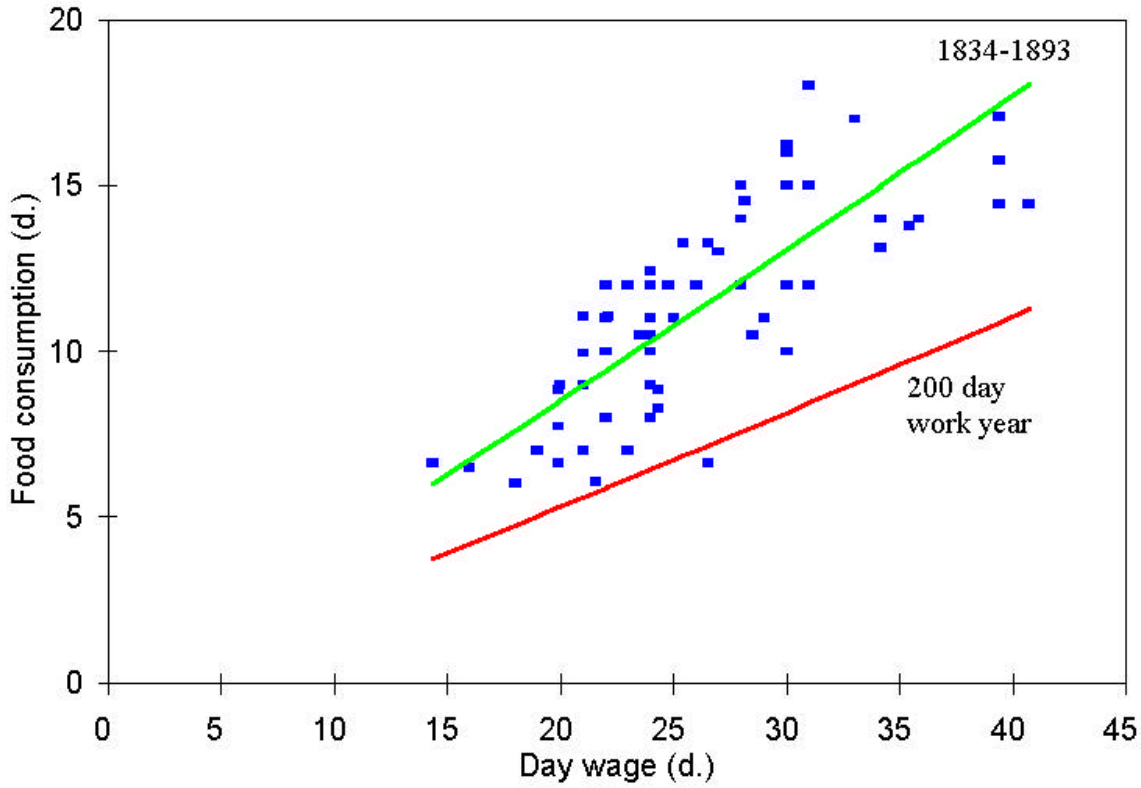
was estimated (*a* here now equals *ln(c/365)+ bln(N)).*

At the average wage of 25 d. per day, farm workers in the years 1834 to 1893 would receive food worth 11 d. per day if the farmer fed them, which was 42 percent of the wage. Only because laborers in the nineteenth century worked 300 or so days per year could they afford to both feed themselves on Sundays, buy shelter and clothing and provide for wives and children.

If, however, the number of days worked was lower in the years before 1700 then the same observations of real food expenditure versus real day wages will lie below the curve observed for the nineteenth century. That is, the amount paid to feed workers will be a smaller proportion of their daily wage than would be suggested by the real value of their daily wage if they typically work only a small number of days per year. Their food consumption per day is a measure of their annual real income. This annual real income can be compared to their daily real income to estimate the number of days they work per year.[10] Figure 2 also

[10] Christopher Dyer, for example, finds that the value of the food given to harvest workers increased sharply in the years after the onset of the Black Death when day wages without food were also much higher. Dyer (1989), pp. 158-9.

FIGURE 1: FOOD CONSUMPTION AND THE DAY WAGE, ENGLAND AND WALES 1834-1893



Note: The figure is based on 73 observations of the day wages of agricultural workers in England and Wales from 1834 to 1893 along with either the stated food allowance to workers per day, or the food allowance implied by the difference between wages with and without food. The day wage and implied food consumption was adjusted to the prices of 1860-9 using the Phelps-Brown and Hopkins cost of living index.

shows the food to day wage relationship where workers work only 200 days per year.

Hours per Day

We can infer "hours" of labor per day all the way from the 1260s to the 1850s using the payments by the day and by the piece to sawyers and threshers, since both these tasks seemingly changed little over this interval. But we must put the quotes around hours because what we are really estimating is the amount of work achieved, which is a combination of time and labor intensity.

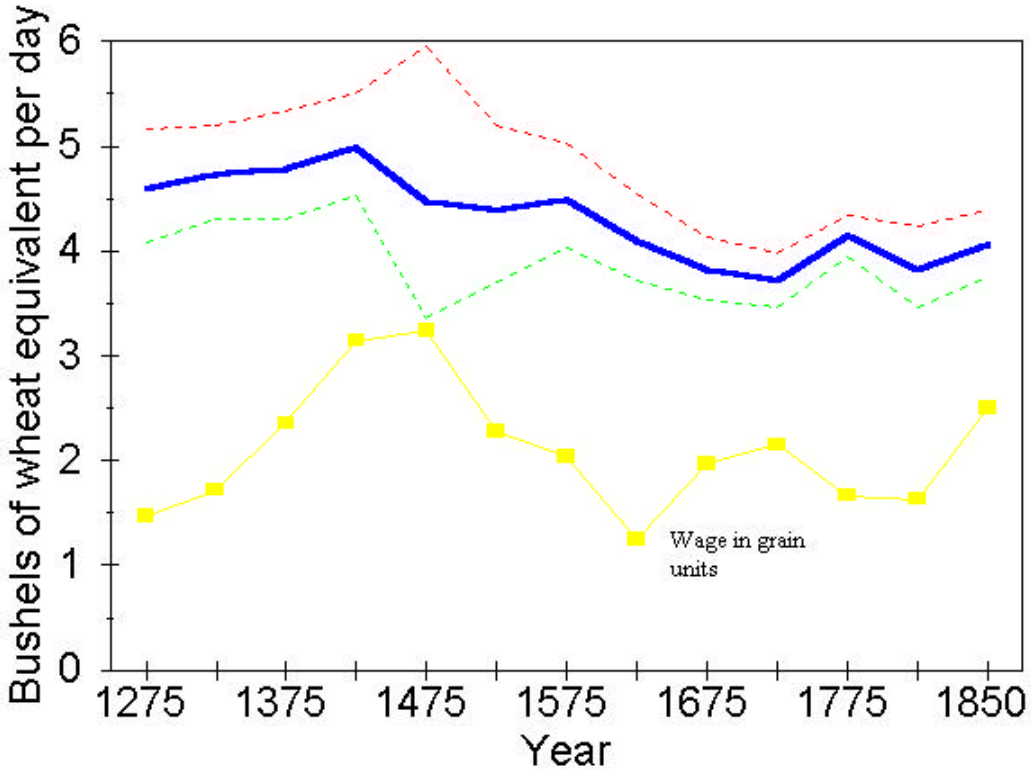
Sawyers worked in pairs and were paid either by the day or per hundred square feet of wood sawed. The saw used by sawyers was the two-man pitsaw, composed of the blade and the "frame" which was the handle which held the blade. One of the sawyers stood above or on the piece of wood while the other, the pitman, stood below. The only documented innovation in the pitsaw between 1267 and 1850 was the introduction of the "open" pitsaw sometime in the interval 1630 to 1760. Until 1450 it appears that all pitsaws were "closed" meaning that the blade was attached to the center of a rectangular wooden frame. The "open" pitsaw had only a wooden handle at each end of the blade which allowed the saw to cut wood of any size but should have had little effect on work rates. While this is the only documented innovation there may have been other incremental improvements in the design of the blade, such as the introduction of blades that tapered inwards towards the teeth so as to reduce the friction of the blade against the wood. Such innovations would increase the work rate. But while it is impossible to rule them out they imply only that any increase in the calculated work rate might be the result of technical change as opposed to more intense work.

Throughout northern Europe from 1200 to 1850, grain was threshed by beating the harvested stalks with a jointed wooden stick, known as a flail, to separate the grain from the stalks. After threshing, the grain was separated from the chaff by winnowing. The most primitive methods were to toss the grain into the air and let the breeze carry away the chaff, or to toss the grain lengthwise along the barn floor so that the resistance of the air sorted out the grain which flew further than the lighter chaff. From an early date wooden winnowing machines that created their own breeze from a hand cranked fan were also used.

Figure 3 shows the amounts threshed per day from 1250 to 1850. As can be seen if anything the rate declines over this time.

For sawing the picture is somewhat different. As figure 4 shows there is an increase of almost 80% in the number of feet sawed per day between 1300 and 1800. The increase is concentrated in two periods however. The work rate is fairly constant from 1280 till the early 15th century. It then jumps nearly 40% between 1425 and 1475. Thereafter the rate is stable at a little over 100 square feet per day until the late eighteenth century. There is a further increase of about 20% in the sawing rate in the late eighteenth century, though here there is so little data that this may be a result of errors in the data. This shows up in the wide error bands of the later observations.

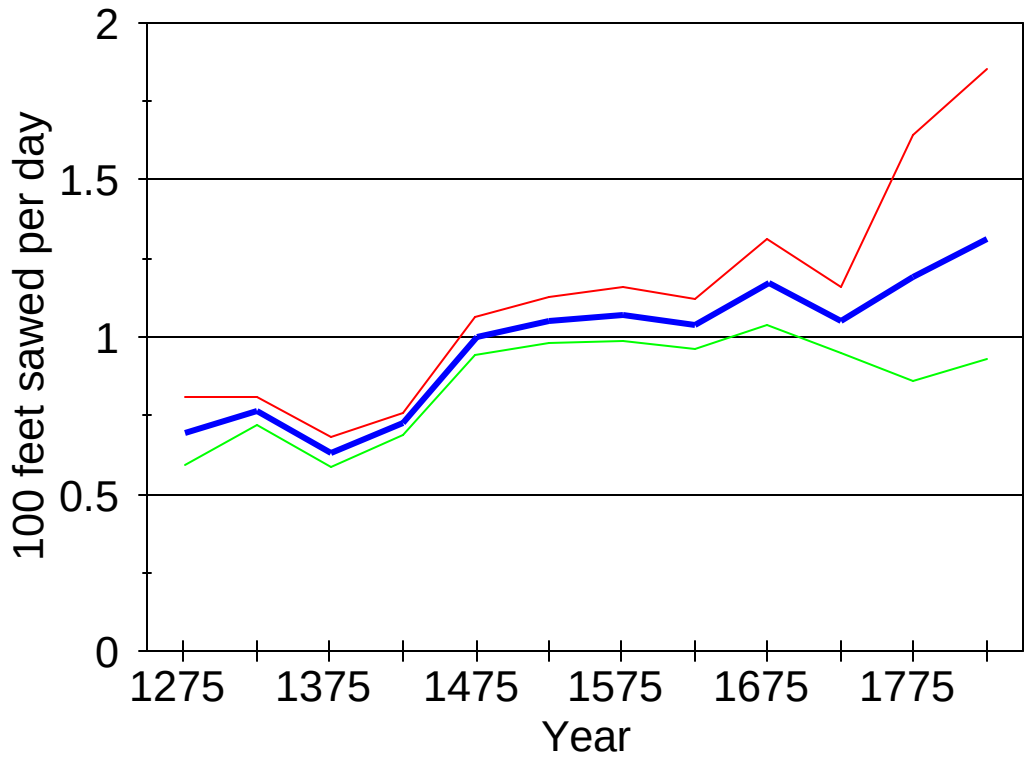
FIGURE 3: BUSHELS OF WHEAT THRESHED AND WINNOWED PER DAY, 1267-1850



Though the overall rise in sawing rates is consistent with an industrious revolution having occurred in pre-industrial England several factors suggest that the increase was more likely caused by improved sawing technology or a change in the way the hundred feet was measured. The greatest increase in rates, of about 40% occurs between 1420 and 1460. In this same period the threshing rate does not change as would be implied by an industrious revolution. The later increase in rates in the late eighteenth century is based on only 9 observations, and occurred at a time when mechanical saw mills began to replace hand sawing. What is very clear from the sawing data is that nothing happened between 1500 and 1750, the period de Vries identifies as that of the industrious revolution.

Thus taken in combination the threshing and sawing data suggests little gain in hours or intensity of work all the way from 1267 to 1850. Workers seemingly did as much per day in medieval England as in England at the end of the Industrial Revolution.

FIGURE 4: HUNDRED FEET SAWED PER DAY, 1280-1800



Notes: The thin lines show the 5% confidence intervals for the estimated sawing rate in each period.

MEN'S DAYS PER YEAR

Rural workers may have worked long and hard on the days they worked, even back in the middle ages, but how many days per year did they work? Accounts of the complete days worked per year by workers are difficult tofind in the surviving farm accounts. But the evidence shows that even before 1750 some workers were putting in work years of nearly 300 days. Thus on the Harrold estate in Bedford over the account year 1647-8 four regular workers worked for this employer on average 291.5 days.[11] Of the 21.5 idle days per worker (excluding Sundays), 14 were potentially common to all the workers and may reflect regular holidays (four of these were from the Christmas/New Year period). The other 7.5 were definitely idiosyncratic to individual workers. The household accounts of a curate in Cambridge in 1705-6 show that Thomas Watson, an agricultural laborer, worked 296.5 days in one year.[12] On the Dryden estate in Northampton five regular workers who were employed in 1727-28 worked for this employer respectively 288, 264, 297, 296, and 300 days. For only 6 days in the year were all the workers absent implying that this was a general holiday. In Christmas week 1728, for example, all the workers only worked 5 days. Finally on the Oakes estate in Derbyshire in 1772 five regular workers put in respectively 308.5, 309.5, 311, 301 and 300.5 days for this employer.[13]

These estate and farm accounts, sparse though they are, do show that even long before the Industrial Revolution some rural workers were working 290 or more days per year. There was certainly no norm of short work weeks before 1770. Unless these regular employees were very atypical agrarian workers as early as 1650 had labor inputs not unlike full time workers in the nineteenth century.

Another source of evidence on annual days worked is the annual earnings of full year employees relative to the average day wage. Workers paid by the year typically received a cash wage plus food and

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[11] Assuming they worked a full six day week for the eight week harvest period where the information is incomplete. Bedford Record Office, Harrold MSS. TW 802/1-31.

[12] Brassley et al., Accounts, pp. 154, 167, 184, 194.

[13] Sheffield City Library, Oakes MSS, 1518.

lodging. Where we are told the value of that food and lodging for the year we can infer the total value of the yearly wage. Assuming employers minimize labor costs this annual wage divided by the day wage will indicate the number of days worked per year by annual workers. Table 2 shows this evidence for the years 1560 to 1870. In 1867-70 the ratio of annual to day wages is close to the 300 days that other estate account evidence suggests was the work year. Arthur Young's data for 1771 suggests a very similar picture of the agrarian work year, with no strong sign of a much lower expected yearly labor input. The data from Holkham in Norfolk, and from three wage assessments for the early eighteenth century again suggest that workers employed by the year would be expected to work close to 300 days. The wage assessments for the sixteenth and seventeenth centuries, however, do allow for some possible increase in the normal work year. For by the time we get back to 1560 to 1599 the ratio of the maximum yearly to the maximum daily wage is down to 257 days, which would imply a typical work week of 5 days as opposed to the norm of six in the nineteenth century. There may have been modest increases in the expected length of the work year, though the wage assessments are a much more indirect source than actual transactions.[14]

There is no evidence on the annual wage of full time estate workers before 1560. The *famuli* on the medieval estates - ploughmen, carters, cow herds and shepherds - were employed year round. But David Farmer has argued that the *famuli* were not generally full time employees, but would have substantial farms of their own that they also tended to. Thus on two Glastonbury manors in the fifteenth century which listed the names of the *famuli*, he finds most of them also rented holdings, some of which were as large as 16 acres. He concludes of medieval estate workers "One must assume they were not so busy working for the lord that they had no time to work the lands they rented."[15]

[14] It is possible that adult males in 1850 worked more than in 1700 or 1600 by doing other work at by-employments beyond their 300 days of regular employment: either more days of work or work in the evenings. The data on "hours" per day and days per year from day wages would not detect this. But for rural areas in the 1850s the possibility of large scale by-employments by men seems remote.

[15] Farmer, "*Famuli*," p. . Not appreciating this Clark, "Productivity Growth" used estate workers annual wages to estimate the implied day wage of agricultural workers circa 1300. This wage was then used to compute an implied threshing rate, which was also correspondingly too low. Bob Allen pointed out the inconsistency of this threshing rate with other rates for the period.

There is evidence, however, on the ratio of wages with food to wages without food for the years 1280 to 1602, mainly for rural craftsmen. Figure 4 shows for these workers the day wages, measured in pence of 1860-9, and the implied food consumption.[16] Also portrayed is the best fit line when equation (1) is fitted to the data. In comparison the best fit line for the nineteenth century laborers is also shown. As can be seen workers before 1602 at a given level of real income consumed more food per day than those of the nineteenth century: 52 percent of the day wage as opposed to 42 percent. There is thus no evidence of any increase in days worked per year between the middle ages and the nineteenth century. Indeed in the years before 1349 artisans received 55 percent of their daily wages as food. This implies that even in the middle ages they had to work at least 201 days per year just to pay for their food alone. When we add in clothing and shelter, and support of women and children, the work year would have to be considerably longer.

The high implied food consumption per day of medieval workers argues that at a given day wage they had high annual real incomes, and thus must typically have worked as many days per year as in the nineteenth century.

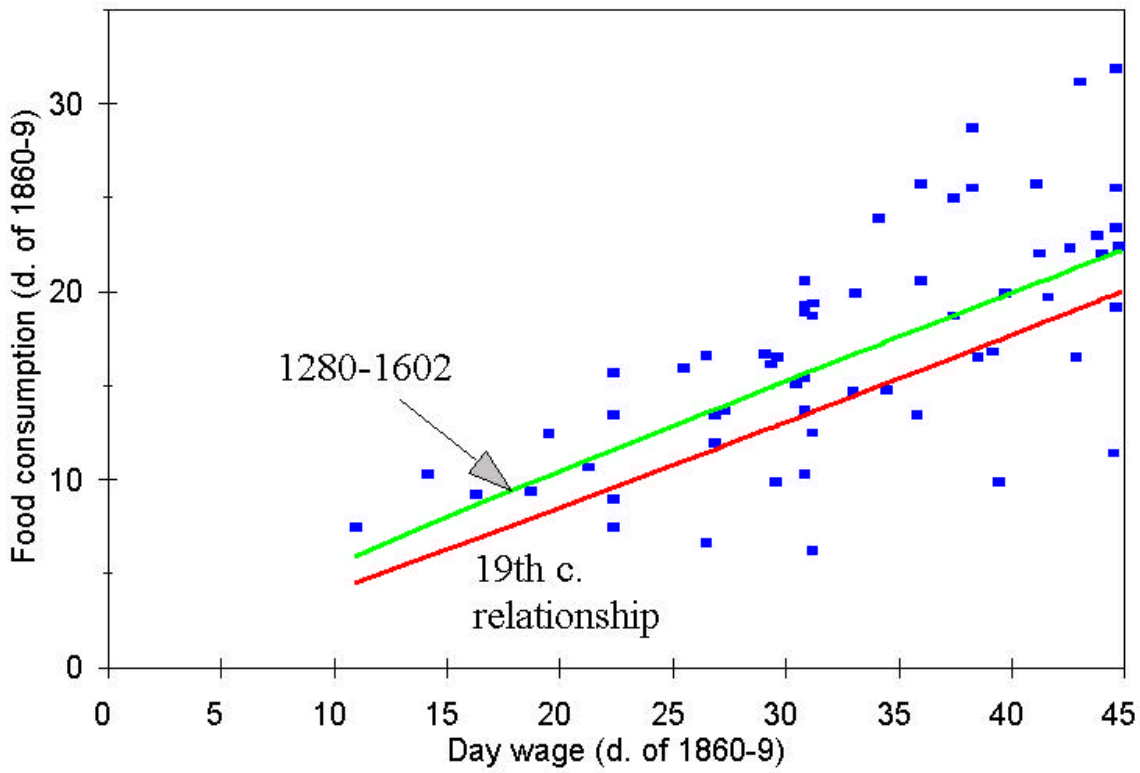
[16] For comparability with the nineteenth century agricultural laborers, only the 72 workers with wages below 45 d. per day are shown.

TABLE 2: INFERRED DAYS WORKED PER YEAR

Period	N	Annual Wage			Average Day wage	Implied Work Days per Year	Standard Error of estimate (days)
		Cash (£)	Food etc. (£)	All (£)	(pence)		
1867-9, England	7	£14.0	£21.8	£35.8	28.7	293	13.4
1867-9, Wales	5	£15.4	£14.6	£30.0	23.2	311	5.9
1870, Scotland [a]	27	-	-	£37.3	28.4	318	6.0
1771, England	10	£6.4	£9.1	£15.5	12.4	280	12.9
1733-6, Norfolk	24	£6.4	£12.0	£18.4	14.9	295	4.6
1700-32, England	3	£4.7	£8.4	£13.0	11.1	286	13.7
1685, Deptford	2	.	.	£31.2	24.0	312	-
1650-99, England	16	£3.9	£7.3	£11.2	10.2	276	6.5
1600-49, England	12	£2.2	£6.1	£8.3	7.6	266	5.9
1560-99, England	17	£1.8	£5.8	£7.5	7.1	257	4.8

Notes: [a]Annual wages in these cases are for plowmen, and day wages for ordinary workers. Ploughmen seem to have been regarded as slightly more skilled, which will bias upwards the estimated days.
The figures in italics are calculated from the wage assessments of local magistrates.

FIGURE 4: DAY WAGES AND FOOD CONSUMPTION, 1280-1602



Notes: The day wage and implied food consumption was adjusted to the prices of 1860-9 using the Phelps-Brown and Hopkins cost of living index.

THE LABOR OF WOMEN AND CHILDREN

So far we have examined only the labor inputs of adult males. For this group there is little sign of any "industrious revolution" in England. But labor input per family could also have been increased by higher participation rates in market work by women and children. Measuring the labor input of these other groups is, however, difficult. We can safely assume that almost all adult male workers engaged in labor, so all we need to do is estimate how hard they labored. For women and children we can make no such presumption. We need to know how many engaged in labor, and how long they worked.

The manorial and estate records we have used to infer adult male labor patterns are not helpful here. Women and children appear much less frequently than men, but that could be because they engaged more in small scale industry than in agricultural and building labor. They may also have engaged in production activities which left no documentary trace such as gleaning after harvest, vegetable gardening, keeping cows on the village common, and domestic clothing production.

While it is impossible to estimate the amount of labor performed in general by women and children including non-market production, we can find some evidence that suggests that the increase in *market work* by women and children between 1300 and 1850 was probably of less significance to overall labor input in the economy than de Vries would imply. Table 3 constructs an estimate of the share of total earnings in England in 1851 which came from the labor of women and children, using the census as a base. Horrell and Humphries argue that the census did not count as occupied a large number of married women whose work would have been part time. Thus the census lists counts only about 300,000 out of 2.9 million married women aged 15 to 64 as having an occupation even though Horrell and Humphries estimate that in laboring families 45 percent of women in this period earned some income. Table 3 thus estimates the earnings of married women using Horrell and Humphries estimates of participation and earnings. For unmarried women the census figures are used, and the wage is assumed to be half that of men (since the unmarried women were disproportionately young). For children again Horrell and Humphries numbers for participation and earnings are used, since these suggest many more were occupied than the census lists.

Even with these corrections, however, it emerges that even in 1851 at the end of the supposed Industrious Revolution women and children

earned only 21 percent of market incomes in 1851. Indeed the labor of all children aged 5-14 is calculated as being only 4.1 percent of all labor income, and that of married women is again only 4.1 percent of all income. Thus even if no married women or children were engaged in the market economy before 1700 the total labor supply per capita would have been only 8 percent smaller. If adult males, and adult males only, labored in England before 1700 the labor supply would have been 21 percent less.

This census evidence that women's and children's work did not add much to family income is corroborated by surveys of family earnings for poorer workers in Britain in 1790 and 1862. We find in these surveys very small earnings by other resident family members, both circa 1790 and in 1862. Since the 1862 survey allows us to divide up families only into four categories "adult male," "wife", "children under 10 years of age" and "children 10 or more years of age" we give in table 4 the figures for both 1790 and 1862 in this form. The

TABLE 3: OCCUPATIONS AND EARNINGS IN 1851, ENGLAND AND WALES

	All	Occupied	Earnings (Men=1)	Percent of All Occupied	Percent of All Earnings
Men (15-64)	5,213,934	5,029,810	1.00	56.0	79.0
Women (15-64)	5,349,028	2,931,148	-	32.7	16.9
[a]**Wives**	2,863,522	1,297,175	0.20	14.5	4.1
Unmarried	2,485,506	1,633,973	0.50	18.2	12.8
[b]**Children (10-14)**	1,913,357	866,751	0.27	9.7	3.7
[b]**Children (5-9)**	2,092,359	148,558	0.18	1.7	0.4

Note: [a]The census of 1851 only ascribes occupations to about 300,000 of the 2.9 million married women. Horrell and Humphries argue that many more of these women would be wage earners. Thus for married women I calculate the occupation rate and relative earnings using the numbers reported for working class families by Horrell and Humphries "Women's Labour" pp. 98, 107 for the period 1846-65.

[b]The occupation rate and earnings for children 5-9, and 10-14 is calculated from Horrell and Humphries "Exploitation" pp. 497, 500 using the information for the period 1840-72.

TABLE 4: EARNINGS OF FAMILY MEMBERS OTHER THAN FATHER

Family member	Earnings as a fraction of adult male		
Year	1790	1862	1862
Type of family	farm	farm	urban
number of families	169	368	57
husband	1.00	1.00	1.00
wife	0.11	0.06	0.11
Children > 9	0.13	0.20	0.41
Children < 10	0.01	-0.00	-0.03
all other family members together	0.26	0.31	0.55

earnings of agricultural and non-agricultural workers in 1862 are estimated by regressing total family income relative to the husband's income on the number of wives in the household (1 or 0), the number of children 10 years old or older, and the number of children less than 10 years old. As can be seen children less than 10 reduce family income in both agricultural and non-agricultural families.

They presumably do this by requiring care which reduces the market labor input of adult women and older children. In contrast the 1790 figures show the average earnings of each category of family member independent of their external effect on the earnings of others.

What is clear from the table is that even after the supposed industrious revolution the earnings of women relative to their husbands' are very small. Wives consistently earn only about 10% of what husbands earn. Even if married women in the middle ages did no work that generated cash income family incomes would have risen little as a result of their greater participation.

Further there is limited, but suggestive, evidence that women were very active in the wage labor market as early as the fourteenth century, and indeed may have been as active as they were in 1851. When the Black Death drove up the market wage rate after 1349 the authorities tried to regulate wages through the Statute of Labourers. Laborers were required to take no higher wages than was customary before 1349. If demand for male and female labor moved up equally after the Black Death, and men and women were equally likely to be prosecuted for breaking the statute, then the fraction of those presented should indicate the relative proportion of men and women in the wage labor force. Simon Penn summarized the numbers of male and female workers at a variety of locations in the years 1352 to 1360.[17] Overall nearly 30 percent of 818 workers presented for taking excessive wages were women. If there were equal numbers of men and women in the population this implies 41 percent of women in the medieval period were active in the labor force. Table 2 suggests that 55 percent of women in 1851 were active at least part time in the labor force. But the number of women working at any given time was more likely around 40 percent, given the relatively low earnings of married women. If the chances of running afoul of the Statute of Labourers depended on the activity level also, then it is quite possible that these prosecution records

[17] Penn, "Female Wage Earners."

are the result of as high a level of activity by medieval women in wage labor as by women in the nineteenth century.

THE INDUSTRIOUS REVOLUTION?

While the evidence presented above is tentative and to some degree contradictory, we see that on balance there is little sign of an industrious revolution of any consequence either in the years 1750 to 1800 as favored by Voth , nor in the years 1600 to 1750 as favored by de Vries. Male threshers did not change their work rates in either of these periods, and while sawyers may have seen an increase in feet sawed per day from 1750 to 1800 there are few observations in this period. The work year of those regularly employed on farms seems to have been close to 300 days even in the eighteenth century. In the sixteenth and seventeenth century the wage assessments suggest there may have been a work year of only around 260 days, but when we look at food consumption in the years before 1602 compared to the nineteenth century it appears as though even medieval workers must typically have worked a full year. For women and children the evidence is fragmentary, but suggests that any rise in wage labor input would be a small fraction of the total labor inputs in 1851.

The existence of a pre-industrial "industrious revolution" thus is at the best an open question. Indeed on balance the evidence seems to suggest that even in the middle ages labor input per person in England was at high levels. The fabled medieval world of laughter and leisure may turn out to have been instead a more familiar landscape of routine and drudgery.

This has three major implications.

(1) Medieval England, by anthropologists standards, was a highly unusual pre-industrial society. Labor inputs for adult males were at very high levels. Indeed the balance of the evidence is that they were working as long and as hard as the 300 day grind of 1850.

(2) These high levels of labor input per year, combined with the high day wages, imply that medieval England was materially a wealthy society even by the standards of the mid-nineteenth century.

(3) The wealth of the society, combined with the high levels of labor input in the agrarian sector implies that medieval England was not only

relatively wealthy, it also had to be relatively industrialized. We see above that there was the same relation between food and lodging consumption and wages in the years before 1400 as in the nineteenth century. In that case given the high wages of England in 1400 it must have been as industrialized as in 1850. Annual income levels were too high for England to have been a largely agrarian economy even in the middle ages.

FURTHER READING

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