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THE IMPORTANCE OF IDEOLOGY: THE SHIFT TO FACTORY PRODUCTION AND ITS EFFECT ON WOMEN'S EMPLOYMENT OPPORTUNITIES IN THE ENGLISH TEXTILE INDUSTRIES

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Abstract

This paper uses data from the 1833 Factory Inquiry to assess male and female occupations and earnings in factory textile production. This is contrasted with evidence drawn from various sources on male and female employment in domestic industry. 1780-1850 was a period of dramatic change in the nature and location of textile production, with important consequences for women's work. Whilst economic factors explain some of the changes we see, gender ideology had a powerful effect on how the labour market operated, and this was increasingly the case over this period as the organisation of work became more formalised and hierarchical.

[1] I would like to thank all the members of the academic community who have provided comments on various versions of this paper, especially Jane Humphries and Joyce Burnette. All errors are, of course, my own.

Introduction

Visiting Huddersfield in 1849, Angus Bethune Reach found that for women employed in the mils there, 'The average [weekly earnings] may be about 8s.6d.' Whereas for men they, 'may be placed at from 14s. to 15s. per week.' The woman:man wage ratio found here contrasts favorably with the carding, drawing, and spinning departments he viewed at the Houldsworth mill in Halifax where, 'the mechanism was almost exclusively looked after by women and girls at the low wages of 5s. and 5s.6d. The men employed were overlookers, and earned from 15s. to 22s.' (Reach, 2007) As can be seen in Figures 1-2, the typical wage ratio between men and women in the mills of the Lancashire cotton and the Yorkshire wool textile industries was somewhere between the two preceding examples. This wage gap was seen as beneficial by many commentators, since it discouraged women's work. A pervasive ideology hostile to women's work outside of the home, particularly labor performed in factories and mines, had emerged by the 1820s and 30s, attracting support from polemicists as diverse as Andrew Ure (Ure, 1835) and Friedrich Engels (Engels, 1892).

Many historians of women's work argue that this ideology was highly significant in determining laboring women's relatively low wages. Sonya O. Rose claims that employers paid women a customarily low wage which was influenced by the separate spheres ideology, and they believed that it was natural for men to have better paying jobs than women (Rose, 1992). Deborah Valenze believes that, 'Employers did not offer a "living wage" to the female or child since they assumed that she was dependent upon a household headed by a male and therefore did not depend only on her wages for subsistence' (Valenze, 1995). Joyce Burnette challenges this interpretation, arguing instead that in the absence of distributional coalitions and government interference, occupational segregation and the gender wage gap were determined by natural strength differentials and women's unique ability to give birth and breastfeed. The high fertility of this period meant that women's comparative advantage in childcare had a particularly large impact on reducing their ability to earn (Burnette, 2008). For Burnette, ideology was created to explain existing patterns of work and pay rather than determining these patterns, and, 'Employers were not constrained by gender roles, but switched between men and women workers when prices signalled that they should.' (Burnette, 2008)

The 1834 Report

This paper draws heavily on the information provided in the 1834 Supplementary Report on the Employment of Children in Factories in an attempt to assess the importance of gender ideology for determining female wages relative to those of men (B.P.P., 1834, XIX-XX). The source is unrivalled for this period in terms of geographical spread, and the number of workers and employers covered. It is also highly unusual in providing wage data for individual ages (e.g. 17, 18 etc), making it possible to get a clear picture of changes in male and female earnings over the life-cycle. Very few sources from this period provide such information, especially for females, and this data is highly informative for the importance of various factors affecting the gender wage-gap, including; strength, mothering and childcare responsibilities, and workplace experience. Unfortunately, as responding to the questionnaire was voluntary it is almost certainly biased towards large firms, since they are likely to have been better organised, therefore, more likely to possess data on wages paid, and have staff able to complete the forms. Additionally, the owners of large firms may have been more concerned with their standing in the industrial and political community, and, therefore, had a greater incentive to appear to do the bidding of parliamentary investigators. Writing in 1842 William Cooke-Taylor found that, 'Experience has everywhere shown that great capitalists are more equitable and more merciful employers than persons of limited fortune.' (Cooke-Taylor, 1842)[1] This view is shared by most historians, with a consensus emerging that the worst exploitation probably occurred under small-scale employers (Fitton and Wadsworth, 1958; Lee, 1970). Thus, the big-firm bias in this source is likely to give evidence which is not fully representative of typical employment conditions at this time. However, most other primary sources available for the textile industries in this period are heavily biased towards large firms, since they were the ones most likely to leave records. Therefore, the bias in this report is probably lower than in most other sources.

Some errors in data collection may have occurred in the 1834 Report because of the short period of time allowed for the survey, arising from, '…the urgency of the promoters of the bill before the legislature.' (B.P.P., 1834) However, the large sample size means that any errors are unlikely to have affected the data too significantly.[2] Potentially more harmful is that it appears from Dr Mitchell's introduction that the district commissioners did not check to see if the returns were a true depiction of employment practices within the mills (B.P.P., 1834). Since the report was commissioned with the purpose of providing a statistical basis for proposed legislation on child and female labour, the factory owners had an incentive to downplay the harshness and extent of the work these groups performed. However, it is difficult to quantify the effect of this, especially as it may have been countered by some factory owners trying to overstate the level of female and child labour, so as to claim that such workers were indispensable to the industry, and

[1] See also, (Reach, 1972)

[2] It seems safe to assume that any genuine errors were randomly distributed.

therefore for the good of the national economy should not have restrictions placed on their work. Indeed, this argument was successfully used by the silk industry to gain an exemption from the restrictions placed on the labour of children aged ten to twelve years old (Kirby, 2003). This uncertainty over how truthful the responses were has led me not to attempt to revise the figures, instead, leaving them as they are. Fears that the investigators were in alliance with capitalist producers are partially allayed by Cowell's firm rejection of British manufacturers' claims that they were placed at a competitive disadvantage by the high price of labour in this country:

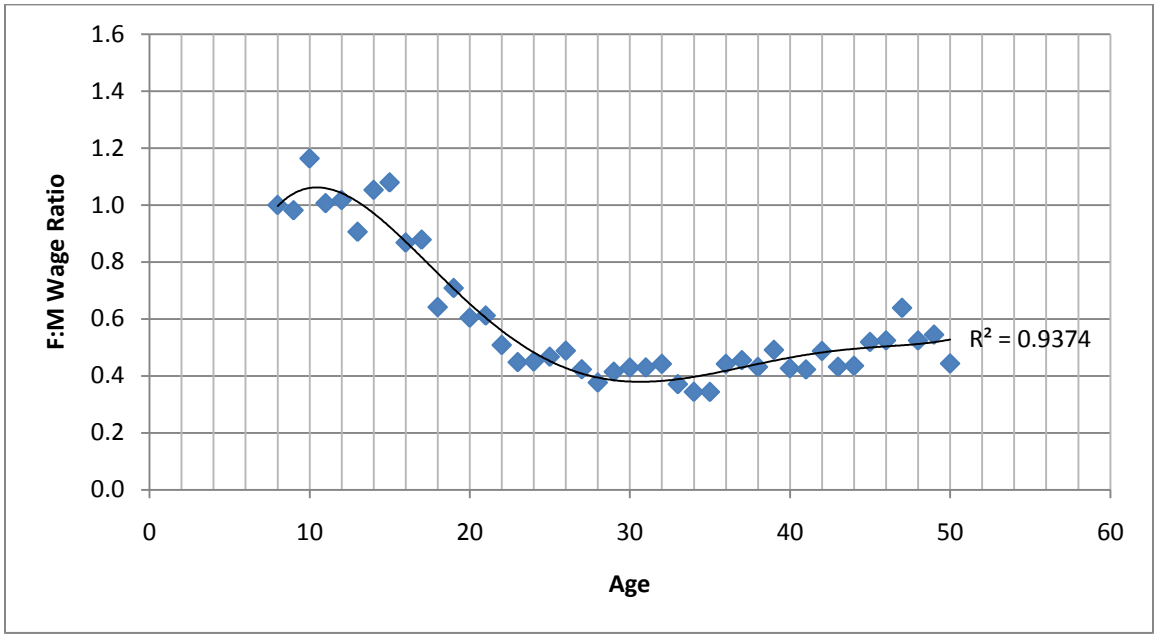
> It seems somewhat unaccountable that gentlemen who are in the habit of paying their own operatives according to a scale dependent on the varieties of productive capability in the machine, and according to the extent to which the operative develop such capability, should think it a simple and easy matter to compare the rate of wages in foreign and English cotton-working (B.P.P., 1834, p.399).

Male and female earnings and occupations

Figures 1-2 show a female:male wage ratio of around, or slightly above, 1.0 up until the age of 15, after which it plunges dramatically. As can be seen in Figures 3-4 this is because of rapidly rising male wages and relatively slowly rising female wages. The relationship between male and female wages then stabilizes from the early-20s, as a result of male and female wages rising at approximately the same rate from the mid-20s to mid-30s, after which they level off or decline. The 1834 Report reveals a broadly similar general trend for the wool textile industry in Somerset, Wiltshire, and Gloucestershire; the silk industry in Derby, East Anglia, and Somerset; the flax industry in Leeds; and the lace industry in Derby, and Tiverton (B.P.P., 1834). Janet Greenlees rejects the claim of many historians and contemporaries that women in the cotton industry generally received wages between one-third and one-half of those of men, arguing that the gender wage-gap was much smaller (Greenlees, 2007). However, she bases this on records from individual factories and does not distinguish between adult and child labour, instead basing her claims for the woman:man ratio on the figures she has for the female:male ratio for all ages. Since workers aged under eighteen accounted for 46.48% of the factory cotton workforce in 1833 (and workers aged under sixteen, for which the F:M wage ratio was particularly high, accounted for 35.37%), it is easy to see how failing to distinguish wages by age would grossly understate the gender wage-gap for adult workers. Further, much of the data she presents is for specific occupations, or specific rooms within factories, and so fails to account for the importance of occupational segregation which resulted in women being denied access to many of the best-paid jobs in the industry (see below, especially pp.10-13).[3]

[3] Figures extracted from B.P.P. 1834, XIX, p.279.

Figure 1: Female : Male Wage Ratio in Lancashire Factory Cotton Production (1833)

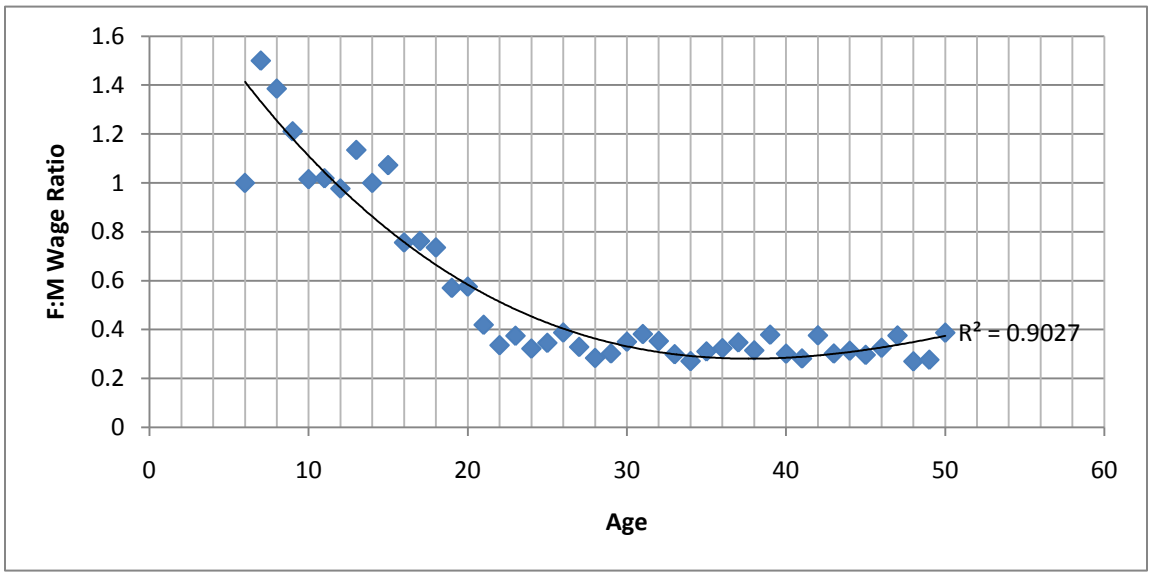


Source: Extracted from B.P.P. 1834, XIX, p.279. N.b. all data and calculations derived from this source in this paper excludes workers aged above 50 since they accounted for such a small proportion of the workforce. The data for 'Lancashire' includes workers in some of the border areas of Cheshire and Yorkshire. Lines of best fit for Figures 1-6 are derived from a least-squares linear regression with the specification appropriate to the number of turning points.

Male strength advantage partially explains the relative decline of female wages from the mid-teens, since some of the factory occupations at this time were physically demanding. The importance of strength for explaining some of the gender wage-gap can be seen in the greater decline of male wages from their peak than those of females as their age moves beyond their physical prime. Trade unions also reduced women's earning capability: in the cotton industry the mule-spinning and dressing unions acted to exclude women from these well-paid occupations.[4] Lower levels of investment in the human capital of females, by both themselves and by parents, provides a further reason for the gender wage gap.

[4] N.b. although trade unions did not become legal until 1824, proto-trade unions, officially designated as 'trade societies' or 'sick clubs', had operated well before this date. In this paper 'trade union' is used to refer to both legal trade unions and any prior organisations which shared their key characteristics.

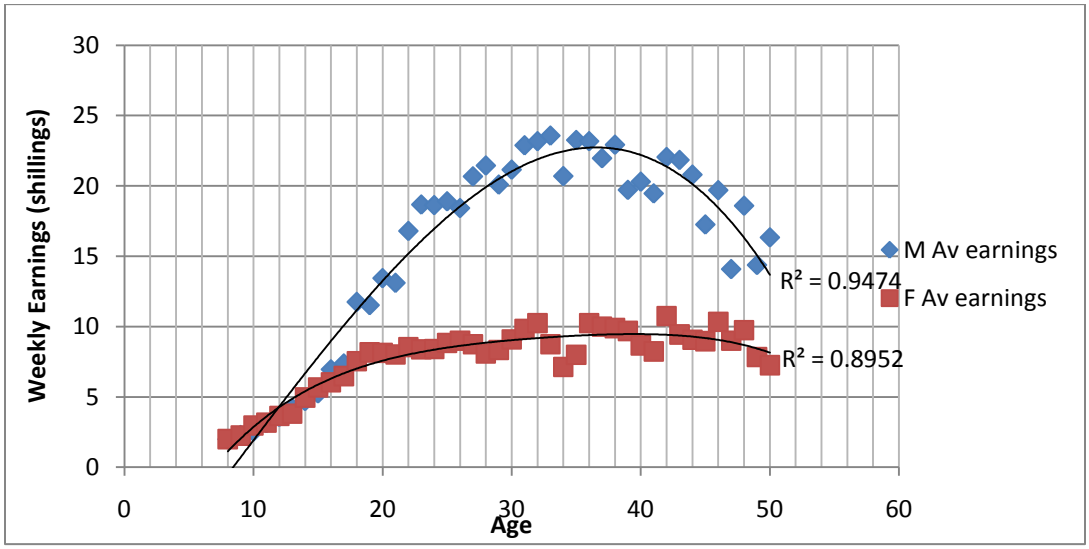
Figure 2: Female : Male Wage Ratio in Yorkshire Factory Wool Textile Production (1833)[5]



Source: Extracted from B.P.P. 1834, XIX, p.281.

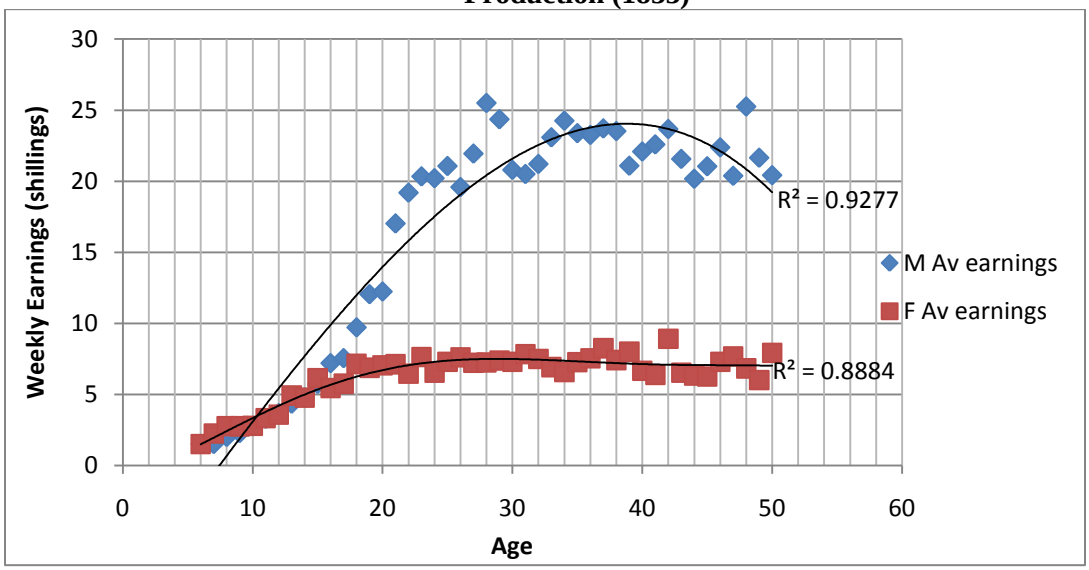
[5] N.b.The table in the 1834 Report from which this graph is extracted is headed 'Wool; Leeds', and H. M. Boot has followed this description when using this data but this seems to be inaccurate. In the introduction to the age-earnings data in the 1834 Report, it states that, 'From the factories working in wool ... Those in the North are nearly all in the West Riding of Yorkshire, and have been classed together. A few from the neighbouring districts, being insufficient to form in any instance a satisfactory average, have been conjoined with them.' Since no tables with earnings by age are given in the report for the West Riding other than 'Wool; Leeds', it would seem that this data is referring to the West Riding (and a few factories found in bordering areas). It was the intention of the inspectors to assess factory conditions in all types of factories, and the West Riding factories are described as those 'working in wool', so it also seems that this data is referring to both woollen and worsted factories, rather than just woollens. Finally, in the 1833 data females account for 44.32% of the total workforce: in the 1835 Factory Returns females account for 61.11% of the workforce in the worsted mills of Bradford and Halifax (the two main centres of the West Riding worsted industry), and only 24.64% of the workforce in the woollen mills of Leeds and Huddersfield (the two main centres of the West Riding woollen industry). It does not seem plausible that there would be a dramatic change in the gender composition of the workforce in only two years, giving further evidence for the 1833 data including both woollen and worsted workers. See, (B.P.P. 1834, XIX; Boot, 1995; Hudson, 1986)

Figure 3: Male and Female Average Weekly Earnings in Lancashire Factory Cotton Production (1833)



Source: Extracted from B.P.P. 1834, XIX, p.279.

Figure 4: Male And Female Average Weekly Earnings in Yorkshire Factory Wool Textile Production (1833)



Source: Extracted from B.P.P. 1834, XIX, p.281.

I have found no valid evidence for women in the cotton industry being paid less than men for the same work (i.e. 'direct discrimination') in either the primary evidence or secondary literature I have consulted for the Industrial Revolution era. The only evidence for direct discrimination in textiles comes from a Parliamentary Commissioner's report on handloom weavers in the declining West of England trade in the late 1830s, where women received lower piece-rates with the natural consequence that the lighter branches

came to be dominated by women (Pinchbeck, 1969). It should be noted that there was no mention of this practice occurring in the West of England (or anywhere else) in the extensive parliamentary reports on wool textiles of 1802-03 and 1806, suggesting that direct discrimination may have been a late development here (B.P.P. 1802-03; B.P.P. 1806).

Paul Johnson argues that 'direct discrimination' (i.e. women being paid less for performing the same work as men) occurred in Lancashire mule-spinning around 1830 when women were employed at half the male piece-rate for 'equal work' (Johnson, 2003). However, his only reference for this is Mary Freifeld's article, and of the references she provides for Lancashire, and Scotland, only Kirby and Musson mention women receiving a lower piece-rate; they describe how in 1831 women and 'lads' were being employed by Manchester small-mule masters below list prices (against which the local spinners had been striking in the winter of 1830). But, they do not state how much lower the piece rate was (Kirby and Musson, 1975). Freifeld apparently infers that women were paid half the piece-rate of men from average weekly wages provided elsewhere in her references, which is a large assumption to make (Freifeld, 1986). As can be seen from my discussion below (see pp.11-14) it is not at all clear that women mule-spinners performed the same work. Not being responsible for paying their own assistants would have lowered the wages received by the operative. Not supervising or recruiting their own assistants would have reduced their value to employers. And, women tended to work on smaller mules and spin coarser yarn, which would have further reduced their earnings (Huberman, 1991). Finally, even if this was not the case, this is not necessarily an explicit example of gender discrimination by the employers; both women and lads were employed as a means of bypassing the union, and if the employers had been able to bypass the union in some other way it is likely they would have taken this option.

There actually seems to have been a strong aversion to paying men more for the *same* work as women. Early country mills, such as the Strutts' mill at Belper, went so far as to branch out into the running of an estate and its subsidiary trades so as to provide the employment for men which was necessary to attract families to come and work at the mill (Fitton and Wadsworth, 1958). There was only limited demand for adult male labour in these factories, for supervision, machine-making, and repair work, and rather than pay men more than women or children for the other factory work, it was seen as preferable to create other work, that could be paid at the higher rate than was expected for men's labour, than to pay men more for performing the same work as women. Much of the adult gender wage gap for factory workers can be explained by the different occupations men and women were employed in, as can be seen in Table 1.

Table 1: Occupations and Earnings by Age and Gender in Lancashire Factory Cotton Production (1833)

Occupation	Sector	Age and gender	N	Avg. Earnings	Avg. Hours
Overlookers	Mule-Spinning	M	145	29.25	275.9
Dressers	Powerloom Weaving	M	836	27.81	276.0
Overlookers	Powerloom Weaving	M	400	26.30	273.9
Spinners	Mule-Spinning	M & W (principally M)	3797	25.66	275.5
Carders or Overseers	Carding	M	376	23.51	275.2
Overlookers	Throstle-Spinning	M	82	22.38	272.8
Warpers	Powerloom Weaving	M & W	332	12.26	273.0
Weavers	Powerloom Weaving	M, W, B, G (Principally F)	10171	10.82	273.7
Jack-frame tenters	Carding	Principally W	696	8.00	273.5
Spinners	Throstle-Spinning	W & G	1123	7.75	272.2
Drawing tenters	Carding	Principally W	1931	7.48	275.6
Bobbin-frame tenters	Carding	Principally W	945	7.46	276.8
Piecers	Mule-Spinning	M, W, B, G (Principally C)	7157	5.39	274.8
Scavengers	Mule-Spinning	B & G	1247	2.89	272.6

Source: Extracted from B.P.P. 1834, XIX, p.427. N.b. Average earnings are expressed in shillings and are calculated for a standardised 69 hour week, thus any differences in hours worked do not affect earnings figures. Key: 'M' = male aged 18 and above; 'W' = female aged 18 and above; 'B' = male aged 17 and below; 'G' = female aged 17 and below; 'C' = males and females aged 17 and below. 'F' = females of all ages.

The exclusion of women from overlooking/overseeing in Table 1 is striking, and highly significant in restricting their earning capability, as they accounted for four of the six most highly paid occupations. Mule-spinning also usually required the supervision of assistants, with the number of assistants to be supervised increasing with the size of the mule (see below, pp.15-17). Whilst there seems to be no evidence for direct discrimination in the cotton industry, Table 1 indicates the importance of occupational segregation in limiting women's earnings. The average earnings of warpers, the highest-paid occupation to employ a large proportion of women, was only 54.78% of that for throstle-spinning overseers (the lowest paid of the male-dominated occupations). It is also noticeable that of the six occupations for which women accounted for a large proportion of the workforce,[6] the two that were the highest paid were the only two to also employ high numbers of men. It is not possible to be certain that no women at all were recorded as overseers in the original returns, since only the aggregated tables remain, and if a gender/age category accounted for only a small proportion of the workers, the tables in the 1834 Report do not necessarily mention them. For example, only 'women' and 'girls' are listed in the aggregate table for Lancashire as performing throstle-spinning, but when this data is broken down into eight sub-regions, in three of these regions 'men' and 'boys'

[6] I.e. 'warpers', 'weavers', 'jack-frame tenters', 'throstle-spinners', 'drawing tenters', and 'bobbin-frame tenters'.

are also reported in this occupation.[7] However, there is no mention of females working as overlookers/overseers in any of the eight sub-regional tables, so if any women were so employed they would have been very rare.

Apart from Lancashire cotton, the only region-industry for which the 1834 Report provides a breakdown of occupations by age and gender is silk manufacturing in Manchester, Stockport and Congleton.[8] Only men were reported as being employed in the highly paid overseeing occupations, and again this holds true even when the data is presented in sub-regional tables.[9] Additionally, the Reports derived from the 1833 investigation, which cover cotton, woollen, worsted, silk, flax, lace, and carpet manufacture in rural and urban locations across Great Britain, feature interviews with 199 overseers in the textile industries, all of whom are male. This is despite interviews with many women in a variety of occupations within textile factories appearing in the Reports (B.P.P., 1833, XX-XXI; B.P.P., 1834, XIX-XX). The only possible evidence for female overseers in these interviews comes from the testimony of Mark Best, a former overseer in flax spinning mills, who stated that at Mr. Hamond's mill, 'I think he has got a young woman there now for overlooker.' However, this is far from conclusive, as Mark Best is not definitive that this is the case and is unable to say which room she worked in (B.P.P., 1833, p.408).

I have examined the wage books of three cotton mills (in Derbyshire and Lancashire), two silk mills (Yorkshire and Essex), one lace mill (Devon), one woollen mill (Yorkshire), and three worsted mills (Yorkshire), encompassing the period 1786-1862, and the only evidence of female overseers in the business records I have consulted is at the Courtaulds silk mill in Essex in the 1830s-60s.[10] Even here, women were only employed as 'female assistant overseers', and not as 'second-class overseers' or 'principal overseers', with their job titles indicating a relative lack of authority, seniority and control over workers at the mill. They worked in the winding department, which employed the youngest workers; boys aged up to 15, and girls up to 17 (Lown, 1990). Their earning capacity was commensurate with their lower status: 'female assistant overseers' earned a maximum of 8s 6d per week, whereas 'second-class overseers' and

[7] The eight sub-regions are: 'Manchester'; 'Stockport and Heaton Norris'; 'Duckenfield and Stayley Bridge'; 'Brinnington, Hyde, &c.'; 'Tintwistle, Glossop, &c.'; 'Oldham'; 'Bolton'; 'Warrington'. Men and boys are listed as throstle-spinners in 'Bolton'; 'Brinnington, Hyde, &c.'; 'Tintwistle, Glossop, &c.'. B.P.P. 1834, XIX, pp.428-35.

[8] Unfortunately the type of age-earnings data from which I have extracted Tables 1-4 is not provided for the silk industry in this region anywhere in the 1834 Report.

[9] The three sub-regions are 'Manchester'; 'Stockport'; 'Congleton'. B.P.P. 1834, XIX, pp.448-50.

[10] Samuel Oldknow Papers, John Rylands Library, Manchester (dates examined: 1790, 1792); Greg Papers, Manchester Central Library, Manchester (1790, 1834); Arkwright Papers, Manchester Central Library, Manchester (1786, 1794, 1810); Bentley Silk Mills Records, West Yorkshire Archive Service, Kirklees (1848-52); Courtauld Papers, Essex Record Office, Chelmsford (1825-60); Heathcoat Records, Devon Record Office, Exeter (1816-28); Benjamin Gott & Son Papers, Brotherton Library, Leeds (1830); Business Records of William Ackroyd Ltd, Brotherton Library, Leeds (1846, 1850, 1854, 1858, 1861); Business Records of Robert Clough Ltd, Brotherton Library, Leeds (1829-33, 1844-48); Business Records of John Foster & Son, Brotherton Library, Leeds (1838, 1840, 1842, 1844, 1846, 1850, 1854, 1858, 1862).

'principal overseers' could earn up to 25s and 40s respectively.[11] D. C. Coleman's research on the Courtaulds firm shows that females, including George Courtauld's four daughters, also worked in a supervisory capacity in the winding rooms in the 1810s, when the subordinate winding workers were female parish apprentices (Coleman, 1969).

Although less time spent working explains some of the gender wage gap that was common in domestic production (Burnette, 2008), this does not apply to the earnings figures given in the 1834 Report, since these are all calculated for a standard 69 hour week. Further, Table 1 shows no clear correlation between the gender(s) employed in an occupation and the number of hours typically worked, suggesting that other factory data prior to the Factory Acts of 1844 and 1847 (which placed specific restrictions on women's labour) may not suffer from a gender-time bias either.[12] The high level of fixed capital investment required for factory production meant that there was little flexibility for workers' hours, especially at steam-powered urban mills. Prior to mechanisation, with its concomitant increase in fixed capital requirements, there does seem to have been more of a gender gap with regard to the number of hours worked, and mothers would have worked the shortest hours. For example the hand-pickers employed by McConnel and Kennedy around the beginning of the nineteenth-century despite their work being primarily based outside of the home, were not subject to regular mill discipline or hours, and worked in a separate building with the option to take work home if they wished (Collier, 1964). Domestic industry offered workers complete control over working hours (subject to income constraints), and it is no surprise that women and children were more likely than men to do handloom weaving on a casual or part-time basis (Bythell, 1969).

Apart from the few women employed in mule-spinning, the highest-paid factory cotton occupation open to women in 1833 was warping, which offered an average wage of less than 12s 6d per week, and provided only a limited number of jobs. From the ages 23-41 in Lancashire cotton, and all ages above 20 in Yorkshire wool textiles, average factory female wages were less than half of those paid to men. This compares unfavourably with the woman:man wage ratio of 0.75 for the Manchester textile workers observed by Arthur Young in 1768, when all the workers worked at home or in small workshops. The ratio for the woollen cloth workers in Leeds in 1768 he reported average wages for was only 0.42, but this is still slightly above the female:male wage ratio for ages 22 and above in Yorkshire factory wool textile production in 1833 (Young, 1770). It can also be expected that the women domestic workers in Manchester and Leeds work shorter hours than men, thus overstating the gender wage-gap relative to the 1833 factory data. Thus, there is little to suggest that the transition to factory production improved women's earnings relative to men, rather the opposite seems to have been the case.

Occupational segregation was less rigid under domestic production, and where women worked alongside men gender wage differential was much smaller than we see in the

[11] Courtauld Papers, Essex Record Office, DF/3/3/27.

[12] However, it should be noted that occupations employing large numbers of child workers did tend to work slightly shorter hours.

1833 factory data. Amongst the cotton handloom weavers in Tottington in 1817 the ratio for the average earnings of married women aged 21-46 (with an average of 3.3 children aged seven or younger) to those of men aged 18-47 was only 0.50. However, these women would have almost certainly been working fewer hours due to their childcare and domestic responsibilities. Indeed, when we replace the earnings of married women with those of co-resident daughters aged 18 and above, who can be expected to have worked hours much closer to those of adult men, the ratio is 0.81 (Lyons, 1989). Payments to the highly skilled female mule-spinners working for Samuel Oldknow from 1788-92, were 0.87 of those paid to males in the same occupation at the firm, despite this work involving a significant strength component.[13] This period encompasses domestic production (1788), water-powered factory production (1790), and steam-powered factory production (1792) (Unwin, 1968). The total absence of female spinners at the firm by 1793, gives an early indication of how the shift to a more hierarchical and formal work organisation entailed by factory production acted against the employment of women, particularly in the way that women lost access to the best-paying occupations.[14]

Unfortunately, we do not know the size of the machines being used by Oldknow's workers for the period 1788-92, but this is provided in the 1793 data. Any possible male strength advantage due to an increase in the size of machinery cannot explain the complete absence of women by this date, since mules ranging in size from 108 to 256 spindles were in use, so even if the largest was beyond the physical capability of women, the smallest certainly should not have been.[15] Further, the application of external power sources to mules within the factory would have reduced the importance of male strength advantage relative to domestic production. The voluntary withdrawal of women from this workforce seems extremely unlikely given the high wages available in this occupation.[16]

Despite strength failing to adequately account for the ending of women working as mule-spinners at the Oldknow firm, it does help to account for some of the gender wage-gap we see in both domestic and factory production, and in some textile occupations the shift to the factory could result in an increase in the level of strength required. The more rapid decline of factory male wages than those of females, which can be seen in Figures

[13] *Oldknow Papers*, SO/4/2. A sample was taken for the years 1788, 1790, 1792. The highly skilled nature of this work is indicated by the very high average count of the yarn spun for the time (for men the average was 81.31, and for women it was 78.51). Before the invention of the mule most yarns had a count of below 20, and towards the end of the eighteenth-century the average count was still only in the high 20s. See, Harley, Knick, 'Cotton Textile Prices and the Industrial Revolution', *Economic History Review*, 51 (1998), p.55.

[14] *Oldknow Papers*, SO/4/3. For my sample 1788-92 women accounted for 12.95% of observations.

[15] Further the mean number of spindles on mules in use at the firm at this time was 162.97. *Oldknow Papers*, SO/4/3

[16] The fragmentary state of the surviving record, and the fact that spinners were not paid at a fixed regular date (e.g. weekly, bi-weekly etc), means that it is not possible to construct weekly earnings at this firm. However, there is considerable evidence from elsewhere that mule-spinning was well-paid at this time, and the fineness of the cotton being spun for Oldknow would have meant that the spinners here were particularly highly paid. For mule-spinners receiving high wages in the late eighteenth-century see, Lazonick, William, 'Industrial Relations and Technical Change: the Case of the Self-Acting Mule', *Cambridge Journal of Economics*, 3 (1979), p.233.

3-4, indicates the tendency for their work to be more strength-intensive, with earning capability dropping particularly fast in cotton as they passed their physical prime. Burnette uses data from US Army soldiers in 1988 to show that men are able to lift twice as much as women (Burnette, 2008). Given that females, especially mothers, had inferior access to nutritional resources within the family during the Industrial Revolution (Humphries, 1991), and unlike late twentieth-century America in this period many people could not afford the optimal calorific intake, it could be that the strength differential during the Industrial Revolution period would have been even greater than Burnette's data suggests. However, it also seems likely that gender ideology influences the type of exercise performed by army recruits throughout their life, with gender-biased results for the acquisition of strength from childhood. Support for this can be seen in the gender gap for maximum lift capacity being slightly narrower for recruits aged 28-39, than for those aged 17-20 or 21-27. The older age group can be expected to have been in the Army for longer, therefore reducing the effect of gender-biased exercise prior to conscription. Unlike modern America, most 'exercise' taken by children in the Industrial Revolution era would have been physical labour for money, which may not have included the same gender biases. Further, the preferential allocation of nutritional resources away from females, especially wives, was influenced by earning capability, therefore this difference can be expected to be lower where a woman performed well-paid and physically demanding work. Finally, *maximum* lift capacity is not a particular useful guide to the kind of muscular power needed in strength intensive jobs during the Industrial Revolution. Mule-spinning required the same motion to be performed thousands of times a day, a level of repetition that nobody could perform for their maximum lift capacity. Far more useful would be a measure of muscular stamina, something Burnette's data does not provide.

Despite the problem of estimating gender strength differentials for the Industrial Revolution period it is evident that men did have a natural biological advantage, and this was typically increased by preferential allocation of nutritional resources. We also do not have an accurate measure of the productivity advantage afforded by strength, especially with regard to different sized mules. Nevertheless, there is no doubt that prior to the spread of the self-actor in the 1830s and 1840s, which all but removed any need for physical strength from the operative, mule-spinning could be done more productively by those with greater strength, since they could operate the heavier machines with more spindles, and work these at a faster pace, thus producing a greater quantity of yarn in a given period of time.[17] Strength was particularly important on the largest hand-powered mules of the late eighteenth-century, and then again in the 1820s and 30s when water- and steam-powered mules were lengthened and 'doubled-up'.[18] William Lazonick claims

[17] It is worth noting that the self-actor was not universally adopted in mule-spinning until well into the 1860s, and this was especially the case for fine counts (which, incidentally, was the branch of mule-spinning most dominated by males). See, (Gatrell, 1977).

[18] 'Doubling-up' involved stacking one mule on top of another to double the spindlage under the control of one spinner.

that strength advantage also mattered for the ability to enact the level of physical coercion on juvenile assistants (piecers and scavengers) which was deemed necessary by employers for maximum efficiency. Not only did larger mules require more strength from the spinner for their technological operation, they also required more assistants, which under Lazonick's interpretation would create a double preference for stronger workers (Lazonick, 1979). Many historians have thus emphasised the importance of male strength advantage in enabling men to create a powerful exclusionary union, which ensured continued male dominance of mule-spinning even after the introduction of the self-actor removed any strength advantage (see, Burnette, 2008; Freifeld, 1986; Lazonick, 1979).

The literature emphasising the importance of strength for the evolution of the workforce in mule-spinning has tended to understate the importance of endogeneity in the development of mule-size. Michael Huberman has challenged this approach, instead claiming that for mule-spinners:

> Undoubtedly it is difficult to separate the relative influences of discrimination and pure abilities; we can, however, be more certain that technical change itself was more an effect than a cause of the substitution of men for women (Huberman, 1996, p.35).

As Lazonick highlights, the relative cheapness of women's labour, and perhaps more importantly, their perceived docility (this was particularly important with regard to their lower tendency to unionise), should have made them more attractive to employers, but women mule-spinners were never widespread (Lazonick, 1979). Hence it may seem strange that Huberman finds that the size of the mule was extended until it made efficient use of the physical capability of adult males (Huberman, 1996). But an analysis that more explicitly examines the importance of patriarchal ideology can explain this puzzle. Both Huberman and Lazonick find that male supervisory advantage was crucial in creating a situation where men came to dominate mule-spinning (Huberman, 1996; Lazonick, 1979). Lazonick's claim that men had an advantage in disciplining their piecers due to greater strength does not stand up to close scrutiny. The level of force that was perceived to be needed to motivate adolescent workers, i.e. rather than being so great as to injure them and therefore make them less productive, would not have been beyond the physical capabilities of a woman. Even if the piecer was of equal or greater strength than the mule-spinner it seems improbable that they would have been able to use violence in response to any behaviour by the mule-spinners given that they were hired by the day or the week and were easily replaceable.[19] The common use of leather straps and ropes for disciplining piecers would have made inflicting pain easy to do with relatively little force (B.P.P., 1833, XX). Despite women seemingly possessing the physical capability for administering the requisite physical discipline, a 15-year-old piecer from Manchester

[19] For piecers being hired by the day or the week and being easily replaceable, see, (Huberman, 1991).

testified to the 1833 Commission that the two female mule-spinners he had worked for never 'licked' him or any of the other piecers or scavengers working for them, whereas all eight of the male spinners he had worked for had done so on a regular basis. When asked how the female mule-spinners were able to motivate the piecers without using physical discipline he replied:

> They used to ask them if they'd mind their work, and then they'd give 'em a halfpenny or a penny; and then the piecers was pleased, and worked; and if the piecers had'nt meat, they used to give 'em meat, and marbles, and tops; and at any pastime here gives 'em money; 6d or 1s. (B.P.P., 1833, XX, pp.688-89).

The differing methods of motivation used by the male and female mule-spinners reflect an ideological climate which had very different expectations regarding the behaviour of men and women, which affected their behaviour at work, in turn influencing their desirability as workers to employers. Since it was widely perceived at this time that physical coercion was important to the productivity of mule-spinners (Huberman, 1996), a reduced willingness to use such methods would have made women less attractive to employers. The differing methods of motivation used by male and female mule-spinners, as described by the adolescent piecer interviewed by the 1833 Factory Enquiry, mirror the much lower frequency and degree of physical punishment meted out by female teachers than by male teachers in the schools of this era (Humphries, 2010), demonstrating the importance of gendered cultural norms for influencing workplace behaviour, and thus the operation of labour markets.

Unfortunately, there is very little evidence on what proportion of women mule-spinners supervised their own assistants. However, we do know that when McConnel and Kennedy began to hire women in the place of men on their mules from 1810 in an attempt to cut wage costs, the women did not supervise, recruit or pay their own piecers, as was standard for male mule-spinners at this firm and throughout the industry to do (Huberman, 1996).[20] Rather, more spinning-room overlookers had to be employed as the internal sub-contract system was broken up. From 1820 McConnel and Kennedy abandoned this strategy due to increased wastage and search costs, and reverted to employing male spinners who once again were responsible for supervising, recruiting and paying the piecers (Huberman, 1996). Women mule-spinners were widely perceived as being less effective at supervising their own assistants (Huberman, 1996). The adoption of standard piece-rate lists across Lancashire as the nineteenth-century advanced, the first being the Bolton list of 1813, acted against women since this would have made mule-spinners who did not supervise their own piecers more expensive to employ. The

[20] Birley's Mill did not allow their male mule-spinners to supervise their own assistants, however, this was highly unusual and even here it was abandoned from the early 1840s. See Lazonick, 'Industrial', p.245.

increasing size of mules, as well as placing a premium on strength, required more assistants, making the supervisory aspect of mule-spinners' work even more important, creating further preference for male workers.

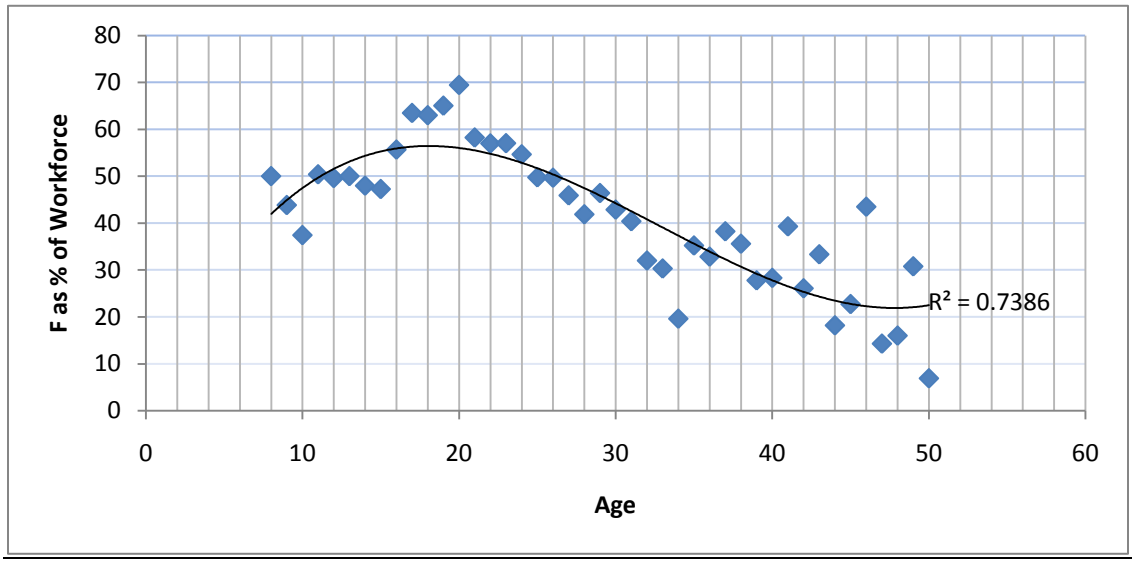
We know that employers in the cotton industry faced considerable difficulty in finding overseers, particularly those who understood the production process they were supervising (Huberman, 1996). Therefore, especially in female dominated subsectors such as carding and throstle-spinning, there should have been strong economic incentives for factory owners to employ female overseers. Unlike in mule-spinning, where the picture is clouded by the difficulty of accurately measuring the importance of strength and trade union behaviour in limiting women's employment opportunities, there do not seem to have been any formal or physical barriers to women becoming overseers. No trade unions emerged for overseers in cotton until the second half of the nineteenth-century (Turner, 1962). The only physical aspect of overseeing work was the disciplining of child workers, and as I have argued in the case of mule-spinning, this was not beyond the biological capabilities of women. Indeed, the 1833 Report interviews many overseers aged over 50, who would have been considerably weaker than younger adult males in their physical prime, including the 60 year old James Paterson who worked at the Brown flax-spinning mill in Dundee, '…and has been in their employment for about seven years; that he was previously at the spinning-mill at Glammis for twelve years and there lost his right hand and arm, caught by the belt of the wheels, in the preparing floor.' (B.P.P. 1833, especially p.131)

Burnette highlights the importance of women's lower level of human capital reducing their productivity, and thus their wages and occupational choice (Burnette, 2008). However, different levels of human capital or skill also fail to explain the absence of female overseers: the only apparent necessary formal skill for overseeing was basic numeracy (for recording worker output and/or hours worked), and the 1833 Report On the Employment of Children in Factories interviews James Tomalson, a 29-year-old overseer in the picking-room of the White Abbey cotton-mill near Belfast who, 'Depones he cannot write' (B.P.P. 1833, p.230). Human capital in the form of a knowledge of the productive process under supervision would have been beneficial, as is demonstrated by the frustration of employers in finding overseers with the requisite knowledge to be able to accurately judge worker performance. Women's years spent working in the textile mills would have adequately prepared them for this. In the carding and throstle-spinning sectors rooms of the cotton industry the female dominated workforce should have provided a large proportion of the workers with the potential to become overseers. An even clearer example for women's exclusion from overlooking despite possessing greater apparent experience in the relevant production process is provided in the burling chamber at Benjamin Gott's woollen mill at Bean Ing in Leeds. Here, in 1830, one male overseer was employed at the weekly rate of 24s to supervise a workforce comprised of 120 women. Since the two women in the chamber who were employed in the next highest-paid occupation (brushers) received an average wage of only 10s, and the 114 burlers received an average wage of only 5s 1½d, it seems clear that a woman overseer could

have been employed for considerably less than 24s.[21] They would also, unlike the male overseer who was employed, have had a thorough understanding of the production process and worker capabilities on a given technology.

Overseers tended to be drawn from the older members of the factory workforce, thus women's tendency to withdraw at an earlier age would have counted against them being able to perform this work. However, as can be seen in Figures 5-6, this withdrawal was by no means total, and is insufficient to fully account for their absence. This data does not provide information on the length of factory experience each worker had but the women in their 30s and 40s can be expected to have typically already spent a considerable length of time working in factories and have gained an understanding of the processes they worked in. If higher paid work was available, it can also be expected that more older women would have remained at work in factories than did so, creating a larger pool of potential female overseers.

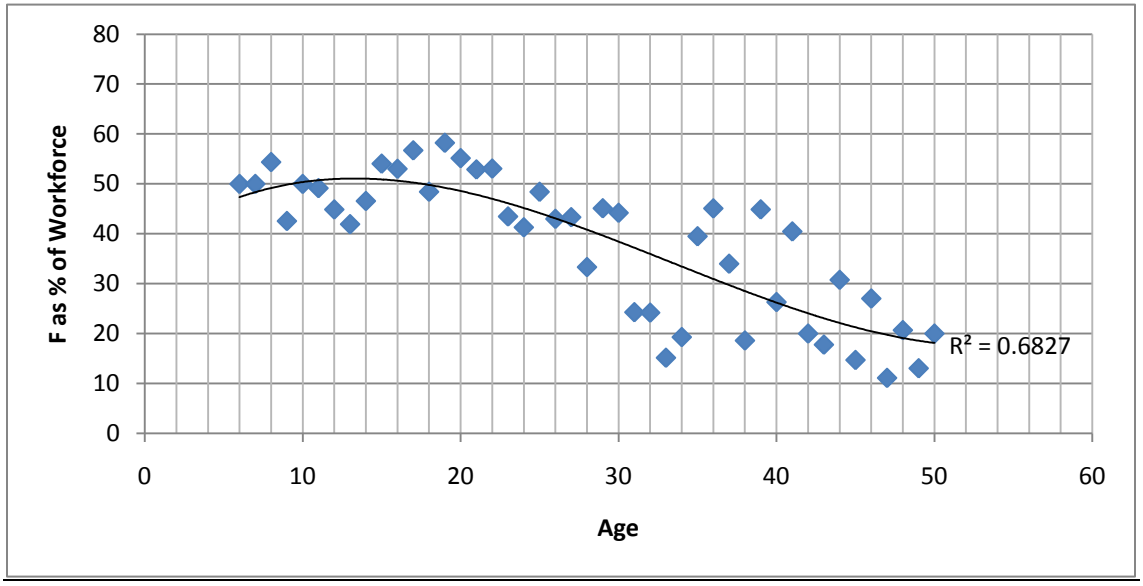
Figure 5: Females As a Percentage of Lancashire Factory Cotton Workers (1833)



Source: Extracted B.P.P. 1834, XIX, p.279.

[21] Benjamin Gott & Son Papers, vol.203.

Figure 6: Females As a Percentage of Yorkshire Factory Wool Textile Workers (1833)



Source: Extracted from B.P.P. 1834, XIX, p.281.

The only way to explain the near total absence of female overseers in textiles is through the existence of a pervasive ideology hostile to female authority. It is significant that the female assistant overseers at Courtauld's mill worked only in the winding department, which never employed males aged above 15 or free female labour above 17.[22] If women were sometimes found as overseers in flax mills this can be explained by most of the processes in factory flax production being performed exclusively by children and/or women, meaning that female overseers could work in rooms without men being subject to their authority.[23] It was apparently ideologically unacceptable for laboring women to have authority over adult males, and a strong preference was exhibited for male supervision even when the subordinate workers were children or women. This affected economic relationships even where there were highly competitive product markets and no government or trade union interference. Whilst the impact of this ideology on the labor market may have been driven through employers in the form of 'androcentric blindness', it seems probable that they were responding to worker preferences.[24] These may have taken the form of an objection by workers, particularly adult males, to working under female supervision and/or female unwillingness to take a job or behave in a manner which compromised her feminine identity. Even where there is no explicit objection by

[22] See above, p.9

[23] For most processes in factory flax production being performed exclusively by children and/or women, see, Reach, *Fabrics*, pp.61-64.

[24] 'Androcentric blindness', whereby employers unconsciously underestimate women's suitability for an occupation(s) due to a widely held ideology that denigrates their productive capability. See Jordan, Ellen, 'The Exclusion of Women from Industry in Nineteenth-Century Britain', *Comparative Studies in Society and History* 31 (1989), especially p.276.

workers to female supervision obviously apparent to the historian, a distaste amongst workers for this would have made female supervisors less productive, discouraging employers from employing women in such a way.

Attitudes regarding women's work

It is clear that an ideology hostile to women's work outside of the home was much stronger amongst the middle- and upper-classes by the 1830s than it had been in the late eighteenth-century. This was particularly the case for factory work (and mining), regardless of the level of authority held by women in the workplace.[25] John Byng, the fifth Viscount Torrington, observing the changeover of shifts at Arkwright's Cromford mill in 1790 happily remarked that, 'I saw the workers issue forth at 7 o'clock, a wonderful crowd of young people, made as familiar as eternal intercourse can make them.' (Byng, 1935, p.195) This lack of concern for the moral effect of genders mixing at work was particularly interesting given Byng's general objection to the deleterious effect on working-class morals of employment in manufacturing rather than agriculture (Byng, 1936). This picture contrasts with that observed at the end of the working day Messrs. Birley's mill in Manchester by the middle of the nineteenth-century, where Reach found that, 'It was curious to observe how each sex and age clung together. Boys kept with boys, men with men, and the girls went gossiping by, in exclusive parties of their own.' (Reach, 1972, p.17) By the 1830s and 1840s the mixing of the sexes at work was being heavily criticised for its damaging moral effects, with particular concern arising from the lack of clothing worn due to the high temperatures of cotton factories (this was especially so in fine-spinning firms) (Faucher, 1844; Reach, 1972). The behaviour of the workers exiting Birley's mill indicates that this attitude seems to have been increasingly shared by the workers as well.[26]

Due to a lack of evidence it is much harder to assess changes in working-class attitudes to women's work. There is little dispute that in the eighteenth-century women were expected to work, and were valued for providing a contribution to family income (Erickson, 2010, Goose, 2007). However, it is less clear how this attitude changed as factory production came to predominance. Ivy Pinchbeck concludes that:

> Among the operatives themselves women's factory labour seems to have been accepted as perfectly natural until the Ten Hours agitation in the 'forties and external criticism was at first centred upon children's employment. (Pinchbeck, 1969, p.199)

[25] See Gaskell, Peter, *Artisans and Machinery; the Moral and Physical Condition of the Manufacturing Population Considered, with Reference to Mechanical Substitutes for Human Labour* (London, 1836), p.173.

[26] This change supports the findings of Jane Humphries regarding working-class concern to maintain sexual propriety and respectability as children's work moved away from the home and parental supervision. See (Humphries, 1987)

This is in contrast to the interpretation of Sylvia Walby, who believed that men resisted women's employment in factories from a much earlier date due to its disruption of the patriarchal ordering of the family and on its effect on the wages of men (Walby, 1986). Although the mule-spinners' union consistently acted to try and exclude women from around 1800 (Lazonick, 1979), it would be mistaken to interpret this as purely motivated by gender since they also sought to limit the labour supply by excluding nonrelated males and the Irish. By the 1840s there is more evidence for opposition from working-class males to female factory work, in 1841 a deputation from the West Riding Short-Time Committee to Peel and Gladstone called for 'the gradual withdrawal of all females from the factories' (Pinchbeck, 1969, p.200). William Dodd, in 1842, described the preponderance of females in the worsted and flax mills of the West Riding as 'excessive' (Dodd, 1968, p.35). After visiting the cotton districts in 1844, Friedrich Engels, reflecting the sentiment of many working-class males argued that:

> The employment of women [in factories] at once breaks up the family; for when the wife spends twelve or thirteen hours every day in the mill, and the husband works the same length of time there or elsewhere, what becomes of the children? They grow up like wild weeds; they are put out to nurse for a shilling or eighteenpence a week, and how they are treated may be imagined...That the general mortality among young children must be increased by the employment of the mothers is self-evident, and is placed beyond all doubt by notorious facts. (Engels, 1892, pp.142-43)

A desire for male privilege at work was not limited to male members of the working class. In 1849 a survey of cotton textile operatives by the factory inspectors found just under 55% of women supported a reduction of women's factory labour to ten hours per day (Neff, 1929). Interpretation of this is problematic since many workers saw the Ten Hours Act (1847) as a means of reducing the hours of all workers, but it is clear that it would result in some degree of increased preference for male workers. Also, the level of support amongst females not employed in the factories, but who had male relatives that were (and thus would have benefited from any increase in male wages resulting from the exclusion of women), is likely to have been somewhat higher. Reach, two years after the Act had been passed, found widespread appreciation for it amongst female factory workers for the extra time it allowed them to perform domestic duties (Reach, 1972). Some further, albeit limited and perhaps slightly ambiguous, evidence for female support for limitations on their work can be seen in the extensive involvement of women in the general strike of 1842, despite one of the demands of the strike being that there should be no factories which employed only women (Walby, 1986).

It is worthwhile distinguishing between what the working class saw as *natural/acceptable* for women and what was *desirable*. Michael Anderson concludes from his Preston data for 1851 that, 'Only before they had their first child did many

women work because they wanted to.' (Anderson, 1972, p.72) He finds that the wives of low paid men working in cotton factories were far more likely to work in factories than wives of men employed in highly paid factory cotton occupations. Also, there was a much larger withdrawal of women from factory work once their children were old enough to enter the labour market than when their children were born (Anderson, 2007). Theodore Koditschek's analysis of the 1851 Census data for Bradford also reveals that most working-class housewives avoided factory work whenever economically feasible (Koditschek, 1990). R. Burr-Litchfield's study of Stockport for 1841-61, shows that more than half of mothers with children at home aged less than one were listed as working, with many of these working in factories. As was the case in Preston, women's level of employment decreased once their children were old enough to go out and work (Burr-Litchfield, 1978). Thus, it seems that working-class mothers tended to seek work when family income needs demanded it, rather than when it would have been easier to do so due to lack of childcare responsibilities. Although wages for factory cotton operatives in Preston were notoriously low, average wages in Stockport were relatively high for the cotton industry, as can be seen in Table 2.[27] Women's withdrawal from the factory workforce as soon as family income permitted indicates that there was little desire amongst married working-class women to perform factory labour unless the financial demands of the family made it absolutely necessary.

As Figures 5-6 show, women accounted for a declining proportion of the factory textile labour force in Lancashire and the West Riding from their mid-20s onwards. This was an era of extremely high fertility (Wrigley and Schofield, 1981), and the tendency for women to shoulder the majority of child-rearing and domestic tasks helps to explain their relative withdrawal from the mid-20s upwards, particularly given the greater choice of jobs for adult males in Lancashire (Burr-Litchfield, 1978; Bythell, 1969; Greenlees, 2007). As Burnette highlights, much of women's lower labour force participation can be attributed to their comparative advantage in domestic tasks (Burnette, 2008). The biological necessity of their temporary withdrawal shortly before and after childbirth would have affected the human capital formation required for high-paid jobs, since it is less worthwhile for an individual to invest time or wages forgone to acquire human capital if they would spend less time in the workplace. Given the high levels of fertility at this time this biological necessity would have been a significant consideration. These lower levels of human capital would have reduced women's attractiveness to employers. Parents' unwillingness to invest in the human capital of their female children would have been influenced by their expected shorter period spent in the labour force and lower weekly earnings, although discrimination may also have played a role in this decision.

[27] It should be remembered that the 'Lancs. Avg.' does not include data from Preston, if it did the ratio of wages for Stockport and Heaton Norris to the rest of Lancashire would appear even higher.

Table 2: Average Earnings in Stockport and Heaton Norris (1833)

Occupation	Sector	Age and gender	N	Avg. Earnings	Ratio to Lancs Avg.
Carders or Overseers	Carding	M	55	23.64	1.01
Jack-frame tenters	Carding	W principally	155	9.30	1.16
Bobbin-frame tenters	Carding	W principally	103	7.98	1.07
Drawing tenters	Carding	W principally	253	7.70	1.03
Overlookers	Mule-Spinning	M	10	26.22	0.90
Spinners	Mule-Spinning	M & W (principally M)	398	24.29	0.95
Piecers	Mule-Spinning	M, W, B, G (principally C)	571	5.87	1.09
Scavengers	Mule-Spinning	B & G	93	3.32	1.15
Overlookers	Throstle-Spinning	M	17	23.70	1.06
Spinners	Throstle-Spinning	W & G	221	8.34	1.08
Overlookers	Powerloom Weaving	M	113	29.57	1.12
Warpers	Powerloom Weaving	M & W	96	12.32	1.01
Weavers	Powerloom Weaving	M, W, B, G (chiefly F)	2888	10.69	0.99
Dressers	Powerloom Weaving	M	234	29.11	1.05

Source: Extracted from B.P.P. 1834, XIX, pp.427,429. Same notation and units as in Table 1.

Conclusion

In this paper I have given what may seem a disproportionate amount of attention to women's access to overseeing occupations given the small proportion of adult factory employment for which it accounted, and thus the small impact on the aggregate gender wage gap that these occupations had. However, it provides clear evidence for gender ideology limiting women's access to this work. This is difficult to demonstrate conclusively for most factory occupations in this period due to insufficient evidence on a range of issues, and provides greater confidence that gender ideology harmed women's access to other factory occupations which involved the supervision of subordinate workers where the evidence is more complicated, such as mule-spinning.

The occupational segregation that resulted from this ideology, along with biological differences and trade union behaviour, severely curtailed earning capacity; there is only very limited evidence for females being paid less for performing the *same* work as males. The adult female:male wage ratio in the 1833 data contrasts unfavorably with the figure of 0.87 for the payments to the highly skilled and relatively well-paid adult spinners at Samuel Oldknow's firm 1788-92, especially given the strength component of this work. The ratio in the 1833 data is also much lower than the ratio of 0.81 for co-resident daughters:adult men in handloom weaving in Tottington (1817). Of course, these are for specific occupations, rather than the aggregate figure in the 1833 data, but Young's figures for Manchester and Leeds in 1768 suggests that the aggregate gender wage-gap was also lower in domestic production, particularly if women's shorter hours could be compensated for. Women's reduced access to the best-paid jobs would have been particularly problematic for women who did not have a male head of household. Craig Muldrew's recent work emphasises the high level of employment spinning provided to women across the country prior to mechanisation, something that declined dramatically from the mid-eighteenth century, as well as relatively good wages being available to some of the women employed in hand-spinning (Muldrew, forthcoming). Finally, the shift to factory production meant that hours of work became much less flexible; this lowers the adult gender wage gap for factory work relative to domestic work without accounting for the reduction in the benefit and availability of work to individuals caused by the requirement that all workers work full-time and away from home or not at all. The decreased utility arising from the loss of control over the location and hours of work can be expected to have been gender-biased against women.

Urbanisation and increased fixed capital requirements gave a boost to unionisation, which, as in the case of mule-spinning, sometimes acted to the detriment of women's access to the best-paid occupations. This shift of the location of work away from home, and to long standardised hours, made it harder for women to combine work with the mothering responsibilities expected of them. Strength mattered for productivity in some factory occupations. The lower level of parental and self investment in the human capital of females gave males a further advantage in the labour market. However, women's decreased access to the best-paying jobs was also due to an ideology hostile to women

having authority within the workplace, and this was increasingly important as the spread of factory production meant that the work environment became more formalized and hierarchical.

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