Spinning the Industrial Revolution

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Abstract

The prevailing explanation for why the Industrial Revolution occurred first in Britain is Robert Allen’s (2009) ‘high-wage economy’ view, which claims that the high cost of labour relative to capital and fuel incentivized innovation and the adoption of new techniques. This paper presents new empirical evidence on hand spinning before the Industrial Revolution and demonstrates that there was no such ‘high-wage economy’ in spinning, a leading sector of industrialization. We quantify the working lives of frequently ignored female and child spinners who were crucial to the British textile industry in the Early Modern period with evidence of productivity and wages from the late sixteenth to the early nineteenth century. Our results show that spinning was a widespread, low-wage, low-productivity employment, in line with the Humphries (2013) view of the motivations for the factory system.

JEL Codes: J24, J31, J42, J46, N13, N33, N63, O14, O31

Keywords: hand spinning, women’s wages, Industrial Revolution, textiles, Great Divergence, High Wage Economy interpretation of invention and innovation
The handloom weaver and the coal miner are the tragic heroes of nineteenth and twentieth century British economic history, their skills rendered redundant, their livelihoods decimated and their communities destroyed by the onward march of economic progress. One figure is missing from this iconic company: the hand spinner. The spinner shared a similar fate in the technological changes of the late eighteenth century, indeed the demise of her trade was perhaps more brutal than the later and prolonged agonies of the weavers or the miners. Yet until recently hand spinners have been overlooked in the historiography of industrial change, partly because they were almost exclusively women and children who spun alongside domestic work, making their occupation nearly invisible.¹ A spotlight has suddenly been shone on these long-neglected workers by a new interpretation of the Industrial Revolution.

The currently popular explanation of why Britain was first to industrialize is Robert Allen’s ‘High wage economy’ (HWE) thesis, which claims that the high cost of labour relative to capital and fuel in Britain, but not Europe or Asia, incentivised innovation and the adoption of techniques that enabled Britain to access a new and superior growth trajectory.² Allen places the spinning jenny among the key innovations of the period, and he relates both the location and precise timing of the invention to a boom in the wages of English hand spinners. ‘[I]t would not have paid to use spinning machines before the eighteenth century: hence, they were not invented earlier. The analysis of profitability turns on the history of women’s wages relative to the cost of spinning machinery’.³ For Allen, it was spinners’ high wages that prompted the inventions and innovations of the late eighteenth century and placed the textile industry in the vanguard of the first Industrial Revolution.

The HWE interpretation requires that the costs of hand spinning rose from the late seventeenth to the mid-eighteenth century, prompting technological change.

¹ Most searches on library resources report large numbers of references to handloom weavers and
Investigating this hypothesis is made difficult not only by the fragmentation of sources but also by the nature of remuneration, almost always via piece rates. Estimates of spinners’ weekly or daily earnings involve observations of these piece rates, i.e. payments per quantity of material processed, and the productivity of spinners, i.e. how much material was processed per unit time. Wages computed using piece rates and productivity can then be compared with other evidence on wages in spinning and comparable occupations and scrutinized to see if they did march upwards, encouraging mechanization.

To date the evidence for spinners’ inclusion in the HWE has been thin. For spinners’ wages, Allen relies on pioneering estimates by Craig Muldrew that also provide the backdrop to our empirical study.\(^4\) While a landmark, Muldrew’s research is overly dependent on the impressions of peripatetic social commentators who differed from the spinners by class and gender.\(^5\) His assumptions about productivity, alleged piece rates, inferred earnings per pound of fibre processed, and the resulting claims about day wages are all heavily reliant on circumstantial evidence compiled by biased observers and likely to overestimate the level and growth of wages.

This paper offers fresh evidence based on recorded production, piece rates, and therefore computed earnings; these figures are supplemented by direct observations of spinners’ actual remuneration by the day or week. Our sources include the records of putting out networks, spinning schools, poor law accounts, farm accounts, diaries, and workers’ commonplace books. While confirming the importance of spinning employment and the extent of participation, our evidence rebuts the claim that spinners were part of the high wage economy, and that time

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trends in their wages explain the invention of the jenny or water frame. Instead
spinners’ remuneration appears in sync with recent evidence on women’s day
wages. Reflection on the organization of hand spinning as independent local
networks of spinners and weavers gave way to larger-scale production systems
within which isolated female spinners faced powerful yarn manufacturers who often
acted as monopsonistic cartels, along with the widespread involvement of the poor
law in the organization of spinning and the supply of spinning labour, suggests why
spinners may have been excluded from the HWE.

The paper is organised as follows. The first section provides a more detailed
account of the recent rediscovery of hand spinners and describes how they have
been included in the HWE. We question the Muldrew-Allen empirical strategy for
its reliance on the hearsay evidence of social commentators who were likely to
overestimate spinners’ remuneration. The extension of the spinners’ wage series into
the mid-eighteenth century is shown to rest on particularly limited evidence. In
section II, new and robust data provides the basis for estimates of productivity,
which paint a more pessimistic picture of the amount of yarn that spinners could
produce. Spinning was not an easy task, nor was it readily combined with childcare

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7 Other authors have been critical of the HWE interpretation of mechanisation: John Styles has
emphasized the resort to machinery as a way of overcoming the technical challenges that the industry
Anglo-Japanese Conference of Historians, University of Osaka, August 2015, while Jane Humphries
has claimed that mechanisation, especially the development of the factory, was motivated by the
desire to use cheaper child and female labour in a way that ensured discipline and quality control, see
‘The Lure of Aggregates and the Pitfalls of the Patriarchal Perspective: A Critique of the High Wage
418. Other authors have provided an internal critique by questioning Allen’s profitability
computations, see U. Gragnolati, D. Moschella, and E. Pugliese, ‘The Spinning Jenny and the
Industrial Revolution: A Reappraisal’, *Journal of Economic History* 71 (2011): 97–120. There are links
here to an older literature which saw mechanisation and the factory as the product of either the
search for standardisation, see R. Szostak, *The Role of Transportation in the Industrial Revolution*
(Montreal, 1991), or control see S. Marglin, ‘What Bosses Do’, *Review of Radical Political Economics* 6
and domestic work, as often assumed. Section III combines our productivity estimates with direct observations of historic piece rates to generate computations of likely earnings. Piece rates are taken from our preferred sources: clothiers’ and merchants’ own reports or the statements of spinners’ themselves and surviving business records and wage books. Our piece rate evidence is checked by comparing it with estimates of value added in yarn manufacture by fibre based on probate inventory valuations of fibre and yarn. The latter provide a novel independent approach to the valuation of spinning by way of the financial margins available to clothiers from which to pay spinners. Section IV combines our computed wages with four other types of wage observations: first, an expanded set of estimates drawn from contemporary commentaries, called here ‘Indirect Claims’; second, a collection of ‘Wage Assessments’ based on local labour market regulations; third, a compilation of estimates offered by workers and clothiers themselves, classified as ‘Direct Claims’; and, fourth, a set of wages recorded as paid in contemporary business ‘Accounts’. These different types of evidence are used to build up a multi-sourced picture of wage levels and trends. Section V combines the resulting series with a cost of living indicator to derive trends in real wages, and compares them with other benchmarks including the Humphries-Weisdorf series of women’s wages. Section VI reflects on the reasons why spinners wages might have been held back even in the face of industrial growth, compares our findings with Muldrew and Allen’s recent figures, and challenges the claim that spinners were part of the HWE. We conclude by proposing an alternative explanation for mechanisation in spinning that combines our wage and productivity data with the limited contemporary evidence for the motivation of the inventors.

8 Spinning’s dismissal as unskilled reflects the condescension towards the attributes of women’s work that has long marked labour market studies, see S. Horrell, J. Rubery and B. Burchell, ‘Gender and skills’, Work, Employment and Society (1990): 189–216.
9 These observations involve revisiting the type of source given precedence in the calculations of productivity.
10 Humphries and Weisdorf, ‘Women’s Wages’.

Humphries and Schneider | Spinning the Industrial Revolution 5
Although gender historians have noted the extent and importance of hand spinning, for mainstream economic historians it was Craig Muldrew who rescued the domestic spinner from obscurity. Muldrew’s main aim was to establish the extent of employment in spinning and to demonstrate that it constituted the largest single manufacturing occupation, but he also sought to estimate the remuneration of spinners and their contribution to family incomes. His findings were startling. Spinning emerged as a massively growing sector, by 1750 involving over a million women and children whose earnings constituted often more than a third of poor families’ incomes. Moreover Muldrew’s estimates suggested that spinners’ earnings had increased over time and grown rapidly from the beginning of the eighteenth century, which he interpreted as offering concrete support for Allen’s hypothesis: ‘The evidence of high wages in wool spinning across the eighteenth century also adds important evidence in support of Allen’s argument that high wages in England made investment in technological innovation cost-effective’.

Muldrew’s investigation recognised the difficulties created by different fibres, the production of which was often differently organised and measured. Even in wool, Muldrew’s main focus, there was a clear distinction between traditional types of cloth and newer styles, which required different preparatory processes and finer spinning. A key problem is that spinners were almost always paid piece rates, so much per pound spun, and so estimates of both earnings per unit time and employment per pound of raw material processed require information on productivity. But the length of yarn spun from a pound of fibre depended on its fineness, or count, which is rarely noted in historical sources. Finer counts of yarn were of higher value but took longer and perhaps more skill to produce, creating a

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12 Muldrew, ‘’Ancient distaff’’, 523.
trade-off that experienced spinners (and yarn masters) sought to negotiate in order to maximise (minimise) earnings.\textsuperscript{13}

Given the basic link between productivity and remuneration implied in piece rates, Muldrew’s strategy was to explore both together in the historical sources. He offered five estimates which link productivity, piece rates and earnings taken from the late sixteenth to the mid-eighteenth century. As these are the basis for Allen’s spinners’ wage series, they merit close attention.

The figures from 1588 and 1615 are taken from documents concerned with the state of the wool textile industry and particularly the employment potential of the ‘New Draperies’, as the finer lighter woollens were called, reproduced in well-known collections.\textsuperscript{14} The Tudor document was based on an inquiry by the ‘Vycare of Leedes’ and intelligence provided by a Rauf Mathewe ‘who ys very skelfull in all things apperteninge to his trade of clothinge’ and compares employment and earnings in the production of broadcloths and kerseys.\textsuperscript{15} According to Muldrew, it shows that spinners could spin and card 5.6 lbs of wool per week for broadcloths and 4.2 lbs for kerseys per week and that the pay was 3d a lb. However, while the document itself does list 30 people spinning and carding 12 stones of wool in broadcloths, (i.e. 5.6 lbs each), it records the spinning of 1 stone of wool as ‘xxd’ that is a rate of pay of 1.4d per lb. For kerseys, 40 spinners were said to process 20 stones of wool per week, that is 7 lbs, and the reward per stone was 2s 4d, that is 2d per lb.\textsuperscript{16} Nowhere can we see that spinners were paid 3d per lb. The figures for 1615 come from another comparison, here explicitly of employment and earnings in the production of ‘Old’ (traditional) woollen cloth and ‘New’ (the lighter finer worsteds) and, according to Muldrew, suggests that spinners earned 3d per lb in the former

\textsuperscript{13} Other aspects of the yarn could also command premia: consistency, strength, twist, and speed of delivery. Yarn for different uses had different requirements and yarn masters’ needed to organise production accordingly.


\textsuperscript{15} Tawney and Power, eds., \textit{Tudor Economic Documents}, vol. I, 216.

\textsuperscript{16} Ibid., 216–7.
but 9d per lb in the latter.\textsuperscript{17} The document does indeed suggest that it cost £1 1s to spin 3 tods (84 lbs) of wool in the old draperies, that is 3d per lb, but it is difficult to work out the reward for spinning the same quantity of wool for the new draperies as two figures are given for spinning costs, 6s ‘for spinning and draping the noils and coarse wools’ and £3 4s for ‘the spinning and twisting of the tire ? (sic) wool’ and the output was also split between stuff and stockings.\textsuperscript{18} The piece rate suggested by these figures is 10d per lb not 9d. More importantly, however, both sets of estimates were based not on actual practice but on claimed knowledge of far from disinterested commentators. Muldrew, himself, acknowledges that ‘This pamphlet was written in support of expanding the new draperies, so it might be exaggerated, but the rates and speed of spinning are similar to later accounts’ though the reference here is only to the document provided in Thirsk and Cooper.\textsuperscript{19} We retain these estimates for comparative purposes.

Moving forward to the eighteenth century, Muldrew’s third estimate is based on a pamphlet \textit{Great Britain’s Glory} (1715) written by yet another far from disinterested insider, wool merchant John Haynes. Haynes’ agenda is again a comparison of the value of Old versus New Draperies. He presents counterfactual accounts of the employment and costs of production implied in working up one pack (240 lbs) of wool into Old or New Draperies. In Old Draperies he does not provide the wages of spinners, though their productivity was around 7 lbs of wool per week, and, as Muldrew notes, Haynes suggests that they were well rewarded.\textsuperscript{20} In New Drapery production spinners could process less than 1 lb of wool per week but could earn 1s 5d on average. Those spinning for stockings were able to double weekly production and earn as much as 2s 6d, with the equivalent piece rates.\textsuperscript{21}

\textsuperscript{17} Muldrew, ‘‘Ancient Distaff’’, 505.  
\textsuperscript{18} Thirsk and Cooper, eds., \textit{Economic Documents}, 204.  
\textsuperscript{19} Muldrew, ‘‘Ancient Distaff’’, n.39, 505.  
\textsuperscript{20} Muldrew, ‘‘Ancient Distaff’’, 505.  
\textsuperscript{21} Actually .96 lb.
fourth estimate comes from *The weavers’ true case*, another polemical pamphlet, which suggests that 1.33 lbs of yarn was possible per week paid at 2s.\(^{22}\)

Muldrew admits that these sources were not impartial, but likely ‘…arguing from interested positions’, defending the position of the new draperies by claiming that they generated greater employment and superior wages. The most important point however is that none of these estimates relate to actual volumes of yarn processed per unit time nor the piece rates paid and wages received but to claims made by parties whose sources of information are obscure and whose position on the points at issue was partial.

Muldrew’s main source for the key decades of the mid-eighteenth century is the papers of a cloth manufacturer, Thomas Griggs of Ballingdon. Griggs’ accounts have survived as an unintended consequence of a family dispute that went to law and so provide unvarnished insight into trade conditions and the remuneration of spinners. In the 1740s and 50s, Griggs operated within a putting out system to produce two types of worsted cloth: bunting, a coarse cloth used extensively by the Navy, and says, a much finer woollen product. Muldrew relies on the interpretation of the Griggs’ accounts provided in an article in the *Economic History Review* by K.H. Burley.\(^{23}\) Griggs paid his spinners various prices for yarn of different qualities, according to Muldrew, ‘… anywhere from 7d. a pound for the coarsest type of yarn up to 3s. a pound for superfine’ though he adds (somewhat enigmatically) ‘the price

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\(^{22}\) C. Rey, *The weaver’s true case* (London, 1719), 42–43.

\(^{23}\) K.H. Burley, ‘An Essex Clothier of the Eighteenth Century’, *Economic History Review* 2nd ser., XI (1958): 289–301. Burley also studied Griggs’ account books as background to his London PhD thesis ‘Economic Development of Essex in the Later Seventeenth and Early Eighteenth Centuries’, and, more importantly in our quest for spinning costs, he published an article in *Accounting Research*, which describes the documents in greater detail, see K.H. Burley, ‘Some Accounting Records of an Eighteenth Century Clothier,’ *Accounting Research* 9 (1958): 50–60. Muldrew does not appear to have consulted this article. In it Burley describes one account book as seeming to show individual issues of wool to spinners but notes that it was too fragile to use. A recent visit to the National Archive where these books are now kept suggests that since Burley’s work in the 1950s, the whole deposit has deteriorated, see C/104/17, 18, and 19, located in the National Archive as PIPER v GRIGGS: Title deeds, farming and tradesmen’s books (many in bad condition): Ballingdon, Essex.
actually paid could vary according to demand’. These figures are quoted from Burley who actually summarised the Essex clothier’s rates as ‘from seven pence per pound for the coarsest yarn to 1/6d for fine and up to 3/- for superfine’. Griggs also made a number of estimates of the costs of producing cloth of different qualities from which the spinning costs per pound of wool can be computed, two of which are reproduced in Burley’s article and cited by Muldrew as representative: ‘for the says [Griggs] was paying on average 15d per lb of wool spun and for the bunting 11d’. Several additional cost computations can be gleaned from Burley’s thesis and a further paper published in Accounting Research and these suggest that for the cheaper says Griggs only paid around the same rate as for the bunting yarn, while for the Borsleys, also a kind of say, he only paid $9\frac{1}{2}$d per pound for spinning the weft and 10d for the warp. Burley reported that some 40 such costings were identifiable in Griggs papers, and although the deposit has deteriorated considerably since the 1950s, 31 such computations were located. These are summarised in Table 1. below, and show that while even for the bunting 11d was above the average, the rates cited for the says are at the high end of what Griggs expected to pay.

**Table 1: Spinning costs per pound**

<table>
<thead>
<tr>
<th>Type of cloth or spinning</th>
<th>Number of costings</th>
<th>Maximum piece rate</th>
<th>Minimum piece rate</th>
<th>Mean piece rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Says</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warp spinning</td>
<td>19</td>
<td>13.3</td>
<td>8.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Weft spinning</td>
<td>19</td>
<td>18.0</td>
<td>7.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Bunting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warp spinning</td>
<td>12</td>
<td>13.0</td>
<td>8.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Weft spinning</td>
<td>12</td>
<td>12.8</td>
<td>6.9</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Source: NA C/104/17, 18, and 19.

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24 Muldrew, ‘“Ancient Distaff”’, 507.
27 Burley, ‘Some Accounting Records’, 56ff; see also Burley, ‘Economic Development of Essex’.
28 National Archive, C/104/17, 18 and 19.
More important still, Griggs rarely paid his spinners the quoted rate for the job, but rather a discounted rate that represented market conditions. In ‘Essex clothier’ Burley graphed the discount from the par price for 1747–59 showing that parity was only achieved a couple of times, interestingly in 1751, at a time when the price of spinning was increasing, and when the highest rates are recorded in Griggs’ cost computations. For most of the period a discount of over 2 per cent applied. While extracts for one accounting book show the rates ‘spun to’ hovering around 10d per pound, those actually paid were just over 7d and on one occasion fell to 6.9d. That Griggs could compensate for poor market conditions by swift discounting of spinning rates suggests a market power to which we will return.

Muldrew takes the productivity estimates promulgated in the contemporary literature and combines them with piece rates as reported in similar sources to generate estimates of wages. He also cites the wages that contemporaries again thought representative. Allen extracts headline figures for the period up to 1760 from this account and these are reproduced from his web pages in Table 2 below. In Allen’s ‘Restatement’ he describes his series as extended through the industrial revolution, that is from 1770—a period not covered by Muldrew—using evidence from a paper by Charles Feinstein. As the series reported on Allen’s website is identical to the figures offered by Feinstein (and unavailable in Muldrew) it is to be assumed that it too is taken from this source. These figures in particular, since they...

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29 Burley, ‘Essex Clothier’, 293. The discount from the par price was probably behind Muldrew’s comment that ‘the price actually paid could vary according to demand’ 507. Deductions from spinners’ remuneration were a common practice in the eighteenth century. See, for example, letters to Arthur Young in Annals of Agriculture VIII (1787), 353–354, Annals of Agriculture IX (1788), 336–338, 349–354, Annals of Agriculture XI (1789), 26. Account books also show that piece rates varied over the year by as much as 20% (e.g. Cambridgeshire Archives, P68/12/36–37).


31 Feinstein, ‘Wage-earnings’. In this paper Feinstein appears to have relied on the same conventional sources that dominate the traditional historiography (Mantoux, Eden, the contemporary county surveys) though how exactly he selected the 12d per day figure for the early 1770s remains unclear, see also C.H. Feinstein, ‘Conjectures and Contrivances: Economic Growth and the Standard of Living in Britain during the Industrial Revolution’, Discussion Papers in Economic and Social History 9 (1996).
move forward into the second half of the eighteenth century, provide the basis for
the inclusion of hand spinners in the HWE.

Table 2: Daily earnings of hand spinners in the High Wage Economy

<table>
<thead>
<tr>
<th>Year</th>
<th>Daily earnings (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1589</td>
<td>2.25</td>
</tr>
<tr>
<td>1615</td>
<td>2.67</td>
</tr>
<tr>
<td>1630–39</td>
<td>4.0</td>
</tr>
<tr>
<td>1687</td>
<td>3.8</td>
</tr>
<tr>
<td>1700</td>
<td>6</td>
</tr>
<tr>
<td>1750</td>
<td>8</td>
</tr>
<tr>
<td>1770–74</td>
<td>12</td>
</tr>
<tr>
<td>1775–89</td>
<td>8</td>
</tr>
<tr>
<td>1780–94</td>
<td>6</td>
</tr>
<tr>
<td>1795–1803</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: [http://www.nuffield.ox.ac.uk/People/sites/Allen/Documents/London.xls](http://www.nuffield.ox.ac.uk/People/sites/Allen/Documents/London.xls) Additional Wages, column S.

Summarising the historical record up to 1750, Muldrew concludes that ‘[T]here are many other examples of earnings but unfortunately they are almost never linked to the fineness of yard (sic) spun. However, there are enough data to show clearly that earnings for spinning increased very significantly, and that by the eighteenth century women and children could have earned much more from spinning than previously’. We agree that there are many other examples of earnings but we are less convinced about the gains that were made and remain suspicious of examples provided by commentators with particular agendas or limited direct knowledge. Even when provided by clothiers themselves reported wages were often part of an industrial relations spin to depict workers as well paid and employers as hard pressed. For example, putting-out merchant George Wansey grumbled in 1760 that spinners’ wages were ‘strangely advanced’. ‘Our workfolk are grown scarce, saucy and bad’ and he complained that ‘as a result I have not been

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32 Muldrew, ‘‘Ancient Distaff’’, 507
able to make as much cloth as I used to do; what I do make is made dearer and with more difficulty and trouble, that I believe that on the close of this year’s accounts I shall not have got … as much as last year by £100 or as in some former years by £200'.

Thanks to Julia de Lacy Mann’s meticulous work on Wansey’s papers we know that in reality he made £630 as opposed to £521 in 1759 though less indeed than in some earlier bumper years! Elsewhere in his papers, tucked away in a more honest moment in December 1760, he admitted that his brother John had sold cloth ‘at the most extraordinary prices’, cloth made of ‘sorn locks’ (the worst kind of wool) mixed with ‘coarse Spanish’ and for this he had paid 4½ d per pound for spinning.

Our empirical work includes material drawn from such prejudiced sources but it is tempered by more credible evidence from records of production and accounts of payments in point of fact made and received. We turn first to our estimates of material processed.

II

Productivity is a crucial determinant of hand spinners’ earnings and importance: lower productivity would mean spinners were paid less but more of them would have been needed to sustain supply. As we have seen, on the basis of scant and suspect evidence, it has been widely assumed that women could spin about a pound of fibre a day, except for the finer, half-worsted cloths of the New Draperies. Thus Muldrew assumes productivity levels of 2.5 lbs per week for New Draperies and 6 lbs for Old Draperies.

Herbert Heaton claimed that it took seventeenth century spinners in Yorkshire about two weeks to spin a stone (14 lbs.) of wool. Michael Roberts echoed the ‘pound-a-day’ consensus, which may have its origins in Frederick Eden’s influential claim to that level of productivity for single

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34 De Lacy Mann, ‘Documents’: 41; n.5.
35 De Lacy Mann, ‘Documents’: 46.
37 Muldrew, ‘“Ancient Distaff”’: 508–511.
women.\textsuperscript{39} Muldrew’s supplementary material uses the assumption that a married woman would spin about a pound of flax or hemp per day.\textsuperscript{40} A pamphlet from 1830 provided a more modest estimate for cotton of four pounds of weft per week.\textsuperscript{41}

In contrast to these scattered claims, we use primary sources that record spinners’ output to compute new estimates of productivity. Our sources vary in their detail and the type of information provided. One valuable source is poor law or charity employment creation projects but we also draw on yarn masters’ records and household and farm accounts. Some sources, such as parish account books, only record the total quantity of fibre spun on a monthly or weekly basis and payment for the yarn. The best sources give the names of individual spinners, sometimes with a clue to their marital status, the quantities spun in a defined period, and the payment for yarn produced. In exceptional cases it is even possible to determine the count of yarn spun, although such details are quite rare.

For wool, data are taken from a thorough set of account books for the workhouse of the parish of St Mary, Ely.\textsuperscript{42} Wool spinning data are also available in records of a short-lived spinning school in Nettleham, Lincolnshire from 1787.\textsuperscript{43} An invaluable source for the crucial decades of the mid-eighteenth century is a cashbook covering August 1758 to March 1759 located in the Griggs archive but apparently overlooked by both Muldrew and Burley.\textsuperscript{44} Among a variety of types of disbursements, this records payments made to 69 named spinners for ‘spinning work’ or ‘yarn’, allowing us to observe productivity, piece rates in operation and


\textsuperscript{41} Home Office Papers, 52/11/86, ff. 203–205.

\textsuperscript{42} Cambridgeshire Archives, P68/12/32–58.

\textsuperscript{43} Sheffield City Archives, EM/985.

\textsuperscript{44} National Archive, C/104/19, Cash Book No. 30, ‘Cash to Work People’.
wages, although alas we cannot always tell the age, gender or marital status of the
workers. An excellent account of flax spinning in Northamptonshire under the
supervision of Lord Rockingham’s niece has survived in the North Papers, and these
data have been supplemented with information on flax and hemp spinning from the
workhouse of the parish of St Mary, Lenham in the Kentish Weald.\footnote{Bodleian
Library, Lord North Papers, Ms. North 51. Kent History and Library Centre, P224/18/1.}
Observations from the Blenheim Papers support the Northamptonshire results for spinners’
productivity; flax spinners could produce around 2.1 lbs per week.\footnote{British
Library, The Blenheim Papers, Ms. Add 61680, ff. 83–90.} Cotton spinning
data are very scarce before the factory system, but a small account from the 1750s at
Marlborough in Wiltshire has survived, giving spinning quantities and dates for a
handful of spinners.\footnote{Wiltshire and Swindon History Centre, PR/Marlborough, St
Peter and St Paul/871/190.}

The records used for our productivity estimates are
summarized in Table 3 with further detail in Table 4.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
Location & No. of Spinners & Married Women & Single Women & Widowed Women & Children & Adult Men \\
\hline
Nettleham, Lincolnshire & 12 & 0 & 0 & 0 & 12 & 0 \\
\hline
Marlborough, Wiltshire & 12 & 2–5 & 0–3 & 2 & 5 & 0 \\
\hline
St Mary, Ely & 39 & \(\geq 4\) & \(\leq 16\) & 4 & 6 & 9 \\
\hline
Northants & 46 & 24 & 11 & 11 & 0 & 0 \\
\hline
St Mary, Lenham & 10 & 7 & 2 & 1 & 0 & 0 \\
\hline
Newbury, Berkshire & 26 & 22* & 3 & 22* & 0 & 1 \\
\hline
Sudbury, Essex & 69 & n/a & n/a & n/a & n/a & n/a \\
\hline
\end{tabular}
\caption{Spinning Records}
\end{table}

Sources: See the text. Two spinning units listed as families at Marlborough are assumed to have
included a married woman and two children; *given the title ‘Goody’ but not known if married or
widowed.

The next task is to derive consistent estimates of productivity in pounds of
yarn spun per week. Some of our sources, spinning schools for example, are clear
about the timing of work, specifying when both the material was provided and the

\footnote{Wiltshire and Swindon History Centre, PR/Marlborough, St Peter and St Paul/871/190.}
spinning completed, making it easy to compute productivity. In other cases there is room for ambiguity. For example, the Griggs cashbook records only the date at which a spinner was paid for a specific volume of yarn. For some individuals this is not a problem as they appear with great regularity in the accounts, paid often several times a week for work done. In these cases we can assume with some confidence that the spinners picked up new wool simultaneously with returning finished work and this enables us to work out how much was spun over each week. Figure 1a below illustrates such a regular work cycle achieved by Widow Watson who is recorded in Griggs’ cashbook with only a couple of gaps for the whole 32 weeks documented. She appears, often more than once a week, returning in total 63 pounds of yarn, 41 times in 1 lb deposits and 11 times in 2 lb deposits. With such regular appearances in the cashbook it is surely reasonable to assume that Watson’s work was completed in the time elapsing since her previous appearance in the cash book.

Figure 1a
Figure 1b, which depicts the timing of payments to spinner Clarke suggests more ambiguity. The payments here are usually made every two weeks. It is unclear then whether the spinner picks up the work as he/she drops off and takes two weeks to produce the yarn or picks up the same week that he/she is paid and simply does something else in the interim. The falloff in production achieved when this spinner appears in consecutive weeks and accounts of the operation of putting out systems which feature spinners accessing fibre when they dropped off yarn suggests that the former is much more probable but the latter remains a possibility.

The figures given in Table 4 use the dates and quantities given in the primary sources. Data given in ranges relate to cases where the dates when spinners received fibre were not specified. Here the lower bound assumes the work was done between the payment date and the previous appearance in the accounts and the higher one assumes it was done in the same week as the disbursement was made. Where a single number is given, we are confident of the timing of transactions, and in view of the greater credibility of the ‘previous appearance’ methodology subsequent computations are based on production divided by days between deposits.
The single startling finding is that spinners were nowhere near as productive in any fibre as previous wage and employment claims have assumed, and this remains true even if we take the less-reliable upper bound estimates of productivity. Contrary to the claims of contemporaries, only the very best spinners could spin 4 pounds of fibre per week. Historians who have taken the ‘pound a day’ conjecture at face value have been misled. Our findings on productivity are consistent with rates recently proposed by Alice Dolan on the basis of her study of Richard Latham’s account book and other contextual evidence. Dolan suggests rates between 1.5 -2.5 lbs per week in coarse flax spinning. She acknowledges that these are lower than the 1-4 lbs per day suggested by Muldrew and by John Styles in his classic work on cloth manufacture, but backs up her conjecture with references not only to the historical record but modern practitioners. “An unmarried, highly-skilled spinner might spin more than 2.5 lb a week and children or the elderly might spin less”.

Other claims too are called into question. For example, Eden suggested that single women could spin 6 pounds a week, and married women just 2.5 pounds, but the productivity differences between spinners who can be identified as single, widowed, and married are much lower—maybe 25% at most.

Table 4: Spinning Productivity from Primary Sources

<table>
<thead>
<tr>
<th>Location</th>
<th>Type of Institution</th>
<th>Dates</th>
<th>Obs</th>
<th>Fibre</th>
<th>Top Quartile</th>
<th>Overall Average</th>
<th>Bottom Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nettleham, Lincolnshire</td>
<td>Spinning School</td>
<td>1787</td>
<td>71</td>
<td>Wool</td>
<td>2.86 lbs/wk</td>
<td>1.94 lbs/wk</td>
<td>1.09 lbs/wk</td>
</tr>
<tr>
<td>Marlborough, Wiltshire</td>
<td>Parish Putting-out</td>
<td>1752–5</td>
<td>13</td>
<td>Cotton</td>
<td>4.16 lbs/wk</td>
<td>1.52 lbs/wk</td>
<td>0.23 lbs/wk</td>
</tr>
<tr>
<td>Ely, Cambridgeshire</td>
<td>Parish Workhouse</td>
<td>1736–9</td>
<td>746</td>
<td>Wool</td>
<td>1.71 lbs/wk</td>
<td>1.12 lbs/wk</td>
<td>0.59 lbs/wk</td>
</tr>
<tr>
<td>Northamptonshire</td>
<td>Philanthropic Scheme</td>
<td>1742–3</td>
<td>740</td>
<td>Flax</td>
<td>3.23 lbs/wk</td>
<td>1.94 lbs/wk</td>
<td>1.15 lbs/wk</td>
</tr>
<tr>
<td>Lenham, Kent</td>
<td>Parish Putting-out</td>
<td>1788–9</td>
<td>68</td>
<td>Flax</td>
<td>0.75–3.39 lbs/wk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To give some idea of how much spinners varied in the amounts they could produce, Table 4 also reports the top and bottom quartile of the productivity distribution. Unfortunately the Kent data are poor, and breaking them into quartiles does not provide much perspective on the general picture. Initially surprising findings are easily explained. Thus at Ely, the spinners were spinning 24-count yarn—a high count—so their seemingly low productivity was reasonable for such fine work, whereas the high productivity of the young spinners in the Lincolnshire spinning school can be accounted for by the strict labour discipline and carefully calibrated incentive systems used in such institutions, and the efficiency of the Newbury-Kendrick spinners by their concentration on list, the inferior yarn used on the edges of cloth. This latter was very low-grade work as indicated by the rate of remuneration of 1¾d per pound for ordinary list and 2d for fine.52

III

While empirical estimates of productivity begin to put us on firmer ground in describing the working lives of spinners, we are most interested in their remuneration. We now combine our fibre-specific estimates of productivity with evidence on piece rates taken from credible sources including merchants’ account books and records of payments made to spinners. One example of such evidence comes from the memorandum books of John Brearley, a cloth frizzer working at Wakefield during 1758–62, roughly the same time as Griggs was operating in

Essex.\textsuperscript{53} As well as recording Brearley’s views about the peccadilloes of Yorkshire folk, the books contain much detail on local trade conditions, including the rates that Brearley paid or expected to pay for spinning, rates we categorise as Direct Claims.\textsuperscript{54} Twenty-four examples of piece rates are cited in this source, only one of which was over 6d per pound and most 2½d for weft and 3d for warp. We have also collected earnings from parish records, including detailed account books and payment vouchers. One such piece of evidence appeared in the records of Holton, Oxfordshire:

\begin{verbatim}
Cost of two pair of sheets & two pillow cases
spun by Blind Headington
1815
2 Dozen of flax — 1 – 12 – 0
Spinning Do — 12 – 0
4 ½ lb. of yarn to finish
at s 2/ —— 7 – 10 ½
Weaving Do
24 ¾ ells — — 1 – 4 – 9
£1 – 18 – 3 ¾ Pr pair 3 : 16 : 7 ½\textsuperscript{55}
\end{verbatim}

This scrap of paper shows a piece rate of 6d. per pound, which when converted into a daily wage using the productivity estimate for flax would have been 2.1d.

Our piece rates are checked with reference to estimates of value added in spinning by type of fibre computed from probate inventories from different times and places as shown in Tables 5.1 and 5.2 below. On rare occasions, probate inventories provide valuations for both yarn and related fibre either in the same or a


\textsuperscript{54} ‘The are extraordnery sharp people in Yorkshire and much given to cheater and deceiveing (sic)’, Smail, ‘Woollen Manufacturing in Yorkshire’, 62.

\textsuperscript{55} Oxfordshire History Centre, PAR 135/13/F1/1.
closely related (nearby time and place) account. The difference between valuations identifies the margin from which spinners were paid and so provides an independent check on piece rates.\textsuperscript{56}

These margins are in general consistent with the piece rates suggested by Muldrew for the seventeenth century. Moreover, they suggest variation in the value-added by the fineness of yarn demanded, with higher margins in worsted spinning, as would be expected. It is significant therefore that there is little evidence of widening margins over time although the well-known paucity of probate evidence in the eighteenth century hampers the comparison in the key decades. The value added figures are also consistent with the piece rates collected for our wage observations, most of which come from the seventeenth century. While the piece rates used for the wage series only rarely indicate the quality of the yarn produced, most are in the 3–8d per pound range. There are some instances of higher piece rates, but these were not sustained for any substantial period. Only 39 of the 354 piece rates recorded for our wage series show payment of 10d per pound or more.

Table 5.1: Value Added From Probate Inventories, Flax and Hemp

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Fibre Valued at per lb</th>
<th>Yarn Valued at per lb</th>
<th>Value added per lb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hemp (raw)</td>
<td>Hemp (dressed)</td>
<td>Flax (raw)</td>
</tr>
<tr>
<td>1558</td>
<td>Notts</td>
<td>1.7d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1558</td>
<td>Surrey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1593</td>
<td>Surrey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1597</td>
<td>Surrey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1628</td>
<td>Devon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1633</td>
<td>Worcs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1668</td>
<td>Yorks</td>
<td>6d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1668</td>
<td>Yorks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1696</td>
<td>Salop</td>
<td>8d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{56} Value added will overstate remuneration per lb because margins would also have to cover transport costs but the independence of the source recommends it as the basis for robustness checks.
<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Fibre</th>
<th>Yarn</th>
<th>Value added per lb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Valued at per lb</td>
<td>Valued at per lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unknown</td>
<td>Coarse</td>
<td>Best</td>
</tr>
<tr>
<td>1446</td>
<td>Yorks</td>
<td>2.6d</td>
<td>9.8d</td>
<td>5d</td>
</tr>
<tr>
<td>1553</td>
<td>Notts</td>
<td>4.9d</td>
<td></td>
<td>7d</td>
</tr>
<tr>
<td>1559</td>
<td>Surrey</td>
<td>4d</td>
<td></td>
<td>9d</td>
</tr>
<tr>
<td>1561</td>
<td>Yorks</td>
<td></td>
<td>4d</td>
<td></td>
</tr>
<tr>
<td>1561</td>
<td>Surrey</td>
<td>8.6d</td>
<td>11.4d (dyed)</td>
<td>12.8d (white)</td>
</tr>
<tr>
<td>1563</td>
<td>Yorks</td>
<td>4.9d</td>
<td></td>
<td>8d</td>
</tr>
<tr>
<td>1591</td>
<td>Surrey</td>
<td></td>
<td>4d</td>
<td></td>
</tr>
<tr>
<td>1623</td>
<td>Sunderland</td>
<td>4.3d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1620</td>
<td>Gloucs</td>
<td>8d</td>
<td></td>
<td>11d</td>
</tr>
<tr>
<td>1639</td>
<td>Yorks</td>
<td></td>
<td>10.3d</td>
<td></td>
</tr>
<tr>
<td>1639</td>
<td>Wilts</td>
<td>8d</td>
<td>9.2d (dyed)</td>
<td>14d</td>
</tr>
<tr>
<td>1645</td>
<td>Staffs</td>
<td>10d</td>
<td></td>
<td>13.2d</td>
</tr>
<tr>
<td>1673</td>
<td>Gloucs</td>
<td>6d</td>
<td></td>
<td>6.7d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td>5–7d</td>
<td></td>
<td>8d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td>9d (fine parted)</td>
<td>18d (white)</td>
<td>9d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td></td>
<td>12d</td>
<td>24–32d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td></td>
<td>20.5d (twisted)</td>
<td>28d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td>8–9d</td>
<td>12–15d</td>
<td>4–7d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td>5–7d</td>
<td>8.5d</td>
<td>1.5–3.5d</td>
</tr>
<tr>
<td>1679</td>
<td>Bristol</td>
<td></td>
<td>15d (at the spinners)</td>
<td>24–32d</td>
</tr>
</tbody>
</table>

Sources: see the list of collections of inventories consulted in the specified section of the bibliography.

Table 5.2: Value Added From Probate Inventories, Wool
<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>3d</th>
<th>9d</th>
<th>6d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1687</td>
<td>Bristol</td>
<td>3d</td>
<td>9d (combed)</td>
<td>21d</td>
</tr>
<tr>
<td>1687</td>
<td>Bristol</td>
<td>3d</td>
<td>16d (white)</td>
<td>26d (white)</td>
</tr>
<tr>
<td>1687</td>
<td>Bristol</td>
<td>3d</td>
<td>18d (dyed and combed)</td>
<td>28d (dyed)</td>
</tr>
<tr>
<td>1689</td>
<td>Bristol</td>
<td>3d</td>
<td>6d (dyed)</td>
<td>12d (dyed)</td>
</tr>
<tr>
<td>1691</td>
<td>Bristol</td>
<td>3d</td>
<td>14d</td>
<td>30d</td>
</tr>
<tr>
<td>1691</td>
<td>Bristol</td>
<td>3.6d (at the spinners)</td>
<td>6d (dyed)</td>
<td>12d (dyed)</td>
</tr>
<tr>
<td>1691</td>
<td>Bristol</td>
<td>3d</td>
<td>5d (white)</td>
<td>9d</td>
</tr>
<tr>
<td>1691</td>
<td>Bristol</td>
<td>3d</td>
<td>26d</td>
<td>27d (dyed)</td>
</tr>
<tr>
<td>1697</td>
<td>Wilts</td>
<td>3d</td>
<td>9d</td>
<td>4d</td>
</tr>
<tr>
<td>1673</td>
<td>Salop</td>
<td>3d</td>
<td>6d</td>
<td>9.6</td>
</tr>
<tr>
<td>1711</td>
<td>Salop</td>
<td>3d</td>
<td>3.6d</td>
<td>3.6d</td>
</tr>
</tbody>
</table>

Sources: see the list of collections of inventories consulted in the specified section of the bibliography.

Altogether we have computed 354 estimates of spinners’ daily wages based on productivity and piece rates reported in the primary sources and a further 3 estimates where the spinners also received board and lodging. These estimates relate to spinners working with different fibres though most relate to wool. These are shown in the scatter plot below.

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57 In these cases we added the value of Allen’s CPI ‘respectability’ basket for the relevant years to the cash payments.
The computed wages do not trend upwards and although a rare group of spinners did manage the 8–10d per day imagined in the HWE, they were as likely to achieve these heights before 1700 as after. The vast majority of spinners got nowhere near this peak, instead earning the 3–4d per day claimed in the gender histories. Decadal averages of our computed wages tell a similar story as shown in the graph below.
Although the 10 year average does peak in the early 1700’s, this spike is reliant on only a couple of observations (see Appendix I) and occurs too early to fit with Hargreaves’ invention of the jenny. Wages were back down to their long run mean around 3–4d well before 1750. Far from showing long-run wage increases, the decadal averages of computed wages indicate that spinning remuneration changed little in nominal terms through the early modern period.

IV

We now buttress the wage estimates computed from piece rates and productivity by searching other kinds of historical sources for additional evidence. We present four kinds of wage observations by source. These overlap with the wage computations described above.

The most accessible and straightforward estimates of spinning earnings come from contemporary observers such as Arthur Young, Frederick Eden, the writers of pamphlets on textiles, and county surveys, hence their attraction to historians.
Muldrew’s figures are taken from such sources, and using them he claims that married spinners earned 1s. 4d. per week (2.7d./day) in 1615, 3s. per week (6d./day) in 1700, and ‘possibly’ 4s. per week (8d./day) in 1750: numbers we have seen reproduced in Allen’s series. But Muldrew’s important claim that ‘there are enough data to show clearly that earnings for spinning increased very significantly, and that by the eighteenth century women and children could have earned much more from spinning than previously’ is not supported by earlier writers. Alice Clark and Deborah Valenze held that spinners did not earn wages in line with the demand for yarn and supply of labour, and that spinners’ pay was frequently squeezed in order to provide savings for merchants. Women tried to push back through the embezzlement of fibre and yarn. Moreover, observers frequently quoted wages ‘if industrious’ or of ‘a woman that works hard’ or a ‘brisk’ girl, adjectives that suggest reference to peak rather than average productivity. The subjective judgments of non-spinning passers-by were likely to overstate rather than understate spinners’ wages.

Although we regard estimates of this kind with some scepticism, we have searched the historical record for analogous claims and present an expanded sample of 269 such observations described in our data set as Indirect Claims; these include the 3 estimates which were grossed up to incorporate the augmentation of cash wages with board and lodging and 54 cases computed from productivity and piece rates. Wage Assessments from the early modern period provide 51 further observations; these include 35 cases computed from productivity and piece rates. While these have the distinct advantage of being reliably contemporaneous and produced by disinterested sources, they do not necessarily reflect the amounts

actually paid to spinners, and by the late seventeenth and early eighteenth centuries are more likely to represent minimum than maximum rates, a point which should be remembered when considering trends over time.

Our third historical source consists of the letters and writings of workers and merchants in the textile industry, such as John Brearley, cited above, whose statements we consider reliable and classify as Direct Claims. These yield 62 observations that include 55 cases computed from productivity and piece rates. Fourth, and most reliably, we have hundreds of pages of previously untouched records from parish schemes, workhouses, and yarn masters, from which we draw our 1574 Accounts observations which include 203 cases computed from productivity and piece rates. Finally, we have a very small number (44 cases) of hybrid or difficult to classify observations, 7 of which were based on productivity and piece rates. Finding Direct Claims or Accounts estimates in the primary sources is more difficult than simply registering what contemporaries thought about ‘brisk’ girls or ‘industrious’ women but it is vital to compare the former with the latter.

Appendix I presents the daily nominal wages for the three principal types of fibre spun in Britain during the period under consideration. For all of our daily wage figures we assume a six-day working week, and wage claims that are based on longer time spans (such as a week or a fortnight) have been converted into daily figures.

Figure 4 is a scatter plot of the data by source. Even the Indirect Claims, based on similar sources to those on which Muldrew and Allen rely, are more pessimistic than suggested in the HWE, and the pessimism mounts when attention extends to the estimates based on the other more robust sources. There are a couple of extreme outliers with wages over 2s per day; these observations are from the Griggs data, which does not provide information on when fibre was accessed and may include deposits which were not the work of a single spinner. Aside from these extremes, while our estimates broadly match Muldrew’s for the early seventeenth century, there was no sustained and widely experienced increase in wages to the levels
suggested for the mid-eighteenth century. 6d per day might just pass muster as a ballpark figure in 1700 but most observations fall well below 8d around 1750, and 12d in 1770 is clearly out of line with historical reality. The fitted line through the scatter plot does slope upwards but any growth in wages is very minor.\textsuperscript{62}

**Figure 4: Daily Wages by Source Type**

Sources: See Appendix I.

For readers who may have reservations about our procedure for computing wages from productivity and piece rates, note that excluding these cases does not significantly change the trend and has only a modest effect on the levels. This can be seen in a comparison of the decade averages shown in the graph below, which excludes the computed cases, with figure 3, which was based on the excluded cases.

\textsuperscript{62} The slope coefficient on a linear time trend is 0.016 (t stat = 9.13).
It is important too to remember that many of the claims by contemporary commentators and more recent historians were also based on such computations albeit less formally acknowledged than in this paper.

**Figure 4: Average Daily Wages without Computed Wages, Decadal Averages**

Sources: See Appendix I.

V

The nominal daily wages, retaining evidence on the source from which the estimate was drawn, have also been converted into welfare ratios, income divided by the cost of living, using Allen’s CPI basket and shown in Figure 5. These real wages reinforce our relatively pessimistic account. As most spinners were likely married women, many with children, welfare ratios above 1 do not necessarily indicate that women were enjoying a good standard of living because spinners’ incomes would have been shared with other family members.⁶³

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⁶³ Again the time trend through the scatterplot while upward sloping does not suggest strong growth.
The HWE view states that the inventions behind the British Industrial Revolution were a rational response to high wages and cheap capital and energy. In spinning, Allen claims that high wages were the impetus to the inventions of Hargreaves, Arkwright, and Crompton, and justified the adoption of the new techniques.\textsuperscript{64} To account for the timing of the inventions of the Industrial Revolution, there should have been an increase in nominal wages and welfare ratios for spinners up to the beginning of the ‘wave of gadgets’ in 1765.\textsuperscript{65} As Figure 6 shows, there was

\textsuperscript{65} Falls in the prices of capital and energy might also have played a role but Allen’s emphasis is on the upswing in spinners’ wages. In fact, Allen discounts any significant change in the price of capital as a
an increase in nominal wages up to the invention of the spinning jenny but it was very modest and much smaller than claimed by Allen and Muldrew. Any increase in welfare ratios was also quite modest, as shown in Figure 7.

**Figure 6: Nominal Wages to 1765**

Sources: See Appendix I.
To provide a view of the change over time, Figures 8–10 and Appendix I present averages by decade in nominal wages, welfare ratios, and comparisons with wage series for women’s casual and annual wages and men’s casual wages. The limited number of observations before 1750 means that the size of movements in the wages and ratios may be spurious, but the overall series should give a good picture of the averages. Figures 8–10 show that there was no substantial jump in nominal, real, or relative wages for spinners leading up to the spinning innovations of the

Sources: See Appendices I & II.

1760s and 1770s. The spike in the 1720s is likely the product of a few rogue observations in a decade when data is scarce, but even if it is not, the timing does not match up with Allen’s argument. Rather, the data show spinners’ earnings falling relative to the CPI basket and other wage-earners after prosperity in the earlier part of the eighteenth century. Figure 4 also shows that the broad trends are still present if we remove the computed wages. Spinning was and remained a low paid sector of women’s work and compared poorly even with other forms of casual employment. Spinners could barely support themselves, let alone contribute to family incomes. In spinning, the high wage economy is on shaky ground.

Figure 8: Nominal Daily Wages, Decadal Averages

![Graph showing nominal daily wages from 1570-1819.](image)

Sources: Appendix II and Table 2.
Figure 9: Welfare Ratios, Decadal Averages

Sources: See Appendix II, Table 2, and the text.

Figure 10: Ratios of Spinners’ Wages to Other Wage Indices

Sources: See Appendix II and the text.
The Allen-Muldrew view of eighteenth-century spinning is optimistic up to the invention of labour-saving machinery. Spinners were productive and their wages rose alongside the growth of the British textile sector during the early modern period. Their perspective, reliant as it is on contemporary commentators, may reflect the opinions of the country’s elites as they paged through pamphlets extolling the success of British manufacturing. However, the subjective judgements of passers-by do not always fairly reflect the circumstances of those who actually toiled in the burgeoning industries. Credible evidence of the actual productivity and pay of hand spinners challenge their inclusion in the HWE.

Reflection on the eighteenth-century organisation of hand spinning might explain spinners’ exclusion from the new dawn. Three points are relevant. The first concerns the potential for the extensive growth of the yarn market. Masters who faced labour shortages could always extend their reach into the countryside, mopping up the unemployed labour of women and children. Griggs extended his spinning operations in this way. His spinning labour force mentioned in various account books totalled around 400 people who lived in 22 parishes within a 15 mile radius of Ballingdon. Before we start considering this a strain on his operations we should note the relative unimportance of transport costs in his cloth costings and more generally the improvement in road transport taking place in this period. Similarly, the extensive business records of the Oakes family, Suffolk manufacturers, never mention their packmen or problems with quality control.

More dramatic geographical relocation also helped keep down spinning costs. The move north was seen by both contemporaries and historians as a response to wage pressure as well as fuel costs with the work people allegedly satisfied by a lower standard of living. Comparison of the spinning piece rates quoted by Brearley

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67 Burley, ‘Some accounting Records’.
with those cited by Griggs, for example, suggests that the north did promise lower costs. Similarly the relocation of the Scottish linen industry as described by Alastair Durie was also a search for cheaper workpeople. Finally, of course, yarn could be, and indeed was, imported from low wage economies such as Ireland.

A second ceiling on spinners’ wages was provided by the involvement of the poor law and charities in providing yarn produced by pauper labour often at subsidised rates. Brearley makes extensive reference in his memorandum books to experiments taking place at Ackworth Foundling Hospital employing the children in spinning and the Humphries-Schneider dataset draws on several such ventures to estimate productivity. Commercial putters out were also keen to establish links with local overseers to access cheap sources of labour. Griggs’ cashbook regularly features ‘Parish’ as a depositor of yarn, while James Oakes, an important Suffolk manufacturer, and one of Arthur Young’s sources, supplied the Melton House of Industry with combed wool which was spun in the house and collected and paid for by his agent, thereby entering into the normal supply chain. Oakes went to great lengths to retain this connection, winning and dining the Guardians of the House when the contract was up for renewal to fend off the keen competition from other Bury manufacturers who were equally eager to access the subsidised labour.

Workhouses provided a form of elementary factory organization where as Wadsworth and Mann suggested ‘... the idea of labour discipline within the shop was fully grasped’. In addition to the workhouse, Oakes used village poor houses and had a monopoly of the spinning done in the charity school in Bury and he was not alone among manufacturers in exploiting such sources of captive labour.

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70 By the 1770’s Irish yarn supplied one sixth of all yarn used in the Norwich industry for example, a competitive advantage built on the lower costs of wool and provisions, see Fiske, ‘Oakes Diaries’, 51.
Prisoners were also apparently forced to spin. Essex Quarter Session records for 1765 reported a complaint from a man incarcerated in Chelmsford Bridewell that he was made to spin yarn for 4d a day when his mother had paid 8s a week for his board and lodging! More generally, many of the wage observations from account books and vouchers are the records of parishes that organised and administered spinning employment to the local poor, whether in a workhouse or as parish outwork.

Thirdly, spinners were disadvantaged in bargaining with the suppliers of fibre, for the diffused structure of the industry meant that yarn manufacturers had leverage over their employees. The manufacturers were relatively few, known to each other, and frequently in touch both through formal organisation and sociability. They could easily gang up against the rural spinner who faced a take it or leave it offer of work. Fiske, again, shows clearly that the Suffolk trade was far from competitive; rates went down when trade was slack but rarely up when there was a recovery. The manufacturers acted as a monopsonistic cartel: ‘...Suffolk spinners’ rates of pay were decided once a year at a meeting of yarn makers at Mr Mathew’s wool hall so that the manufacturers’ claim that free competition kept wages up was less than the truth’.

This perspective on the structure of spinning employment combined with our wage and productivity estimates undermine the HWE interpretation for the spinning innovations of the Industrial Revolution. In the age of the spinning wheel, meeting the rising home and foreign demand for British cloth required an expansion of the labour supply, but growth was achieved, as we have demonstrated, without a corresponding increase in wages; nor is there any evidence of increased productivity of labour or physical capital. What then provided the incentive to invent and implement new techniques?

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74 Essex Record Office, Q/SBb 258.
75 The most comprehensive set of accounts that we have found is from the parish of St Mary, Ely, in the Cambridgeshire Archives, but the Warwickshire, East Sussex, Essex, and Kent Record Offices also have surviving collections of documents from parish schemes.
To resolve this apparent paradox we can turn to the stories of the three inventors of spinning machinery. James Hargreaves and Samuel Crompton were weavers who wanted an increased supply of cotton yarn and took it upon themselves to create machines to provide it. Their earnings in weaving were constrained by the low productivity of wheel spinning and the inconsistent yarn it produced. Richard Arkwright had greater plans for his machinery, but the extensive work on his biography has not produced evidence that he was interested in undercutting any alleged high wages in spinning. To the contrary, when he moved from Nottingham to set up the Cromford Mill along the River Derwent in Derbyshire, he wrote of the ample labour supply, particularly of children, in the southern Peak District. Arkwright would likely have known that he could obtain such labour at low wages. This admittedly limited evidence suggests that substituting inexpensive capital for high wages was not the driving incentive behind the crucial inventions in this key sector. Instead, overcoming the low productivity and inconsistent quality in spinning and taking advantage of low wages for spinners and female and child workers more generally may have been the spur for tinkerers and inventors in the late eighteenth-century textile industry.

Andrew Ure, a sharp albeit partisan commentator on early industrialization stated that ‘the constant aim and tendency of every improvement in machinery [is] … to diminish the costs by substituting the industry of women and children for that of men’. This ‘aim and tendency’ was acknowledged in the statements of inventors and factory masters and reflected in their actions as they sought to exploit local wage differentials that were widely recognised as a source of profits. Allen sees this motivation as merely a footnote to his own meta narrative: ‘… that machines were more profitable because they allowed the substitution of cheap women and children for expensive men is not an alternative to my analysis of the high wage economy;

rather ... simply ... one channel by which high wages might have induced mechanization’. In our view this channel was likely uppermost in the minds of men who invented, employed and made their profits in the bounded reality of the factory districts of Great Britain. In this sector at least, the route to mechanization and factory production was a response to low not high wages.

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### Appendix I: Average Daily Wages Observations (Nominal d), Welfare Rations, and Comparisons

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Sources: See Appendix I. Note that sources did not always include the fiber used, so the count of observations here will be lower than in Appendix I.
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