



Spinning the industrial revolution[†]

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The prevailing explanation for why the industrial revolution occurred first in Britain during the last quarter of the eighteenth century is Allen's '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 article presents new empirical evidence on hand spinning before the industrial revolution and demonstrates that there was no such 'high wage economy' in spinning, which was 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 with evidence of productivity and wages from the late sixteenth to the early nineteenth century. Spinning emerges as a widespread, low-productivity, low-wage employment, in which wages did not rise substantially in advance of the introduction of the jenny and water frame. The motivation for mechanization must be sought elsewhere.

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, condemned by the technological changes of the late eighteenth century, the demise of her trade perhaps even 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 and agricultural 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 Allen's 'high wage economy' thesis. It claims that the high cost of labour relative to capital and fuel in Britain, but not in Europe or Asia, incentivized innovation and the adoption of techniques that enabled Britain to access a new and superior growth

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¹ Most searches on library resources report many references to handloom weavers and their fate but few to hand spinners, most of which are concerned with the persistence of spinning as a leisure activity. Hand spinning has even been relatively neglected in gender history, though with notable exceptions. See Berg, *Age of manufactures*; Valenze, *First industrial woman*; Sharpe, *Adapting to capitalism*.

trajectory.² However, international comparisons of relative wages can explain only the *order* in which countries and regions industrialized. Allen goes further, placing the spinning jenny among the key innovations of the period, and relating 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.

Allen is to be commended for bringing women's work in the form of hand spinning into the mainstream of long-run growth.⁴ However, the high wage economy interpretation requires that the costs of hand spinning in Britain rose from the late seventeenth to the mid-eighteenth century, prompting technological change. Investigation of this hypothesis is made difficult not only by the fragmentation of sources but also by the nature of remuneration, almost always through piece rates. Estimates of spinners' weekly or daily earnings involve combining observations of piece rates—that is, payments per quantity of material processed—with estimates of the productivity of spinners—that is, how much material was processed per unit time. Wages constructed in this way can then be compared with other evidence on wages in spinning and similar occupations and scrutinized to see if they did march upwards, encouraging mechanization.

To date the evidence for spinners' inclusion in the high wage economy has been thin. For spinners' wages, Allen relies on pioneering estimates by Muldrew.⁵ While Muldrew's research is a landmark, we argue that his assumptions about productivity, alleged piece rates, and inferred earnings per lb of fibre processed, and his 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 article offers fresh evidence based on recorded production, piece rates, and earnings per unit time constructed from productivity and pay per lb of yarn. These figures are then 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 a high wage economy, and that time trends in their wages explain the invention of the jenny or the water frame. Instead spinners' remuneration shows trends similar to those found in recent evidence on women's day wages.⁶ Reflection on the underemployment of women and children in many parts of the country, on the organization of hand spinning as independent local networks of spinners and

² Allen, *British industrial revolution*; idem, 'Industrial revolution in miniature'; idem, 'Spinning jenny: a fresh look'; idem, 'Why the industrial revolution was British'.

³ Allen, 'High wage economy', p. 14.

⁴ *Ibid.*, pp. 18–19; and see also idem, *Very short introduction*, pp. 3–4, 17–18, 81–3.

⁵ Muldrew, "'Ancient distaff'". Allen cites only Muldrew as the source for his spinners' wages; see Allen, 'London'; however it is clear that he also draws on Feinstein, 'Wage-earnings'.

⁶ Humphries and Weisdorf, 'Wages of women'.

weavers gave way to larger-scale production systems within which isolated female spinners faced powerful, often monopsonistic yarn manufacturers, and on the widespread involvement of the poor law in the supply of spinning labour, suggests why spinners may have been excluded from the high wage economy.

The article is organized 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 high wage economy.⁷ We question the empirical strategy followed by Muldrew and hence Allen 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 and the purported increase in earnings is shown to rest on particularly limited evidence. In section II, new data provide 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 and domestic work, as often assumed.⁸ Section III combines these productivity figures with direct observations of historic piece rates to construct estimates of 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. Section IV introduces direct observations of spinners' daily or weekly wages drawn from sources analogous to those searched for our productivity and piece rate evidence. The resulting dataset comprises wage observations of four different kinds: first, 'indirect claims' made by contemporary commentators like those drawn on for Muldrew and Allen's estimates; second, 'wage assessments' provided by justices of the peace attempting to regulate local labour markets; third, 'direct claims' about wage levels made by spinners, weavers, yarn masters, and clothiers; and, fourth, 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.⁹ Section VI summarizes our case against spinners' inclusion in the high wage economy, reflects on the reasons why their wages might have been held back even in the face of industrial growth, and, finally, notes other possible explanations for mechanization.

I

Although some gender historians had long noted the extent and importance of hand spinning,¹⁰ for mainstream economic historians it was Muldrew in his pioneer

⁷ Other authors have been critical of the high wage economy interpretation of mechanization. Styles, 'Fashion, textiles and the origins', has emphasized the resort to machinery as a way of overcoming the technical challenges that the industry faced, while Humphries, 'Lure of aggregates', has claimed that mechanization, 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. Other authors have provided an internal critique by questioning Allen's profitability computations; see Gragnolati, Moschella, and Pugliese, 'Spinning jenny'. There are links here to an older literature which saw mechanization and the factory as the product of the search for either standardization (see Szostak, *Role of transportation*) or control (see Marglin, 'What bosses do').

⁸ Spinning's dismissal as unskilled reflects the condescension towards the attributes of women's work that has long marked labour market studies; see Horrell, Rubery, and Burchell, 'Gender and skills'.

⁹ Humphries and Weisdorf, 'Women's wages'.

¹⁰ Pinchbeck, *Women workers*; Clark, *Working life of women*; see also n. 1 above.

article who rescued the domestic spinner from obscurity. Muldrew's main aim was to establish the extent of employment in spinning and to demonstrate its status as the largest single manufacturing occupation in the eighteenth century, but he also sought to establish spinners' contributions to their family incomes and for this he needed estimates of their remuneration. On the extent of yarn manufacture, his findings were startling. Spinning emerged as a hugely important 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 underlying estimates of remuneration suggested that earnings had increased over time, growing rapidly from the beginning of the eighteenth century, and although it was not a central part of his argument he did conclude that this offered 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'.¹¹

Muldrew's investigation recognized the many difficulties involved in measuring spinners' daily or weekly earnings. Spinners worked with different fibres, the production of which was often differently organized 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. Another major problem was that since spinners were almost always paid piece rates, so much per lb spun, estimates of both earnings per unit time and employment per lb of raw material processed required information on productivity. However, the length of yarn spun from a lb of fibre depended on its fineness, or count, which was rarely noted in historical sources. Finer counts of yarn were of higher value but took longer and more skill to produce, creating a trade-off that experienced spinners (and yarn masters) sought to negotiate in order to maximize (minimize) earnings.¹² If spinners could move freely between spinning of different qualities then time rates would be equalized as the premium for higher-quality yarn would be just offset by the extra time it took to meet the superior standard. In reality, variation in skills meant that some spinners earned more, others less, and probably specialized in fibres and counts that were to their advantage.

A final difficulty was that by and large spinners were outworkers whose time use and discipline remained under their own control. Even if their productivity and earnings could be observed, the continuity and intensity of their employment could not, and since most spinners were female, both contemporaries and economic historians were easily convinced that they worked 'part time', combining work at the wheel with childcare and domestic duties, especially if they were married women. The estimation of average earnings from historical evidence that combined part- and full-time workers in unknown and shifting proportions is clearly treacherous. Overcoming this raft of interrelated difficulties requires careful and creative scrutiny of the historical record, beginning with productivity and piece rates. Muldrew's strategy was to explore both together in the historical sources.

Muldrew offered five estimates that combined productivity with piece rates to trace the evolution of spinners' earnings from the late sixteenth to the

¹¹ Muldrew, "Ancient distaff", p. 523.

¹² Other aspects of the yarn could also command premia: consistency, strength, twist, and speed of delivery.

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 employment potential of the 'New Draperies', as the finer, lighter woollens were called.¹³ 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.¹⁴ 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 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 (that is, 5.6 lbs each), it records the spinning of one stone of wool as 'xx d.', 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 per spinner, and the reward per stone was 2s. 4d., that is, 2d. per lb.¹⁵ 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 but 9d. per lb in the latter.¹⁶ 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.¹⁷ 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.¹⁸ We retain these estimates for comparative purposes.

Moving forward to the eighteenth century, Muldrew's third estimate is based on a pamphlet, *Great Britain's glory* (1715), written by yet another partisan reporter, wool merchant John Haynes.¹⁹ Haynes' agenda is again a comparison 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,

¹³ Tawney and Power, eds., *Tudor economic documents*, pp. 216–17; Thirsk and Cooper, eds., *Seventeenth-century economic documents*, p. 204; Coleman, 'Innovation'.

¹⁴ Tawney and Power, eds., *Tudor economic documents*, p. 216.

¹⁵ *Ibid.*, pp. 216–17.

¹⁶ Muldrew, "Ancient distaff", p. 505.

¹⁷ Thirsk and Cooper, eds., *Seventeenth century economic documents*, p. 204. We are grateful to one of our anonymous referees for pointing out that the word in the original is 'fine' not 'tire' (see TNA, SP14/80, fo. 22) and refers to the combed long-staple wool used in the production of New Draperies. This referee also noted that the cost quoted was for both spinning and twisting the fine wool, usually two separate processes.

¹⁸ Muldrew, "Ancient distaff", p. 505, n. 39.

¹⁹ Haynes, *Great Britain's glory*.

Haynes suggests that they were well rewarded.²⁰ In new draperies, spinners could process less than 1 lb of wool per week but earned 1s. 5d. on average.²¹ Those spinning stocking yarn were allegedly able to double weekly production and with the equivalent piece rate earn as much as 2s. 6d. A fourth estimate comes from *The weavers' true case*, another polemical pamphlet, which suggested that 1.33 lbs of yarn was possible per week paid at 2s.²²

Muldrew admits that these sources were not impartial, instead 'arguing from interested positions', defending the position of the new draperies by claiming that they generated greater employment and superior wages.²³ The most important point, however, is that none of these estimates relates 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's 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 1750s, 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 product. Muldrew relies on the interpretation of the Griggs accounts provided in an article in the *Economic History Review* by Burley.²⁴ According to Muldrew, Griggs paid his spinners various prices for yarn of different qualities, '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 actually paid could vary according to demand'.²⁵ Burley actually summarized 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'.²⁶ These figures appear to be based not on wages *actually paid* to spinners but on conjectural computations of the costs of producing cloth of different qualities from which the spinning costs per lb of wool can be calculated, 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'.²⁷ Several additional cost computations originating in the Griggs papers appear in Burley's thesis and a further paper published in *Accounting Research*, and these suggest that for the cheaper says Griggs only budgeted for the same rate as for the bunting yarn, while for the Borsleys,

²⁰ Ibid., p. 505.

²¹ Actually 0.96 lbs.

²² Rey, *Weaver's true case*, pp. 42–3.

²³ Muldrew, "Ancient distaff", p. 506.

²⁴ Burley, 'Essex clothier'. Burley also studied Griggs's account books as background to his London Ph.D. thesis 'Economic development of Essex', and, more importantly in our quest for spinning costs, he published an article in *Accounting Research*, which describes the documents in greater detail; see idem, 'Some accounting records'. 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 Archives where these books are now kept suggests that since Burley's work in the 1950s, the whole deposit has deteriorated; see TNA, C/104/17, 18, and 19, located in TNA as PIPER v GRIGGS: Title deeds, farming and tradesmen's books (many in bad condition): Ballingdon, Essex.

²⁵ Muldrew, "Ancient distaff", p. 507.

²⁶ Burley, 'Essex clothier', p. 293.

²⁷ Ibid., p. 296; Muldrew, "Ancient distaff", p. 507.

Table 1. *Spinning costs per lb of spun yarn*

<i>Type of cloth or spinning</i>	<i>No. of costings</i>	<i>Maximum piece rate</i>	<i>Minimum piece rate</i>	<i>Mean piece rate</i>
Says				
Warp spinning	19	13.3	8.0	10.9
Weft spinning	19	18.0	7.4	11.8
Bunting				
Warp spinning	12	13.0	8.0	10.9
Weft spinning	12	12.8	6.9	10.0

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

also a kind of say, he expected to pay 9½d. per lb for spinning the weft and 10d. for the warp.²⁸ Burley reported that some 40 such costings were identifiable in Griggs's papers, and despite the deposit's deterioration since the 1950s, 31 such computations were located.²⁹ These are summarized in table 1, 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.

In fact, Griggs rarely paid his spinners the quoted rate for the job, but rather a discounted rate that represented market conditions.³⁰ 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's cost computations. For most of the period the discount in pence per lb weight of yarn was between 1 and 2 pence.³¹ Extracts from one accounting book show the rates 'spun to' hovering around 10d. per lb, while those actually paid were just over 7d. and on one occasion fell to 6.9d.³² That Griggs could compensate for poor market conditions by swift discounting of spinning rates suggests a market power to which we will return.

To summarize: Muldrew takes the productivity estimates promulgated in the contemporary literature and combines them with piece rates as reported in similar sources to construct estimates of wages. He also cites the wages that contemporaries 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. 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

²⁸ Burley, 'Some accounting records', pp. 56–60; see also idem, 'Economic development of Essex'. Since these figures were inputs into private calculations of the likely profits from producing different types of cloth, we might expect them to be conservative (that is, high estimates).

²⁹ TNA, C/104/17, 18, and 19.

³⁰ Burley, 'Essex clothier', p. 293. The discount from the par price was probably behind Muldrew's comment that 'the price actually paid could vary according to demand'; Muldrew, "'Ancient distaff'", p. 507. Deductions from spinners' remuneration were a common practice in the eighteenth century. See, for example, letters to Arthur Young in Young, *Annals of agriculture*, vol. VIII (1787), pp. 353–4; vol. IX (1788), pp. 336–8, 349–54; vol. XI (1789), p. 26. Account books also show that piece rates varied over the year by as much as 20%; for example, see Cambridgeshire Archives, Cambridge, P68/12/36–37.

³¹ Burley, 'Essex clothier', p. 293.

³² Burley, 'Some accounting records', p. 56.

Table 2. *Daily earnings of hand spinners in the high wage economy*

<i>Year</i>	<i>Daily earnings (d.)</i>
1589	2.25
1615	2.67
1630–9	4.0
1687	3.8
1700	6
1750	8
1770–4	12
1775–89	8
1780–94	6
1795–1803	5

Source: Allen, ‘London’, col. S.

paper by Feinstein.³³ As the estimates for the 1770s reported on Allen’s website are identical to the figures offered by Feinstein (and unavailable in Muldrew) it is to be assumed that they too are taken from this source. These figures in particular, since they move forward into the second half of the eighteenth century and provide a dramatic spike in earnings, provide the basis for the inclusion of hand spinners in the high wage economy.

Although his evidence does not extend into the crucial years of the industrial revolution, reflecting on 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’.³⁴ There are indeed many other examples of earnings but we are less convinced about purported gains 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’.³⁵ ‘Our workfolk are grown scarce, saucy and bad’ and he complained that ‘as a result I have not been 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’.³⁶ Thanks to 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

³³ 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 idem, ‘Conjectures and contrivances’.

³⁴ Muldrew, “‘Ancient distaff’”, p. 507.

³⁵ de Lacy Mann, ed., *Documents*.

³⁶ *Ibid.*, p. 41, n. 5.

the most extraordinary prices', cloth made of 'sorn locks' (the worst kind of wool) mixed with 'coarse Spanish', and for this he had paid 4½d. per lb for spinning.³⁷ Our empirical work includes such prejudiced sources but 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

As has now been demonstrated, 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. Yet, on the basis of scant and suspect evidence, it has been widely assumed that women could spin about 1 lb of fibre a day, except for the finer, half-worsted cloths of the new draperies.³⁸ Thus Muldrew assumes productivity levels of 2.5 lbs per week for new draperies and 6 lbs for old draperies.³⁹ Heaton claimed that it took seventeenth-century spinners in Yorkshire about two weeks to spin a stone (14 lbs) of wool.⁴⁰ Roberts echoed the 'pound-a-day' consensus, which may have its origins in Eden's influential claim to that level of productivity for single women.⁴¹ Muldrew's supplementary material uses the assumption that a married woman, presumably working less than full time, would spin about 1 lb of flax or hemp per day.⁴² A pamphlet from 1830 provided a more modest estimate for cotton of 4 lbs of weft per week.⁴³

In contrast to these scattered claims, we use primary sources that record spinners' output to compute new estimates of productivity. These sources provide evidence about spinners known or reasonably assumed to have worked full time and with a conventionally acceptable level of application, so that the resulting estimates are not marred by concerns about intermittent work practices or shifting samples of full- and part-time workers, as explained further below.

Our sources vary in their detail and the type of information provided. Some, 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 this level of detail is unusual. For wool, data are taken from a complete and detailed set of account books for the workhouse of St Mary, Ely.⁴⁴ Wool spinning data are also available in records of a spinning school in Nettleham, Lincolnshire, from 1787 and a philanthropic project based at the Newbury workhouse.⁴⁵ An invaluable source for the crucial decades of the mid-eighteenth century is a cashbook covering 32 weeks from August

³⁷ Ibid., p. 46.

³⁸ Brown, *Essex at work*.

³⁹ Muldrew, "'Ancient distaff'", pp. 508–11.

⁴⁰ Heaton, 'Assessment of wages', p. 235.

⁴¹ Roberts, 'Wages and wage earners in England', p. 281; Eden, *State of the poor*, vol. III, p. 796; Randall, *Before the Luddites*, p. 59. For a more moderate view, see de Lacy Mann, *Cloth industry*, pp. 322–3.

⁴² Muldrew, "'Ancient distaff'", online supplement.

⁴³ Home Office Papers, 52/11/86, fos. 203–205.

⁴⁴ Cambridgeshire Archives, Cambridge, P68/12/32–58.

⁴⁵ Sheffield City Archives, EM/985. Jackson, *Newbury Kendrick workhouse*.

Table 3. *Spinning records*

<i>Location</i>	<i>No. of spinners</i>	<i>Married women</i>	<i>Single women</i>	<i>Widowed women</i>	<i>Children</i>	<i>Adult men</i>
Nettleham, Lincolnshire	12	0	0	0	12	0
Marlborough, Wiltshire	12	2–5 ^a	0–3 ^a	2	5 ^a	0
St Mary, Ely	39	≥4	≤16	4	6	9
Northants	46	24	11	11	0	0
St Mary, Lenham	10	7	2	1	0	0
Newbury, Berkshire	26	22 ^b	3	22 ^b	0	1
Sudbury, Essex ^c	69	n.a.	n.a.	n.a.	n.a.	n.a.

Notes: *a* Two spinning units listed as families at Marlborough are assumed to have included a married woman and two children.

b Given the title ‘Goody’ but not known if married or widowed.

c Relates to Ballingdon, part of Sudbury (Suffolk) but physically in Essex at the time.

Sources: See section II.

1758 to March 1759 located in the Griggs archive but apparently overlooked by both Muldrew and Burley.⁴⁶ This document records *actual* payments made to 69 named spinners for ‘spinning work’ or ‘yarn’. The frequency of transactions with individual spinners and the low levels of cash remittances suggest that work was returned as soon as completed, as explained further below, allowing us to observe actual productivity, piece rates, and wages, although alas we cannot always tell the age, gender, or marital status of individual 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.⁴⁷ Observations from the Blenheim Papers support the Northamptonshire results for spinners’ productivity; flax spinners could produce around 2.1 lbs per week.⁴⁸ 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.⁴⁹ The records used for our productivity estimates are summarized in table 3.⁵⁰

The next task is to use these records to derive consistent estimates of productivity in lbs of yarn spun per week. Here we confront the issue of the duration and continuity of employment at the wheel and so the labour input associated with any specific output.

Some of our sources, such as spinning schools, are clear about the timing of work, specifying when the material was provided and when the spinning was completed, making it easy to compute productivity per unit time. 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 regularly in the accounts, paid often several times a week for

⁴⁶ TNA, C/104/19, cash book no. 30, ‘Cash to work people’.

⁴⁷ Bodleian Library, Lord North Papers, MS. North 51; Kent History and Library Centre, P224/18/1.

⁴⁸ British Library, Blenheim Papers, Add. MS 61,680, fos. 83–90.

⁴⁹ Wiltshire and Swindon History Centre, PR/Marlborough, St Peter and St Paul/871/190.

⁵⁰ The spinning in Sudbury took place in the parish of Ballingdon, which was then part of Essex (now in Suffolk).

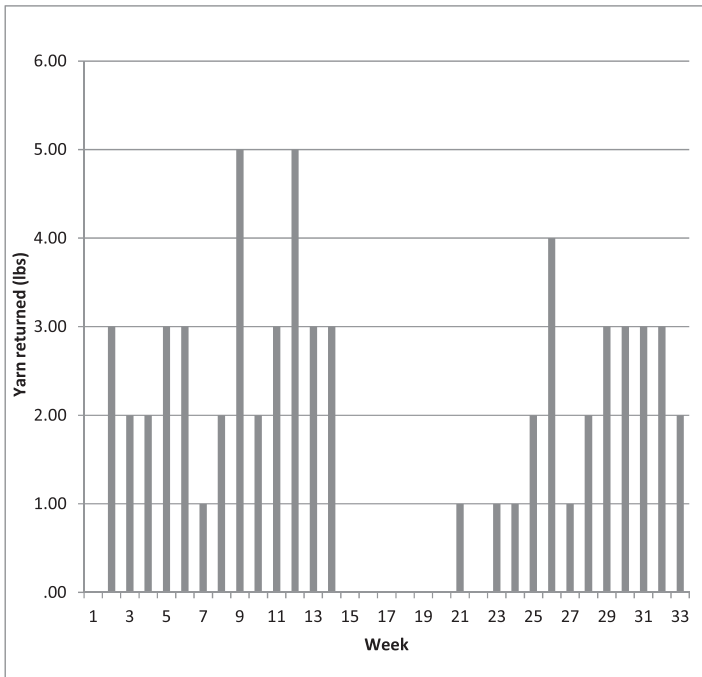


Figure 1a. *Widow Watson's productivity, August 1758–March 1759*

Sources: TNA, C104/19, cash book no. 30, 'Cash to work people'.

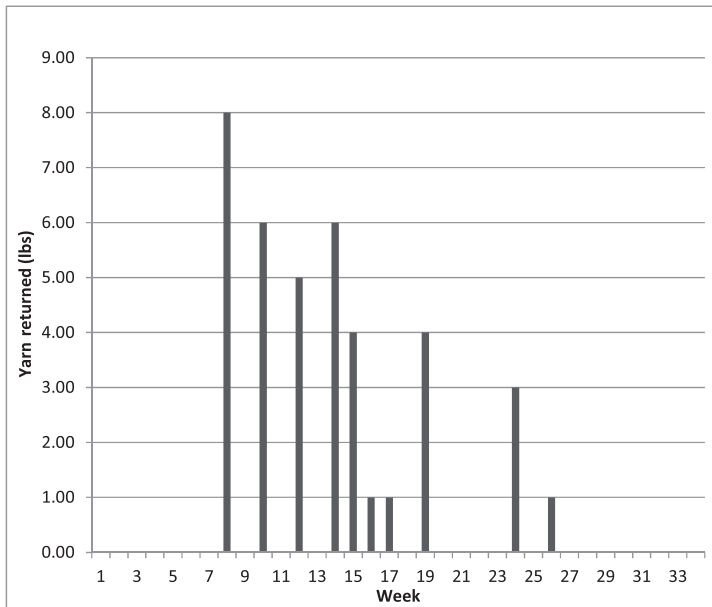


Figure 1b. *Ms Clarke's productivity, August 1758–March 1759*

Sources: As for fig. 1a.

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 each week.

Figure 1a illustrates such a regular work cycle achieved by Widow Watson, who is recorded in Griggs's cashbook, with only a couple of gaps around Christmas 1758 (weeks 15–19), for the whole 32 weeks documented. She appears, often more than once a week, returning in total 63 lbs 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 recorded deposit and payment.

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 whether the spinner picked up the work as he or she dropped it off and took two weeks to produce the yarn, or picked up the same week that he or she was paid and simply did something else in the interim. The falloff in production achieved when this spinner appears in consecutive weeks, accounts of the operation of putting-out systems which feature spinners accessing fibre when they dropped off yarn, and spinners' likely preference for minimizing transactions cost suggests that the former is much more probable.

The estimates of productivity provided in table 4 use the dates and quantities suggested in the primary sources. Where a single number is given, we are confident of the time taken to do the work, as in the case of the spinning school or the workers appearing in Griggs's cashbook. 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 upper bound assumes it was done in the same week as payment was made. In view of the greater credibility of the 'previous appearance' methodology, subsequent computations are based on production divided by days between deposits.

The startling finding is that spinners were nowhere near as productive in any fibre as previous wage and employment claims have assumed. This remains true even if we take the less reliable upper-bound estimates of productivity, which assume that in cases where there is some doubt about the timing of transactions spinners obtained the material and completed the work in the same week as they were paid.⁵¹ Contrary to the claims of contemporaries, only the very best spinners could spin 4 lbs of fibre per week. Historians who have taken the 'pound-a-day' conjecture at face value have been misled.

Other claims too are called into question. For example, Eden suggested that single women could spin 6 lbs a week, and married women just 2.5 lbs, but the productivity differences between spinners who can be identified as single, widowed, and married are much lower—maybe 25 per cent at most.⁵² If our sample included

⁵¹ The differences in the estimates of productivity can be explained by reference to the context. 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: low-grade work reflected in a miserable piece rate.

⁵² Eden, *State of the poor*, vol. III, p. 796.

Table 4. *Spinning productivity from primary sources*

<i>Location</i>	<i>Type of institution</i>	<i>Dates</i>	<i>Obs.</i>	<i>Fibre</i>	<i>Top quartile (lbs/week)</i>	<i>Overall average (lbs/week)</i>	<i>Bottom quartile (lbs/week)</i>
Nettleham, Lincolnshire	Spinning school	1787	71	Wool	2.86	1.94	1.09
Marlborough, Wiltshire	Parish putting-out	1752-5	13	Cotton	4.16	1.52	0.23
Ely, Cambridgeshire	Parish workhouse	1736-9	746	Wool	1.71	1.12	0.59
Northamptonshire	Philanthropic scheme	1742-3	740	Flax	3.23	1.94	1.15
Lenham, Kent	Parish putting-out	1788-9	68	Flax		0.75-3.39	
Lenham, Kent	Parish putting-out	1788-9	15	Hemp		1.18-4.33	
Sudbury, Essex	Putting-out merchant	1758-9	421	Wool	4.13	3.36	2.00
Newbury, Berkshire	Municipal enterprise	1628-30	248	Wool (list)		10.48	

Sources: See section II.

a large share of part-time spinners, we would expect to see a much larger difference in the productivity figures for single and married women. The absence of such a disparity indicates a high prevalence of full-time working.⁵³ Nor can our much-attenuated estimates of productivity be dismissed as the result of a sample of sub-par spinners, the aged, children, the invalid, or the workshy, selected into our evidence base by our search for quantitative records. Instead, the workers we document were likely to be competent spinners exhibiting an above-average level of application. Thus the small note book located at Wiltshire Record Office, which documents the precocious spinning of cotton by the Marlborough poor, also demonstrates that the workers were neither children nor the elderly but mainly teenagers.⁵⁴ Spinning schools operated strict labour discipline, offered dietary supplements to ‘enable [the children] to go through their work’, and provided carefully calibrated incentives.⁵⁵ Workhouse schemes anticipated the early factories in terms of hours and expected work effort. Thus the parish of Mortlake in Surrey hired a clothier to employ the workhouse population ‘in the spinning of yarn for the making of blanketts’, specifying that they should be kept at work from 6.00 am to 6.00 pm from Lady Day to Michaelmas and from 8.00 am to 5.00 pm from Michaelmas to Lady Day, but that they should also receive a proportion of their earnings to encourage them to industry.⁵⁶ Many similar schemes operated in the heyday of textile outwork. Moreover, workhouse production, outworking organized by the overseers, and philanthropic enterprises all sought to be commercially viable, and worked and paid their spinners accordingly. The Newbury Kendrick enterprise, while intended to provide work for the poor, was professionally managed and for significant periods operated at a profit.⁵⁷ Finally, of course, Griggs’s employees were reliable and proficient spinners. Considering the likely poverty of many of the spinners who appear in our data, we are confident that they would have worked as much as practicable in order to maximize their earnings.

To illustrate the variance in the amounts spinners could produce and indicate the likely productivity of skilled full-time workers in comparison with those at the bottom of the range, table 4 also reports the top and bottom quartile of the productivity distribution.⁵⁸ Even the best spinners, those in the top 25 per cent, were nowhere near the pound-a-day target. These new estimates have implications for spinners’ earnings that we will discuss below, but lower productivity also suggests that there must have been more spinners than previously thought. An inclusive estimate of the main fibres could place an upper bound by the 1770s even higher than Muldrew’s work has indicated.⁵⁹

⁵³ For productivity estimates by spinner type, see Schneider, ‘Creative destruction’, tab. 4.

⁵⁴ Wiltshire Record Office, 871/190.

⁵⁵ Gray, *Papers and diaries*, pp. 57–8; see also Cappe, *Account of two charity schools*.

⁵⁶ Surrey Record Office, 2397/6/32; for other examples of workhouse discipline, see Smith, ‘Refuges of last resort’.

⁵⁷ Jackson, ed., *Newbury Kendrick workhouse*; for another example of poor law putting out, see Barker and Harris, *Merseyside town*, pp. 137–8.

⁵⁸ Unfortunately the Kent records do not always include both the dates fibre was put out and returned, and therefore breaking them into quartiles produces very large ranges that do not add much detail.

⁵⁹ The methodology used differs from Muldrew’s demand-side estimate. A supply-side estimate using net imports and estimates of home production of fibre for wool, flax, and cotton and the productivity estimates in tab. 5 has an upper bound of about 1.38 million spinners and a lower bound of 1.18 million spinners in the 1770s; see Schneider, ‘Creative destruction’.

Table 5. *Productivity estimates for constructed wages*

<i>Time</i>	<i>Wool productivity (lbs)</i>	<i>Flax productivity (lbs)</i>	<i>Cotton productivity (lbs)</i>	<i>Unmamed fibre productivity (lbs)</i>
Weekly	2.5	2.1	2.5	2.5
Daily	0.417	0.35	0.417	0.417

Sources: See tab. 4 and section II.

Although challenging to the standard pound-a-day assumption, our findings gain support from independent research. Dolan's study of Richard Latham's account book and other contextual evidence suggests rates between 1.5 and 2.5 lbs per week in coarse flax spinning.⁶⁰ She acknowledges that these are lower than the productivity estimates suggested by Muldrew and by Styles in his classic work on cloth manufacture,⁶¹ but supports her conjecture with references not only to her contemporary sources but also to the productivity of modern practitioners: 'An unmarried, highly skilled spinner might spin more than 2.5 lb a week and children or the elderly might spin less'.⁶² More supporting evidence comes from the tasks assigned to the poor in early Stuart Salisbury.⁶³ While several adult women were required to spin 6 lbs weekly, other named women, several elderly couples, and women with child helpers were allocated smaller individual quotas. Even under closely supervised conditions and on pain of being denied relief, the pound-a-day target was clearly understood as only attainable by the most robust and competent spinners. Moreover, Ottaway has recently reported the exact amount and value of yarn production within Forehoe Hundred House of Industry from 20 February 1786 to 22 January 1787 as part of her meticulous study of the old poor law's insistence on industry and labour discipline.⁶⁴ Although inmates were assigned to various different employments, spinning dominated in terms of both the numbers involved and the amount of money generated, and while overall earnings did not come close to the costs of inmate upkeep, they were hardly negligible. Most relevant here are Ottaway's estimates of productivity, both at Forehoe and in other Norfolk workhouses, which at 1.37 lbs per spinner per week in the 'boys' room', 1.33 in the 'girls' room', and 1.31 in the 'adult/old women's room' suggest norms more in line with our findings than the claims of Arthur Young.⁶⁵

Table 5 provides our estimate of daily and weekly productivity by fibre and constitutes one pillar of our construction of spinners' wages. These estimates are based on the data summarized in table 4, adjusted according to the count and supervisory regime where these are known. For cases where the fibre is not given, we use the more optimistic productivity figure to ensure that our earnings calculations represent an upper bound. The second pillar is the relevant piece rate: our next topic.

⁶⁰ Dolan, 'Fabric of life'.

⁶¹ Styles, *Dress of the people*, pp. 142, 375–6, n. 35.

⁶² Dolan, 'Fabric of life', p. 360.

⁶³ Slack, *Poverty in early Stuart Salisbury*, pp. 9–15.

⁶⁴ Ottaway, 'Workload'.

⁶⁵ *Ibid.*, p. 21.

III

While empirical estimates of productivity put us on firmer ground in describing the working lives of spinners, for estimates of their remuneration we need to 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 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.⁶⁶ 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 categorize as 'direct claims'.⁶⁷ Twenty-four examples of piece rates are cited in this source, only one of which was over 6d. per lb and most 2½d. for weft and 3d. for warp.⁶⁸

Parish records also provide detailed account books and payment vouchers. One such piece of evidence comes from the records of Holton, Oxfordshire:

Cost of two pair of sheets & two pillow cases spun by Blind Headington	
<u>1815</u>	
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 ⁶⁹

This scrap of paper shows a piece rate of 6d. per lb, which, when converted into a daily wage using our estimate of productivity in spinning flax, would have been 2.1d.⁷⁰

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 lb range. There are some instances of higher piece rates, but these were not sustained for any substantial period. Although nominal piece rates rose moderately over the period under consideration, real piece rates actually fell, as shown in figure 2, and this result also holds if we only include piece rates up to 1770. The real piece rate evidence provides no support for Allen's

⁶⁶ Smail, ed., *Woollen manufacturing*.

⁶⁷ 'The are extraordnery sharp people in Yorkshire and much given to cheater and deceiving (sic)'; *ibid.*, p. 62.

⁶⁸ Brearley was working with inferior materials, which might have led him to tolerate less skilled and so cheaper spinning; see *ibid.*, p. xii.

⁶⁹ Oxfordshire History Centre, PAR 135/13/F1/1. Since the spinner here might be objected to on the grounds of disability, and because there is no information on the time taken to complete the spinning, this source is not included in the analysis of productivity.

⁷⁰ 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, and in general are consistent with the rates used in our wage constructions; see Humphries and Schneider, 'Spinning', pp. 21–3.

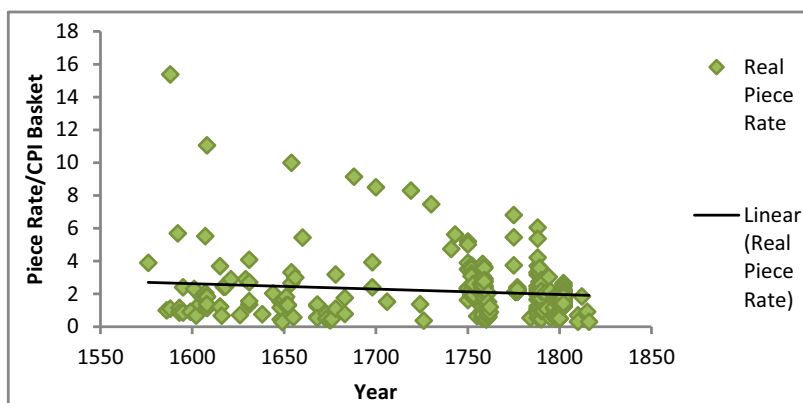


Figure 2. *Real piece rates*
 [Colour figure can be viewed at wileyonlinelibrary.com]

Sources: See online app. S4 and text.

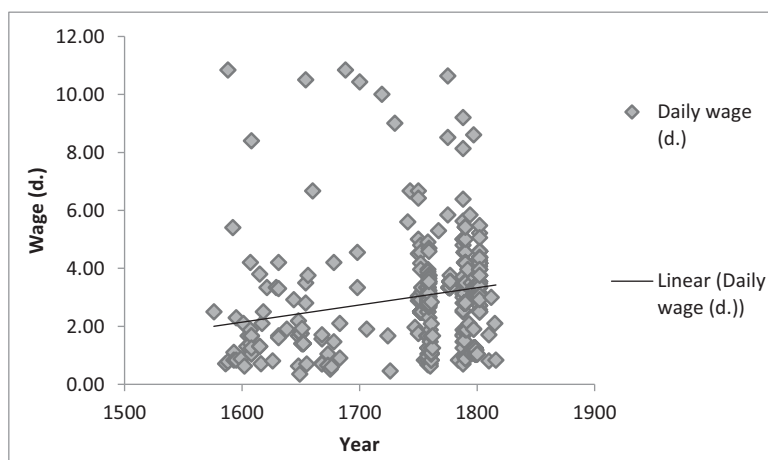


Figure 3. *Constructed (productivity \times piece rate) nominal daily wages*

Sources: See online app. S4 and text.

argument that the timing of the spinning innovations coincided with increases in spinners' remuneration relative to his consumer price index (CPI) basket.⁷¹

Altogether we have constructed 485 estimates of spinners' nominal daily wages from productivity and piece rates reported in the primary sources and a further three estimates where the spinners also received board and lodging.⁷² These estimates relate to spinners working with different fibres, though most relate to

⁷¹ A regression analysis shows that the slow decline in real piece rates is statistically significant, and further that controlling for year of observation, piece rates drawn from 'indirect claims' are higher than cases drawn from other sources (this result is also statistically significant).

⁷² In these cases we added the value of Allen's CPI 'respectability' basket for the relevant years to the cash payments.

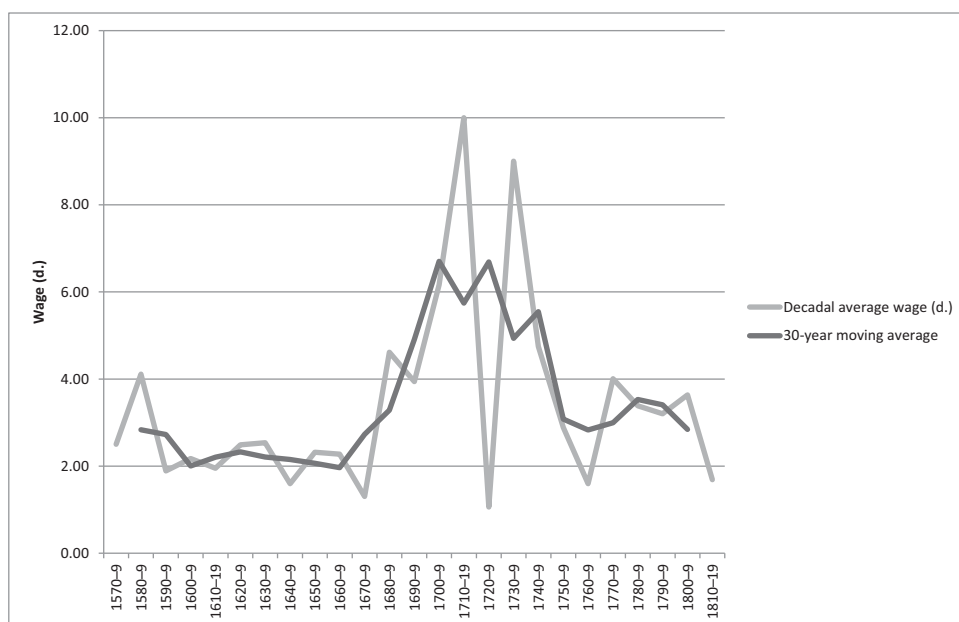


Figure 4. *Constructed nominal daily wages, decadal and moving averages*

Note: YMA: year moving average.

Sources: See online app. S4 and text.

wool. The wages constructed from productivity and piece rates are shown in figure 3.

The constructed wages do not trend upward at the rate suggested by Allen and although a rare group of spinners did manage the 8–10d. per day imagined in the high wage economy thesis, they were as likely to achieve these heights before 1700 as after. The vast majority of spinners earned the much lower 3–4d. per day claimed in the gender histories. Decadal averages of our computed wages tell a similar story, as shown in figure 4.

Although the 10-year average does peak in the early 1700s, this spike is reliant on only a couple of observations (see online appendix S1) and occurs too early to fit with Hargreaves's invention of the jenny. Wages were back down to their long-run mean around 3–4d. well before 1760. Far from showing long-run wage increases, the decadal averages of constructed wages indicate that spinning remuneration changed little in nominal terms throughout the early modern period. The next section investigates whether daily and weekly wages read directly from the historical record exhibit the same stasis.

IV

We now buttress the wage estimates constructed from observed piece rates and our estimates of productivity by searching the same kinds of historical sources used so far for observations of and claims as to wages *per unit time*—that is, what spinners could actually earn per day or per week. We present four kinds of wage observations

classified by type of source. These are combined with the constructed wages based on the same source type.

The most accessible and straightforward claims of spinning earnings come from contemporary observers such as Arthur Young and Frederick Eden, the writers of pamphlets on textiles, and county surveys—hence their attraction for historians. Muldrew's figures are taken from such sources, and using them he maintains that married spinners earned 1s. 4d. per week (2.7d. per day) in 1615, 3s. per week (6d. per day) in 1700, and 'possibly' 4s. per week (8d. per day) in 1750: numbers we have seen reproduced in Allen's series.⁷³ However, historians of women's work have not subscribed to this rosy vision. Clark and 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 pushed back through the embezzlement of fibre and yarn.⁷⁴ Moreover, observers frequently quoted wages 'if industrious' or of 'a woman that works hard' or a 'brisk' girl, descriptions that suggest reference to peak rather than average productivity.⁷⁵ The subjective judgements 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 278 such observations described in our dataset as 'indirect claims'; these include the three estimates which were grossed up to incorporate the augmentation of cash wages with board and lodging and 60 cases constructed from our productivity and piece rates also drawn from contemporary observers. Wage assessments from the early modern period provide 55 further observations; these include 36 cases constructed from our productivity estimates and piece rates proposed by the justices. While these have the advantages of being reliably contemporaneous and produced by disinterested sources, they do not necessarily reflect the amounts actually paid to spinners, but only the piece rates and occasionally day rates that the local justices of the peace thought appropriate. By the late seventeenth and early eighteenth centuries these rates were 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 from within the textile industry, such as John Brearley, cited above, which we classify as 'direct claims'. These yield 68 observations that include 54 cases constructed from productivity estimates and piece rates gleaned from analogous sources. Fourth, we have hundreds of previously unused records from philanthropic schemes, workhouses, and commercial yarn masters, from which we draw our 2,158 reliable 'accounts' observations, which include 335 cases constructed from our productivity estimates and piece rates cited in 'accounts'. 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. Online

⁷³ Muldrew, "Ancient distaff", p. 519.

⁷⁴ Valenze, *First industrial woman*, pp. 72–3; Clark, *Working life of women*, p. 124. Cf. Styles, 'Embezzlement'.

⁷⁵ Young, *Six months tour through the north of England*, vol. II, p. 254; idem, *Annals of agriculture*, vol. IX, p. 309; Eden, *State of the poor*, vol. III, p. 809.

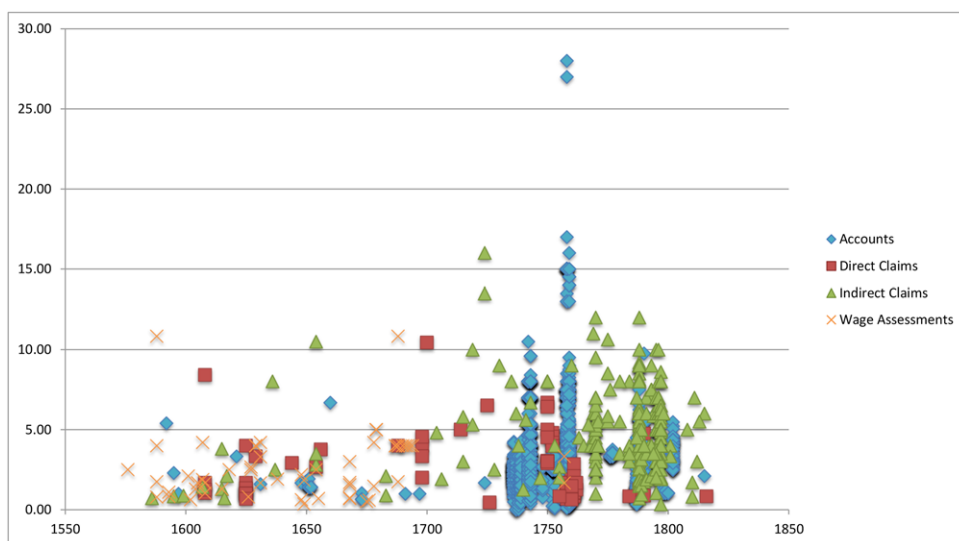


Figure 5. *Daily wages by source type, nominal d.*
 [Colour figure can be viewed at wileyonlinelibrary.com]

Sources: See online app. S4 and text.

appendix S2 presents the daily nominal wages for the three principal types of fibre spun in Britain during the period under consideration, and online appendix S3 breaks down our data by region. 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.⁷⁶

Figure 5 provides 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 high wage economy thesis, and the pessimism mounts when we include 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 and may include deposits that 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. Six pence 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.⁷⁷ A fitted line through the scatter plot does slope upward but any growth in wages is minor.⁷⁸

⁷⁶ If this estimate overstates the amount of work done by spinners in the seventeenth century due to lower levels of ‘industriousness’, a recalculation of earlier wages based on a shorter work week would show a trend that is even less supportive of Allen’s argument; that is, wages in the seventeenth century would be higher than shown here and would decline markedly up to the spinning inventions.

⁷⁷ The only observation that supports this claim is from Arthur Young’s tour of the north in 1770; Young, *North of England*, vol. III, p. 164.

⁷⁸ The slope coefficient on a linear time trend is 0.012 (SE= 0.001). If we remove the top and bottom 5% of observations, the slope is again 0.012, and only including wages up to 1770, 0.0092.

Table 6. *Spinners' wages by source, fibre, and type of labour*

Constant	-3.711** (0.855)	-3.962** (0.860)
Year	0.003** (0.000)	0.003** (0.000)
Source:		
Accounts	-0.409** (0.043)	-0.403** (0.043)
Direct claims	-0.623** (0.086)	-0.565** (0.089)
Wage assessments	-0.381** (0.110)	-0.328** (0.112)
Fibre:		
Cotton	-0.483** (0.134)	-0.509** (0.134)
Flax	0.100* (0.053)	0.068 (0.055)
Hemp	-0.071 (0.101)	-0.078 (0.101)
Tow	0.550* (0.306)	-0.511* (0.306)
Wool	-0.069 (0.047)	-0.089* (0.048)
Labour:		
Boys	-0.455** (0.055)	-0.477** (0.056)
Children	-0.029 (0.121)	-0.058 (0.122)
Girls	-0.672** (0.036)	-0.695** (0.038)
Men	0.028 (0.060)	0.006 (0.060)
Women	-0.010 (0.035)	-0.005 (0.036)
Wage: construction		
Based on productivity x piece rate		-0.088* (0.035)
R ² (adj)	0.240	0.241
SEE	0.600	0.600
F	58.493**	55.130**
N	2,554	2,554

Notes: The dependent variable is the natural logarithm on the nominal daily wage. Coefficients are reported with standard errors in parentheses. ** and * indicate significance at the 1% and 10% levels.

Source: See online app. S4.

To tease out the various factors influencing spinners' daily wages, the natural logarithm of the wage was regressed on the year of the observation while controlling for source, fibre, and the age and gender of the worker. The results are shown in table 6.

The effects of different fibres are relative to those cases where the material was unknown. Not surprisingly, working with wool, tow, or hemp had no significant effect on wages since the omitted category was probably dominated by these fibres, while spinning cotton, an activity concentrated later on in the period, reduced wages, and spinning flax raised wages. The age and gender of the worker was also explored relative to cases where these characteristics were unknown. Again not surprisingly, adult men and women were not significantly more productive or better paid than the unknown category as such workers, particularly adult females, probably dominated it. As to be expected, boys and girls earned significantly less than the omitted category.⁷⁹ The interesting findings here relate first to the effects of the source, and second to the time trend. As all observations have a known source, the indirect claims were chosen as the reference category relative to which wages recorded in accounts or based on the direct claims of insiders or the assessments of local justices are significantly lower. This confirms our argument that contemporary pundits probably overestimated what spinners could earn: an important result given earlier researchers' reliance on such sources. Finally, although wages do drift upward, the rate is only 0.3 per cent per annum.

⁷⁹ Workers were rarely identified as 'Children' so this category contained few cases.

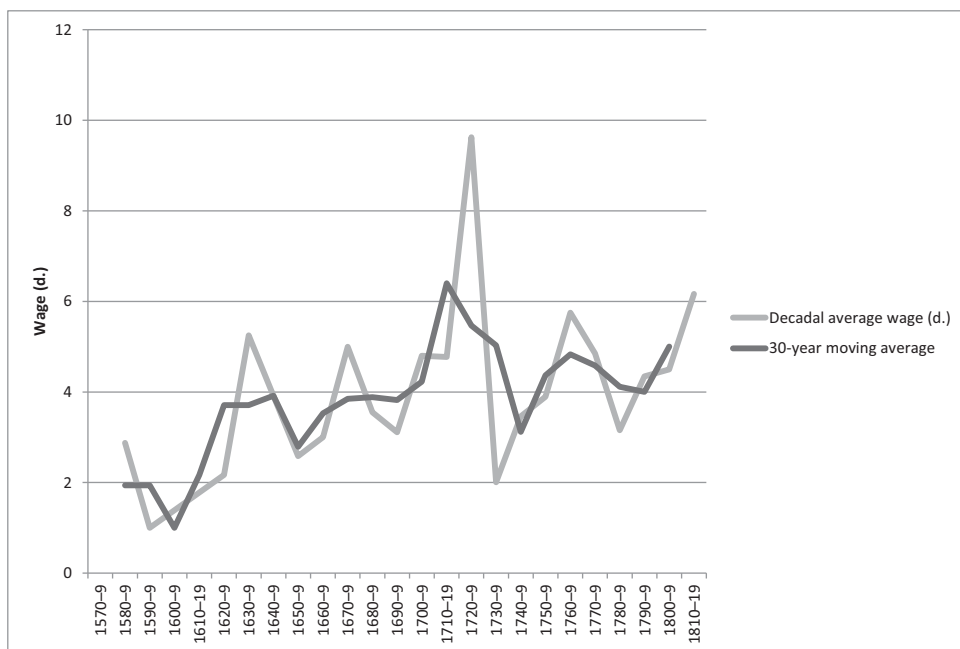


Figure 6. *Daily wages without constructed wages, decadal and moving averages*

Note: YMA: year moving average.

Sources: See online app. S4 and text.

For readers who may have reservations about our procedure for constructing wages from productivity and piece rates, the regression model was also estimated including a control for these cases. Although the dummy variable for construction from productivity and piece rates is negative and significant, meaning that these estimates are systematically lower, the effects on the size and significance of the other variables, including the time trend, are trivial.⁸⁰ The robustness of the findings on trends over time can be seen by comparing the decade averages shown in figure 6, which excludes the constructed cases, with figure 4, which was based on the constructed cases. It is important to remember that many of the claims about spinners' wages by contemporary commentators and more recent historians have also been based on constructing time rates from guesstimates of productivity and quoted piece rates, albeit less formally acknowledged than in this article.

V

The high wage economy 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 and rising wages in the third quarter of the eighteenth century were the impetus for the inventions of Hargreaves, Arkwright,

⁸⁰ Nor does cutting the data at c. 1770 or 1775 substantially change the results, suggesting that any increase in the run up to the inventions is not disguised by the collapse in wages when mechanization was in full swing.

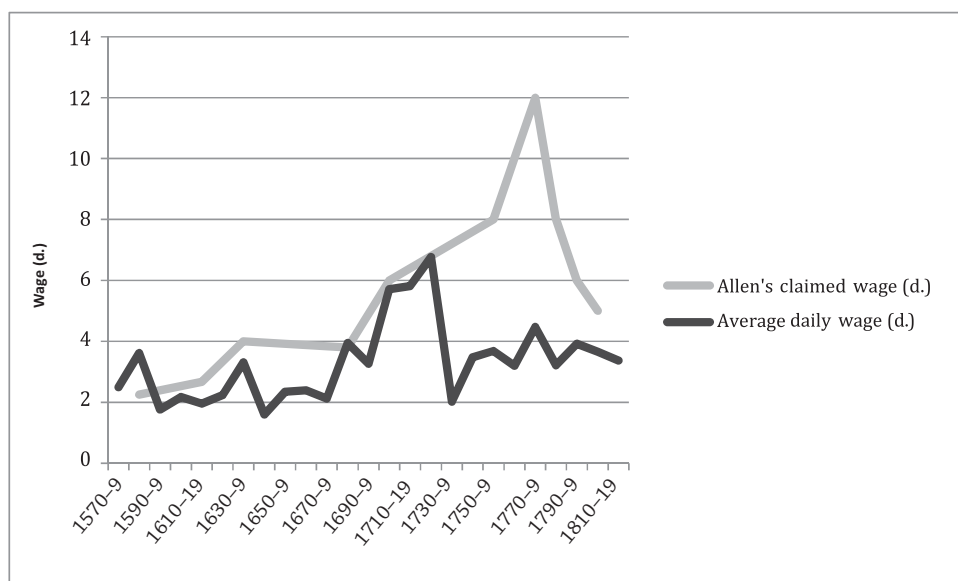


Figure 7. *Nominal daily wages, decadal averages*

Sources: See online app. S4 and tab. 2.

and Crompton, and justified the adoption of the new techniques.⁸¹ To account for the timing of the inventions of the industrial revolution, there should have been an increase in nominal wages for spinners prior to the ‘wave of gadgets’ that began in 1765.⁸² To provide a view of the changes over time, figures 7–9 and online appendix S1 present averages by decade in nominal wages, welfare ratios, and comparative series of women’s casual and annual wages and men’s casual wages.

Mean nominal wages did increase before the invention of the spinning jenny but any rise was modest and certainly smaller than claimed by Allen and Muldrew.⁸³ Welfare ratios, constructed by dividing nominal wages by the cost of living for a single adult using Allen’s CPI ‘respectability’ basket, grew in a similarly restrained fashion over the period of available data, while comparisons with evidence on what women could earn in alternative employment suggests that spinning was relatively poorly paid even by the standards of the contemporary female labour market.⁸⁴ Figures 7–9 show that there was no substantial jump in nominal, real, or relative wages for spinners leading up to the spinning innovations of the 1760s and 1770s. The spike in the early eighteenth century is probably the product of a few rogue observations in decades when observations are scarce, but even if it is not, the timing does not match up with Allen’s argument. Rather, the data show spinners’

⁸¹ Allen, ‘High wage economy’, p. 14; Muldrew, ‘“Ancient distaff”’, p. 523.

⁸² 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, *British industrial revolution*, p. 5, discounts any significant change in the price of capital as a driver of the supposedly increasing ratio of wages to interest rates.

⁸³ For analyses of the data up to 1765, see Humphries and Schneider, ‘Spinning’.

⁸⁴ Allen, ‘London’; Humphries and Weisdorf, ‘Wages of women’, pp. 431–2; Clark, ‘Long march’, pp. 99–100. Cf. Muldrew, ‘“Ancient distaff”’, p. 521–3.

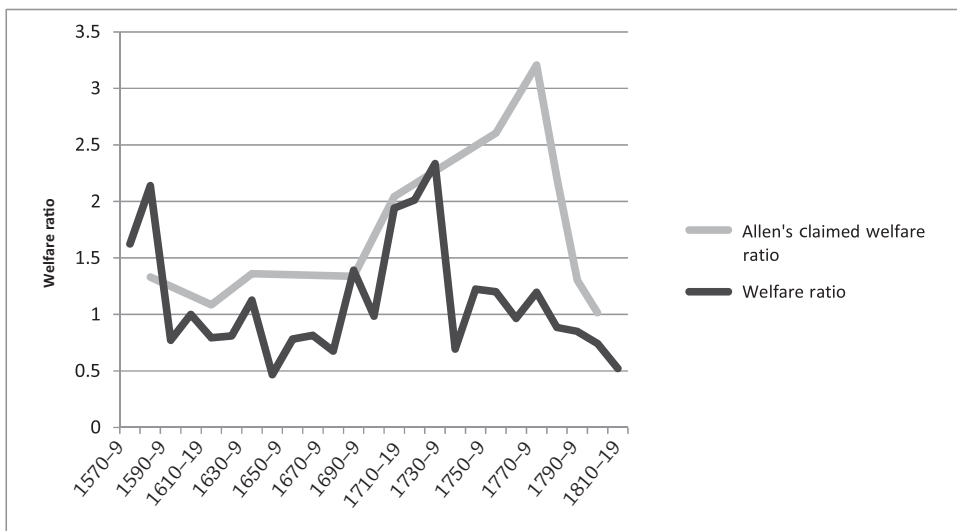


Figure 8. *Welfare ratios, decadal averages*

Sources: See online app. S4, tab. 2, and text.

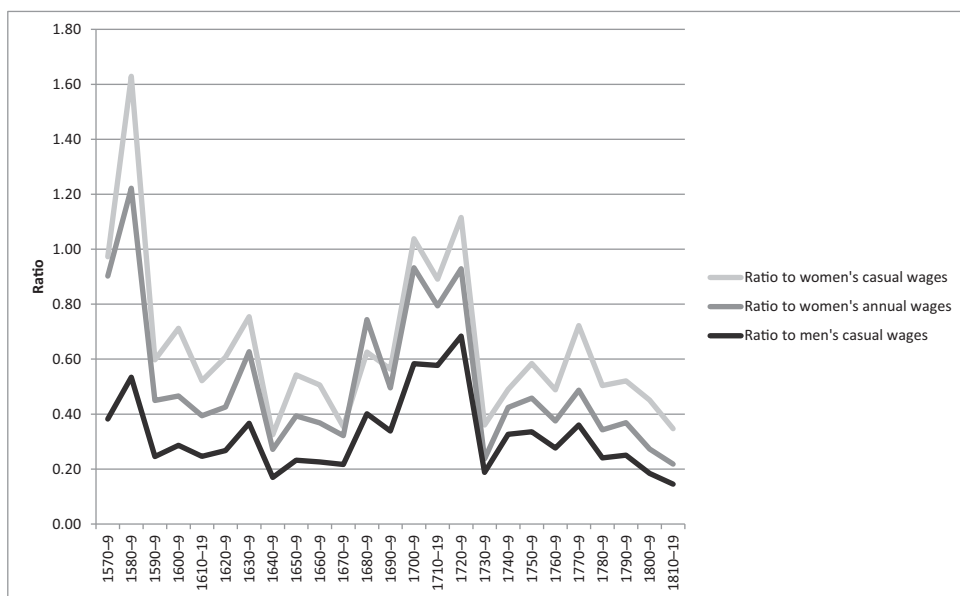


Figure 9. *Ratios of spinners' wages to other wage indices*

Sources: See online app. S4 and text.

earnings falling relative to the CPI basket and the wages of women in other jobs, after prosperity in the earlier part of the eighteenth century.

Similar real wage levels between the seventeenth century and 1730–1819 further suggest that remuneration for the sector changed little over the period, despite the handful of higher wage observations in the 1700–29 period. Figure 6 has shown

that the broad trends are still present if we remove the constructed wages. Even if we only consider the most optimistic estimates, the ‘indirect claims’ from the social commentators, we cannot find evidence to support Allen’s claimed wage levels or growth rates for the 1750s and 1770s. When including, as we believe is crucial, more authentic evidence of remuneration, the picture is more pessimistic still. Spinning 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 substantially to family incomes. We cannot find support for Allen’s view of spinning as a high wage employment.

VI

In the preceding sections of this article we have provided direct evidence of the *actual* productivity and pay of hand spinners to challenge their inclusion in the high wage economy. Our data have shown that there was no ‘smoking gun’ in terms of a peak in spinners’ wages immediately before the three spinning inventions of the late eighteenth century. Figures 7–9 do not suggest that the timing of the industrial revolution was directly linked to high or increasing wages for spinners. Moreover, most actual payments to spinners in Britain were notably lower than the rates claimed by many social commentators, raising questions about Allen’s asserted wages for French spinners, which are heavily reliant on the views of some of these same pundits.⁸⁵ A parallel study of continental spinners’ actual wages is needed to provide a credible basis for any comparative analyses.

Reflection on the eighteenth-century organization 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.⁸⁶ 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.⁸⁷ 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.⁸⁸ Manufacturers in linen and hemp also expanded geographically to obtain enough spinning labour. John Hart, a sailcloth manufacturer from Warrington, employed about 8,000 spinners in and around the town and 30 persons ‘to put out flax in various parts of the country’ in 1756.⁸⁹ The Warrington manufacturers more generally put out flax for spinning all the way up the coast to the north, even as

⁸⁵ See Styles, ‘Fashion, textiles, and the origins’.

⁸⁶ The geographical extension and contraction of hand spinning remains an important topic for future research. Even if wages were low, as one of our referees emphasized, the ability of an initially growing number of women and children to access them at times and in places where employment opportunities were sparse is an important part of the broader account of trends in women and children’s contributions to family incomes.

⁸⁷ Burley, ‘Some accounting records’.

⁸⁸ Oakes’s spinning network covered 60 miles; see Fiske, ed., *Oakes diaries*, pp. 34–5, 41.

⁸⁹ Foster, *Capital and innovation*, p. 280.

far as Scotland, and probably found pockets of inland spinners as well.⁹⁰ While growth on the extensive margin could have been complemented by increased piece rates, we have found no evidence of the latter development, but many examples of the former.

More dramatic geographical relocation also helped keep down spinning costs.⁹¹ The move north was seen by both contemporaries and historians as a response to wage pressure as well as fuel costs, with the workers allegedly satisfied by a lower standard of living.⁹² Comparison of the spinning piece rates quoted by Brearley 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 Durie, was also a search for cheaper work people.⁹³ Finally, of course, yarn could be, and indeed was, imported from low wage economies such as Ireland.⁹⁴ By the early 1780s imports of linen yarn were huge and the industry almost entirely dependent on them.⁹⁵

A second restraint on spinners' wages was provided by the involvement of charities and the poor law in providing yarn produced by pauper labour, often at subsidized 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.⁹⁶ Commercial putters-out were also keen to establish links with local overseers to access cheap sources of labour. Griggs's 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 the normal supply chain. Oakes went to great lengths to retain this connection, wining 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 subsidized labour.⁹⁷ 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'.⁹⁸ In addition to the workhouse, Oakes used village poor houses

⁹⁰ *Ibid.*, pp. 280–1. Despite this search for spinning labour, Foster contends that a full-time spinner could only earn 4–6d. per day.

⁹¹ For an investigation of the regional migration of the textile industry that is critical of a simple resource endowment explanation, see Jones, *Locating*.

⁹² But see *ibid.*

⁹³ Durie, *Scottish linen industry*; *idem*, *British Linen Company*.

⁹⁴ By the 1770s Ireland supplied one-sixth of all yarn used in the Norwich woollen industry, for example—a competitive advantage built on the lower costs of wool and provisions; see Fiske, ed., *Oakes diaries*, p. 51. Even earlier when the expansion of cotton, fustian, and cotton velvet cloth put pressure on Lancashire spinning capacity, the linen yarn required was obtained from imports. In the 1740s it came from Ireland but later on additional supplies were obtained from North Germany, and after the duty on foreign imports was abolished in 1756, Germany shared the Lancashire linen yarn market with Ireland while small amounts came from Scotland; Foster, *Capital and innovation*, p. 278.

⁹⁵ The Manchester merchant Samuel Hibbert Ware reported that in 1782 almost all the linen yarn used in the Manchester industry was imported from overseas; Hibbert Ware, *Life and correspondence*, p. 98. (We are grateful to one of our anonymous referees for alerting us to this reference.)

⁹⁶ Smail, ed., *Woollen manufacturing*, pp. 91, 95. See also Kennett, 'Pauper cloth-making account'.

⁹⁷ Fiske, ed., *Oakes diaries*, pp. 38–40.

⁹⁸ Wadsworth and de Lacy Mann, *Cotton trade*, p. 108; and see above for the account of the hours to be worked by the poor at Mortlake.

and had a monopoly on the spinning done in the charity school in Bury. He was not alone in exploiting such sources of captive labour. Prisoners were also 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!⁹⁹ More generally, many of the wage observations from account books and vouchers are the records of parishes that organized and administered spinning employment by the local poor, whether in a workhouse or as parish outwork.¹⁰⁰ Indeed, Ottaway's recent study of eighteenth-century workhouses as inculcating labour discipline and producing outputs of real value challenges head-on economic historians' rash dismissal of such institutions as places of work. Spinning in the workhouse, or as part of outdoor relief, often appears managed in the same way as outworking, with workers resorting to a cloth manufacturer once their allotted lb of wool was spun to collect an additional lb, which was worked up as a separate transaction,¹⁰¹ and was valued at rates consistent with market prices.¹⁰² Spinning, under the aegis of the poor law, was indeed 'knit into the fabric of the local economy of cloth production'.¹⁰³

Third, the organization of the industry meant that yarn masters had leverage over their employees. The employers bought the fibre—wool or flax—in bulk and 'put it out' to women to spin in their own homes. The women rarely owned the material and sometimes not even the equipment, putting them at a disadvantage in bargaining over wages.¹⁰⁴ The manufacturers were relatively few, known to each other, and frequently in touch both through formal organization 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'.¹⁰⁵

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 real wages. This extension of production pulled hundreds of thousands of women, children, and

⁹⁹ Essex Record Office, Q/SBb 258. Note too that when Mary Saxby was confined in Epping Bridewell for three months c. 1760, her cell mate, who was a good spinner, was made to work; see Saxby, *Memoirs*, pp. 15–16 (transcript of the copy held in the British Library kindly provided by Stuart Hogarth, 27 July 2010).

¹⁰⁰ 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.

¹⁰¹ Ottaway, 'Workload', p. 24, notes the similarity between work patterns in the Gressenhall Spinning Books and those we report from the Griggs cashbook.

¹⁰² The Forehoe accounts record yarn spun in the workhouse at around 7d. per lb, occasionally rising to 8d. and on a few occasions falling to near 6d., which Ottaway notes is close to the rates we report Griggs paid his spinners in the 1740s and 1750s; *ibid.*, p. 23.

¹⁰³ *Ibid.*, p. 16.

¹⁰⁴ Moreover, even where 'putting out' had traditionally been forestalled by poor people's own production of fibre and ownership of spinning equipment, international trade threatened local independence. According to Charles Foster, hemp and flax were not 'put out' for spinning in Lancashire and Cheshire until they were imported from the Baltic at the end of the seventeenth century; Foster, *Capital and innovation*, p. 116.

¹⁰⁵ Fiske, *Oakes diaries*, p. 41.

families into the textile labour pool, providing them with income in the medium term but also making many reliant on a sector that would have no need for their hand spinning by the end of the eighteenth century. Our evidence offers little support for the high wage economy interpretation of the spinning innovations of the industrial revolution. More speculatively, we suggest that overcoming low productivity and the inconsistent quality of yarn, and taking advantage of low wages for underemployed female and child workers, may have been the motivations for tinkers and inventors in the late eighteenth-century textile industry, as other historians have argued.¹⁰⁶

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’.¹⁰⁷ 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’.¹⁰⁸ Perhaps this channel stood out clearly in those districts of Great Britain where the men who invented machinery, employed workers, and organized the textile industry made their profits.

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¹⁰⁶ See Styles, ed., ‘Fashion, textiles and the origins’; Berg, *Age of manufactures*; Humphries, ‘Lure of aggregates’.

¹⁰⁷ Ure, *Philosophy of manufactures*, pp. 22–3.

¹⁰⁸ Allen, ‘High wage economy’, p. 14. Mechanized spinning did of course substitute a male operative for the female hand spinner but the factory workforce as a whole was dominated by women and children.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

- S1. Average daily wage observations (nominal d.), welfare ratios, and comparisons
- S2. Daily wages by fibre (nominal d.)
- S3. Daily wages by region (nominal d.)
- S4. Additional sources