DOI: 10.1111/ehr.70015

THE ECONOMIC HISTORY REVIEW

ORIGINAL ARTICLE

Child labour and industrialization: Evidence from factory records and the 1851 British census

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Xuesheng You's grandmother, Wang Guilan, who was a child labourer, passed away while we were writing this paper. Despite living a long and happy life, the dreadful memories of her time as a young girl in the factory stayed with her.

Abstract

Children were an integral part of the workforce during the British Industrial Revolution. The changing patterns of child labour as well as the causes behind its rise and fall have generated much scholarly debate. This study brings in new direct evidence on child labour from children's age certificates and school attendance records from cotton factories. We link individual children identified from these factory records with the 1851 census, and provide, for the first time, concrete evidence on the scale of the census under-reporting of child labour in factories. We find that the British census under-reported the true scale of children's factory employment by a third. On the basis of this finding, we further reconstruct children's labour force participation rates and occupational structure in the mid-nineteenth century. Overall, we argue that technological change and the early Factory Acts did not diminish children's factory employment immediately nor effectively. Children continued to be a valuable labour source in factory production until at least the mid-nineteenth century.

KEYWORDS
census, child labour, factory records

Child labour formed an integral part of the workforce that ignited and sustained the British Industrial Revolution.[1] It was used to meet the intensive demand for cheap labour in every corner of the economy, from coal pits and agricultural fields to newly erected factories.[2] It has drawn attention from contemporary social observers since the dawn of industrialization. The 'exploitation of little children' was a recurring theme in the early literature, emphasizing the human cost of industrialization.[3] More recent scholarship has sought to estimate the scale of child labour during Industrial Revolution and to determine the timing and causes of its rise and decline. However, this research has generated considerable debate.[4]

At the heart of the debate on the rise of child labour is the question of whether it represented a phenomenon of continuity or change with the onset of industrialization. While the traditional view holds that industrialization brought with it the apogee of child labour, recent scholarship suggests that it was an addition to the continuously dominant role played by traditional sectors such as agriculture, services, and small-scale manufacturing in employing children prior to mechanization.[5] Regarding the decline of child labour, scholars have reached different conclusions from a variety of historical sources. Using working-class autobiographies, Humphries argued that child labour did not decline but rather intensified over the central period of the Industrial Revolution.[6] Nardinelli, on the contrary, relying on evidence from parliamentary inquiries, suggested that child labour did indeed decline early on, from the beginning of the nineteenth century.[7]

Regarding the causes of the changing patterns of child labour over time, the early literature highlighted restrictive legislation, such as the various factory acts from the 1830s and the introduction of compulsory elementary education from the 1870s, as the key drivers behind the eventual decline of child labour in Britain.[8] By contrast, other scholarship has emphasized more conventional economic factors, using the general framework of labour supply and demand to comprehend children's work experiences during the Industrial Revolution. Within this paradigm, the rise of child labour, particularly in new industries during early industrialization, is seen as a direct response to adult labour shortages.[9] Correspondingly, the decline of child labour is attributed to factors such as changing industrial organization, technological maturity, and rising adult male wages, suggesting that it was the success of industrialization itself, rather

[1] For a general review, see Humphries, *Childhood and child labour*; Kirby, *Child labour in Britain*; and Tuttle, *Hard at work*.

[2] Ibid. Burnette, 'Child day-labourers'.

[3] Thompson, *The making of the English working class*, p. 349. For a general survey, see Engels, *Condition* and Marx, *Capital*, pp. 353–8, 389–95, 516–27.

[4] Humphries, *Childhood and child labour*, pp. 211–8.

[5] For the traditional view, see Hammond and Hammond, *The town labourer*, p. 143; Pinchbeck and Hewitt, *Children*; Heywood, *A history of childhood*, pp. 140–3; Cunningham, 'The employment and unemployment'. For more recent scholarship, see Kirby, 'How many children'; idem, *Child labour in Britain*; Nardinelli, *Child labour*; Levene, 'Parish apprenticeship'; Horrell and Humphries, 'Children's work'.

[6] Humphries, *Childhood and child labour*.

[7] Nardinelli, 'Child labor', pp. 743–5; Kirby, *Child labour*, pp. 110–4.

[8] For a general survey of factory legislations, see Hutchins and Harrison, *A history of factory legislation*. For a general survey of the compulsory element education legislation and its effect on child labour, see Robic's recent Sorbonne Ph.D. thesis, 'Where are the children?'. The appendix in Robic's thesis also provides a comprehensive list of labour legislations concerning child labour, both in and outside factories, since the late eighteenth century. It is a convenient and valuable source of reference for scholars who are interested in this field.

[9] Honeyman, *Child workers*, p. 15; Nardinelli, 'Child labor', p. 743.

than state intervention, that ultimately addressed the problematic issue of child labour.[10] In addition, some scholars have recently moved beyond the macro-conditions in society and the labour market, focusing instead on the changing demographic and socio-economic conditions within households to explain the changing patterns of child labour over time. Factors such as breadwinning reliability, life-cycle stages, and dependence ratios have all been identified as key drivers behind children's participation in and withdrawal from the labour market.[11]

Much of the disagreement on child labour outlined above has arisen from the fact that the historical sources on child labour are limited. To date, four main types of sources have been used to study various aspects of child labour: apprentice records, parliamentary inquiries, working-class autobiographies, and household budgets and decennial censuses. While each type of source offers valuable insights, all have intrinsic limitations. Apprentice records provide rich information on child labour for the periods before the early nineteenth century.[12] Pauper apprentices bound in early factories clearly demonstrate how parish incentives to limit poor relief were concurrent with early industries' increasing demand for cheap labour from the late eighteenth century.[13] However, parish apprentice records cease to be as informative in the nineteenth century, past the initial stages of industrialization, given the decline of parish apprenticeship. Parliamentary inquiries have long been used as a source to cover a wide range of economic sectors that employed children, including agriculture, domestic manufacturing, and factories.[14] However, they were often agenda driven and important individual-level information is often missing from these records. It should be noted that Robic, in her recent doctoral work, pioneered a method using official education statistics to study various aspects of child labour in the late Victorian and Edwardian eras.[15] It represents a methodological innovation exploring a new body of evidence from parliamentary inquiries and opens promising areas for future research. Working-class autobiographies and household budgets provide rich contextual information on child labour relating to household demographic and socio-economic conditions at different life-cycle stages. However, their observations are often limited, particularly at critical points in the history of child labour when new legislation and technologies emerged.

Decennial censuses, from 1851 onwards, are the most comprehensive sources on child labour available. The censuses potentially offer historians hundreds of thousands of individual-level records on the ages, genders, geographical locations, and occupational patterns of child workers. However, scepticism about their accuracy, particularly concerning occupational recording, has undermined historians' confidence in using them.[16] Yet there has been little concrete evidence testing and demonstrating their reliability in recording children's employment. Given the outstanding debates on the scale and timing of child labour, one of the key objectives of the current article is to appraise the 1851 census' accuracy in recording child employment. By assessing the scale of any misreporting, the census figures may be corrected to give a more accurate sense of the scale of child labour.

[10] Nardinelli, *Child labour*; Kirby, *Child labour*, pp. 103–11; Goldin. 'Household and market production'.

[11] Horrell et al., 'Beyond the male breadwinner'; Horrell and Humphries, 'Children's work'; easdem, 'The exploitation'; Horrell et al., 'Family standards of living'; Humphries, *Childhood and child labour*, pp. 96–102.

[12] Lane, *Apprenticeship*; Honeyman, *Child workers*; Dunlop, *English apprenticeship*; Wilson, *England's apprenticeship*.

[13] Honeyman, *Child workers*, pp. 7–22.

[14] For example, see Tuttle, *Hard at work*.

[15] See Robic, 'Where are the children?'.

[16] Higgs, 'Women, occupations and work'; idem, 'Occupational censuses'; idem, 'Tabulation of occupations'.

To do this, we collect detailed records on child labour from a primary source hitherto undiscussed and underutilized in the literature – factory records themselves. From factory records, we link the identified child workers with the 1851 Census Enumerators Books (CEBs) to estimate the census' accuracy in recording children's occupations. On the basis of extensive research, the only two mills that have employment records with rich, systematic information on child labour are Quarry Bank Mill (hereafter QBM) in Cheshire and the Strutt Mills (hereafter SM) in Derbyshire. Both were prominent cotton mills from the late eighteenth century.[17] For the linking exercise, we use two types of employment records from these mills: children's age certificates and school attendance records.[18] Background information on QBM and SM, as well as a detailed description of these sources and the linking methodology, will be presented in the following sections.

It should be noted that the two mills under study in this article were larger-than-usual cotton firms. This naturally raises the question of their representativeness. It should be emphasized that the findings on the accuracy of the census recording of child labour obtained through our main linking exercise are not influenced by firm sizes. As elaborated below, we should be able to apply the resulting correction factor to the wider textile industries, or even other industries, with some confidence. Bias would only arise if the ratio of child workers to adult workers in these firms was directly applied to smaller textile manufacturers and other industries. In our robustness check, we use this ratio from QBM in our auxiliary method, but we take it as an upper bound limit.

The focus of this article is on 'very young' children. We take 'very young' children to be aged between 8 and 12 years (inclusive), who, under the Factory Act of 1844, were permitted to work no more than 6.5 hours per day provided they attended 3 hours of schooling per workday.[19] These part-time child workers are conventionally labelled as 'half-timers'. Limited by the availability of sources, we only study those young children employed in cotton manufacturing. Admittedly, they only cover a small share of the entire child labour force. However, while child labour became nearly universal by the age of 14, direct evidence regarding younger children is particularly scarce, and their work experiences have been the subject of the most significant disagreements.[20] Furthermore, despite their small share of the overall child labour force, they represented a substantial share of the total cotton manufacturing workforce.[21] These young children had an undeniably strong impact on the leading industry of the Industrial Revolution. They became the future adult workforce with new skills, such as regular attendance, familiarity with machinery, and the ability to work under non-personal contact, all of which became key components of the factory workforce's skill base.[22] They also made important contributions to their households'

[17] The surviving records from these two mills have been used extensively to study various aspects of British textile history. For QBM, see Rose, *The Gregs of Quarry Bank Mill* and Peers, 'Negotiating work'. For SM, see Fitton and Wadsworth, *The Strutts and the Arkwrights* and Cooper, *Transformation of a valley*.

[18] See MCL, C5/4/4, C5/4/5 and DRO D6948/H.

[19] Children could work a maximum of 7 hours if they worked in the morning, and a meal was provided at 1 o'clock. Alternatively, children could work a maximum 10 hours per day on three alternate days during the week provided they attended at least 5 hours of schooling on each day proceeding the workday. Sections XXX and XXXI, Factory Act 1844, c.15.

[20] Humphries, *Childhood and child labour*, p. 177, see fig. 7.1. Kirby argues that the employment of very young children was never widespread. See Kirby, *Child labour in Britain*, p. 131. Humphries finds that the mean age at starting work dropped below 10 for those born during the Industrial Revolution. See Humphries, *Childhood and child labour*, p. 176. Others also find that industrialization was associated with a decrease in the ages of children starting work. See Horrell and Humphries, 'The exploitation'; Horrell and Oxley, 'Gender bias'.

[21] Even as late as 1835, children under the age of 13 years still accounted for about 20% of the textile workforce. Nardinelli, 'Child labor', pp. 744–6.

[22] Galbi, 'Child labour'.

family incomes, often at crucial stages of a family's life cycle.[23] Analysing these children's employment will fill a significant evidence gap and enhance our understanding of the patterns, causes, and consequences of child labour in the context of transformative changes in technology, legislation, and industrial organization.

We aim to address four questions in this article: First, how accurate was the census in recording child labour? Second, what were the possible reasons behind the census's inaccurate reporting of child labour? Third, how can the census figures on children's employment be revised and reconstructed? Fourth, how did the patterns of the industrial child labour force relate to legal and technological changes?

The rest of this article is organized as follows: Section I provides historical background on QBM and SM. Section II discusses the primary sources. Section III examines the level of census underreporting of children's employment by linking it to the individual-level information contained in the factory records. Section IV explores the possible reasons behind census inaccuracies. Section V presents a reconstruction of children's labour force participation rates and occupational structure on the basis of the results from Section IV. Section VI, drawing on evidence directly from the factory records, analyses patterns of child labour in relation to legal and technological changes. Finally, Section VII concludes.

I | HISTORICAL BACKGROUND: QUARRY BANK MILL AND THE STRUTT MILLS

Quarry Bank Mill was built in 1784 by Samuel Greg. By the time of his death in 1834, the business bearing his name, Samuel Greg & Co., was one of the largest and most successful cotton firms in Britain.[24] The mill was originally built for spinning cotton warp yarns using Arkwright-style water frames. Greg most likely decided to build his mill at Styal due to the reliability of the Bollin River as a power source. However, as with many early water-powered mills, this meant that Quarry Bank's location was not convenient for recruiting labour.[25] Therefore, Greg had to import employees to work at Quarry Bank, and many were children.[26] Greg's child apprentices were brought to the mill from parish workhouses around the country. They were housed, clothed, and fed, but received no wages.[27] At Quarry Bank, the supply of workhouse apprentices was a core feature of Greg's labour force until around the end of the Napoleonic Wars in 1815, though the practice continued until 1847 on a small scale.[28] Greg also apprenticed local impoverished children under contract

[23] For family income contributions, see Horrell and Humphries, 'The exploitation'; easdem, 'Women's labour force participation'; easdem, 'The origins and expansion'. For life cycle analysis, see Horrell et al., 'Family standards of living'; eisdem, 'Beyond the male breadwinner'.

[24] Rose, *The Gregs*, p. 13. This book remains the authoritative business history of the Greg family and Quarry Bank Mill. Greg's firm included five mills: Quarry Bank (Styal), Caton, Lancaster, Bury, and Bollington.

[25] Murray, 'Quarry Bank Mill', p. 295. Styal was a small, agricultural community lacking the necessary number of permanent workers available to run the whole mill. In 1787, the population of Styal was only 420, and was possibly less than that in 1783.

[26] Peers, 'Negotiating work', p. 34.

[27] Collier, *The family economy*, p. 39. See also https://quarrybankmill.wordpress.com/2013/07/29/apprentice-life-at-quarry-bank/

[28] Collier, *The family economy*, p. 46.

from families receiving poor relief.[29] He also employed free labourers (free in the sense that they were not bound by an apprenticeship or contract) who were paid variable wages as a function of their hours worked.[30]

Following the Napoleonic Wars, operations at QBM expanded significantly, but the composition of the workforce had begun to change.[31] As it expanded, Styal became a true textile manufacturing community, with nearly all aspects of daily life centred on QBM. Greg had developed Quarry Bank into a model 'factory colony' on the basis of paternalistic relations between himself (management) and his employees. In exchange for total employee loyalty, Greg provided his workers with a decent living standard and important job security. In general, between 1816 and 1834, there was a decline in the use of parish apprentices in the cotton industry, and after 1833 the practice became much less common among factory employment as legislation rendered its use increasingly expensive.[32] The Gregs, faced with increasing apprenticeship costs, fostered a more permanent, stable community at Styal from the 1820s by retaining ex-apprentices into long-term, wage-earning employment and recruiting whole families amongst the local poor. However, as will be examined in the rest of this article, the end of parish apprentice recruitment in 1847 did not spell the end of child labour employment at Quarry Bank. The Greg family retained their paternal style of management throughout QBM's life and continually recognized the important contributions children made to production and to family stability through their incomes. Many former child apprentices stayed on, married, and started their own families, whose children the Gregs employed in waged work. The Greg family found that, '…the best families for good conduct have sprung from this source.'[33] In fact, as will be shown, there was a remarkable continuity in the employment of child labour from the mill's founding through Greg's tenure, as well as during his son Robert Hyde's period in charge.

Robert Hyde Greg, Samuel's eldest son, took control of Quarry Bank after his father's death in 1834. By the 1830s, the original water frames had been upgraded to newer, more efficient spinning throstles. Under Robert Hyde, the mill's spinning technology improved and diversified further with the installation of the latest self-acting mules in 1838. Mules enabled the spinning of finer count yarns alongside the coarser twist produced on the throstles. The mill's output had also diversified into weaving under Hyde's watch, with power looms installed in 1836.[34] Robert Hyde Greg had transformed QBM from an operation employing older technology producing coarse yarns into a prosperous business combining the newest spinning and weaving technologies to produce pure

[29] Rose, *The Gregs*, p. 32; see also Collier, *The family economy*, p. 39. Parents gave up these children to employers like Greg who housed, fed (but usually not clothed), and paid them fixed wages, usually between 9d and 1s 6d per week.

[30] Collier, *The family economy*, p. 39.

[31] Rose, *The Gregs*, pp. 38, 54–5. Operations expanded, especially between 1819 and 1825. In 1819, the installation of a massive 100-horsepower waterwheel harnessed power from the River Bollin more effectively. In addition to increasing spindleage, Greg increased the numbers employed at Quarry Bank. The mill's total labour force was expanded by just over 50% from 252 at the end of the war in 1816 to 380 by the time of Greg's death in 1834.

[32] Factory apprenticeship legislation had begun with Sir Robert Peel's Act of 1802 but was not effectively enforced. Peel also passed the Cotton Mills and Factories Act in 1819, which also remained largely unenforced until the Factory Act of 1833 established the Factory Inspectorate to examine and enforce conditions in mills. Still, the practice of pauper apprenticeship continued, especially in locations such as Styal, which already had strong connections with poorhouses in Liverpool, where the practice continued until 1847.

[33] Quoted in Rose, *The Gregs*, p. 57.

[34] Ibid., p. 63. Also direct email correspondence to Claire Brown, Technical Demonstrator Manager at Quarry Bank [4 July 2019].

cotton cloth. Thus, QBM had moved towards the technological frontier in cotton manufacturing by the time of the 1851 census studied in this article.

Jedediah Strutt was a contemporary of Samuel Greg and another architect of factory textile manufacturing in Britain during the Industrial Revolution. Strutt initially made inroads into the textile business by inventing the 'Derby rib machine' with his brother-in-law, William Woollat, in the late 1750s.[35] Strutt's first mechanical contribution greatly helped to expand the hosiery business.

Strutt became wealthy from engaging in the expanding hosiery business and eventually partnered alongside Samuel Need, another midland hosier from Nottingham, and Richard Arkwright, the industrial entrepreneur. The three partners established the first water-powered cotton spinning mill at Cromford in 1771.[36] Around 1778, Strutt started to venture on his own accord in the cotton business, establishing his first mill at Belper, Derbyshire.[37] Situated on the river Derwent, the site was remote and had never previously accommodated a water-powered mill. As at Quarry Bank, Strutt had to attract labour to staff his new spinning mill. The first and subsequent Strutt mills at Belper employed children. Unlike QBM, the Strutt Mills never used parish apprentice children.[38] With the expansion of Strutt's industrial operations at Belper by building new mills, the community became another paternalist community, like Quarry Bank but on a larger scale. Strutt and his sons built eight mills in total at Belper, and another mill at the nearby village of Milford, less than 2 miles south. By 1850, Belper had become a thriving company town.[39] As will be demonstrated, child labour continually formed a core part of Strutt's workforce up to and after the 1851 census.

Less information survives on the machine technologies used in the SM than at QBM. In 1812, one of the SMs – the North Mill – contained spinning frames with a total of 4236 spindles, as well as carding engines, mules, drawing frames, and reeling, doubling, and twisting machines.[40] With Jedediah's death in 1797, the firm passed to his sons William (1756–1830), George Benson (1761–1841), and Joseph (1765–1844). William Strutt possessed outstanding mechanical engineering talents.[41] William apparently experimented early on with mule-spinning technology, even developing a self-acting prototype in the 1790s, over 20 years before Richard Roberts (1789–1864) eventually succeeded in 1825.[42] Thanks to William, by the 1840s, the SMs were 'possibly the best equipped in the country'.[43]

[35] See Fitton and Wadsworth, *The Strutts and the Arkwrights*, pp. 24–5. This 'machine' was in fact an attachment that was placed on the stocking frame, a machine for knitting stockings, first invented by William Lee in 1589. Strutt's mechanical attachment enabled ribbed stockings to be machine-knit, which had hitherto been impossible on Lee's machine.

[36] For a detailed account of Strutt's hosiery business and the partnership with Arkwright, see ibid., ch. 3 and pp. 60–5.

[37] Typically, the precise date of the first mill remains largely unknown. See https://www.derwentvalleymills.org/discover/derwent-valley-mills-history/derwent-valley-mills-key-sites/key-sites-belper/ (accessed 4 December 2024).

[38] Fittion and Wadsworth, *The Stutts and the Arkwright*, p. 104. See also B.P.P. 1816 (397) III, *State of Children Employed*, p. 217.

[39] Cooper, *Transformation of a valley*, pp. 91–2.

[40] Rees, *Cyclopaedia*, vol. XXII, *Manufacture of Cotton*.

[41] The North Mill, which is still in existence today, was first built in 1786, but burnt down in 1803. William Strutt rebuilt the North Mill in 1804 and pioneered the construction of iron-frame, fireproof mills. See Chambers and Barley, 'Industrial monuments at Milford and Belper', p. 236.

[42] See Chapman, *The early factory masters*, p. 71. Apparently the prototype was ultimately unsuccessful due to the 'inferior workmanship' of the day.

[43] Cooper, *Transformation of a valley*, p. 92.

Indeed, it is known that water-frame technologies were used to spin yarns for hosiery until at least the mid-1830s.[44] Given William Strutt's technical prowess, the frames were almost certainly upgraded to throstles.[45] As at QBM, the SM, run by Jedediah's sons, continued to innovate and expand the business in the nineteenth century at the technological frontier of cotton spinning and industrial organization.[46] While the mills declined in relative importance with the rise of Lancashire cotton manufacturing, they remained a viable and vital operation considering the intense competition that arose in the industry over the second half of the nineteenth century. In the 1850s, the Strutts adopted steam power, likely in response to this competition, which was an exceptional decision for their mills relative to other water-powered mills in the region at the time.[47] By the time of the 1851 census, both SM and QBM were among the most technologically advanced and largest cotton manufacturing entities operating in Great Britain.

II | SOURCES

We use three main bodies of evidence in this study. They are the 1851 CEBs, the age certificates of young persons aged under 13 employed in QBM and SM, and the school attendance records of these young persons. With the age certificates and school attendance records, we can identify the child labourers and pinpoint when they worked in the factories. Then, by linking those children who were employed in the factories around the 1851 census period with the CEBs, we can estimate how accurate the census was in documenting child labour. In the rest of this section, we discuss these three sources in turn.

The 1851 census was taken on Sunday 30 March. Over the week before the census date, enumerators distributed the household schedules to record the information of each person residing in their households on the census night as well as those returning to the household in the morning. On the morning after the census night, each enumerator transferred the information from the household schedules to the CEBs. The CEBs hence contain individual-level data on name, gender, age, relationship to household head, 'rank, profession or occupation', place of residence, and so on. The occupational recording under the 'rank, profession or occupation' column for those children identified in the factory records are our primary interest. We use this information to gauge the census' accuracy in reporting child labour. For example, if a child identified in factory employment around the census date was returned as a 'scholar' under the occupational column in the census, it would be categorized as a case of misreporting. If linked children were returned as 'cotton factory hands', 'cotton spinner', or 'works at factory' (among other possible cotton-related titles), then they would be considered as accurately recorded.[48] The I-CeM project has already digitized,

[44] Ure, *The cotton manufacture*, p. 239.

[45] A mill machinery ledger from 1822/23 highlights the continuous nature of maintenance and improvement at the Strutt Mills in Belper, Milford, and Derby, with examples of new water wheels, spinning frames, roving frames, doubling frames, and winding machines being installed. See DRO, D6948/L/9.

[46] See Chapman, *The early factory masters*, p. 7. In 1816, the Strutt Mills at Belper and Milford were the largest in the country, employing some 1494 workers. By 1833, the Belper mills alone employed some 2000 workers. See B.P.P. 1834 (167) XIX, *Employment of Children in Factories*, D.S. 310.

[47] Cooper, *Transformation of a valley*, p. 145.

[48] Given the part-time nature of the work of 'half-timers' in factories, it may be argued that 'scholar' is just as accurate as a descriptor as 'factory employment'. However, it should be noted that the term 'half-timer' is an expression of convenience. It does not imply that these children split their time in half between schooling and factory work. Only 3 hours of schooling

along with other census years, the full sample of 1851 CEBs,[49] but its standard dataset does not contain people's names. We instead use the original images of the CEBs via I-CeM's commercial partner, FindMyPast.[50]

To link children from factories with the 1851 CEBs, we use the age certificates and school attendance records from QBM and SM. Mills were required to keep these types of records because of factory legislation. The 1833 Factory Act was arguably the first significant piece of legislation that imposed far-reaching restrictions on children's employment in factories.[51] It prohibited any form of employment in factories for children aged under 9 years.[52] The act introduced the half-time system, in which children aged between 9 and 12 years were allowed to work no more than 9 hours per day or 48 hours per week, with factory employment conditional upon 2 hours of schooling per day.[53] The 1844 Factory Act subsequently dropped the legal age for the half-timers to 8 years,[54] but it remained the case that children were not permitted to start full-time work in the factories without needing to attend school until they turned 13 years old.

Although the half-time system was first introduced in 1833, it only became a legal requirement for factories keep their half-timers' school attendance records in 1844.[55] These school attendance records list children's first and last names; the time they attended school on each day between Monday and Friday for every week they were in factory employment; and the cause of absence if they failed to attend. Two sample images of the school attendance records from the QBM and SM can be found in the online appendix 1. So long as the children were in factory employment, they were legally required to attend school and be recorded as such. This feature means that, based on the school attendance records alone, we can identify the duration of factory employment for those aged between 8 and 12 years – the date when a child started factory employment as a half-timer and the date a child left the half-time system and became a full-time worker without

were required to undertake 6.5 or 7 hours of factory work per day. Furthermore, school attendance was simply a means to an end – employment. These children did not attend school voluntarily, rather, they did so because it was a condition for working in the factories. In terms of both time inputs and socio-economic roles, an occupational title related to cotton manufacturing is a more accurate descriptor than 'scholar'.

[49] Digitized CEBs created by the I-CeM project can be accessed via the UK Data Service. Schürer and Higgs, (2024). *Integrated Census Microdata (I-CeM), 1851-1911*. [data collection]. UK Data Service. SN: 7481, http://doi.org/10.5255/UKDA-SN-7481-3

[50] https://www.findmypast.co.uk.

[51] For example, earlier factory legislations such as the 1802 Factory Health and Moral Act only targeted parish apprentices aged under 21 years employed in cotton and woollen mills and restricted their working hours to 72 hours per week. The 1825 Cotton Mills and Factories Act only targeted children aged under 16 years employed in cotton mills and restricted their working hours to 69 hours per week. Furthermore, none of the earlier factory acts embodied means of enforcement. The 1833 Factory Act was the first legislation that established the post of factory inspectors to enforce the legal provisions, though its effectiveness has been in serious doubt. See Hutchins and Harrison, *A history of factory legislation*.

[52] Section VII, Factory Act 1833, *c*. 103.

[53] Sections VIII and XX, Factory Act 1833, *c*. 103. The act included other forms of restrictions concerning night work, holidays, and mealtime allowance, amongst others. It should be noted that the implementation of restrictions was gradual. It started applying to the under 11 year olds, 12 year olds, and 13 year olds only 6 months, 18 months, and 30 months after the passing of the legislation, respectively.

[54] The maximum working hour was dropped to 6.5 hours per day. The minimum school attendance was increased to 3 hours per day. Sections XXX and XXXVIII, Factory Act 1844, *c*. 15.

[55] Per the Factory Act 1833, tickets or vouchers proving children's school attendance were to be provided by school masters, but factories were under no legal obligations to keep these records unless specifically required by factory inspectors. From 1844 onwards, factories were now required to keep children's school attendance records for at least 6 months. Section XXXIX, Factory Act 1844, *c*. 15.

the schooling requirement. However, as other information such as the parents' names and the location of residence are not reported in the school attendance records, it is difficult to undertake record linkages between the CEBs and school attendance records alone.

Children's age certificates provide the additional information needed. From 1844 onwards, it became a legal requirement for any factories employing children to obtain and keep a child's age certificate from the certifying surgeon.[56] There are two groups of age certificates for children from two different age groups – the half-timers aged between 8 and 12 years and those aged between 13 and 18 years who worked full time. We are only interested in the former in this paper. In the age certificates, the surgeon in charge would certify that 'the said child has the ordinary strength and appearance of a child of at least eight years of age, and that I believe the real age of the said child to be at least eight years'. The information recorded in the age certificates include children's names, parents' names, their location of residence, and the date of certification. It should be noted that, as other forms of proof of age such as baptism records were not required for the surgeon in charge to issue the age certificate, the accuracy of the 'at least eight years of age' reporting must be met with some scepticism.[57] However, for the purposes of this paper, even if children's ages were misreported, they can be used to conduct record linkages if their parents' names and location of residence were correctly reported. There is no reason to suspect that this latter information would have been deliberately misreported or mis-recorded. Two sample images of the age certificates from QBM and SM are included in the online appendix 2.

School attendance records from QBM survive between November 1847 and March 1855.[58] The age certificates for the 8–12 year olds from QBM survive between November 1844 and January 1854. The availability of these records enables us to gauge how accurate the CEBs were in recording child labour at QBM in 1851. The surviving school attendance records and age certificates from SM cover a longer time span. The former are available between 1844 and 1884. The latter are available between 1844 and 1879. This could potentially enable us to check the accuracy of the CEBs in recording child labour at the SM for three separate censuses – 1851, 1861, and 1871. However, to achieve comparable results with QBM, this article focuses only on the census year of 1851.

III | RECORD LINKAGE AND RESULTS

The record linkage process across these three types of records is straightforward. We first identify the names of children who appeared in the school attendance records during the census week of 1851. We then link these children with their age certificates to identify their parents' names and location of residence. As age certificates were required when children started part-time employment in factories, we can also calculate their age range in 1851, as all children were supposed to be aged between 8 and 12 years (inclusive) at that point.[59] On the basis of the information obtained from the children's names, their parents' names, possible ages, and locations of residence, we

[56] The 1833 Factory Act required that children under 9 years could not be employed without personally appearing in front of a surgeon and obtaining an age certificate. However, there was no specific provision that required factories to keep the certificates. The 1844 Factory Act required factories to keep each age certificate and fix them into a book called 'Age Certificate Book'. Schedule A, Factory Act 1844, *c*. 15.

[57] Hurt, *Elementary schooling*, p. 190.

[58] With two gaps: December 1848 to December 1849, and then February 1853 to March 1854.

[59] We allow one extra year at the lower end of the age range to accommodate the possibility that some children inflated their ages when they joined the factory workforce.

then use the online search function in FindMyPast to find their corresponding entries in the 1851 CEBs. We limit our search to areas within a 5-mile radius of Belper and Styal. We allow for spelling variations such as 'Ann' for 'Anne'.

Our record linkage yields a high match rate. There were 174 children aged between 8 and 12 years who appeared in the school attendance records from the SM when the 1851 census was taken. Out of these 174 children, 165 were found in the corresponding age certificates. All but 18 of these 165 half-timers were found in the 1851 CEBs. Amongst those nine half-timers who we could not find in the age certificate records, six could still be linked with the CEBs thanks to the fact that their names are unique among all the children aged between 8 and 12 years who resided within the 5-mile radius of Belper. Overall, 153 of all the 174 half-timers employed at SM during the census week were successfully linked with the 1851 CEBs – a match rate of 88 per cent. Amongst those 153 half-timers employed at SM who we could identify in the 1851 CEBs, 96 were recorded with an occupational title in the CEBs, such as 'winding (cotton)', 'cotton carder', and 'mule (cotton)', indicating their employment in the cotton mill. The remaining 57 were recorded as 'scholar' or 'school' in the CEBs without any indication of their gainful employment in the cotton mill.[60] Similar results emerge from QBM. There were 34 half-timers employed at QBM during the 1851 census week, and 31 of them were linked with the CEBs. Amongst them, 20 were recorded with an occupational title related to cotton manufacturing, whilst the rest were recorded only as 'scholar'.

The results from these linkages reveal for the first time that the British census in the mid-nineteenth century under-reported child labour in factories. As alluded to before, by the nature of our linking exercise, our result is not biased by these two mills' larger-than-average sizes. We therefore argue that child labour under the age of 13 years in factories, as recorded in the mid-century CEBs, represents only two-thirds of its actual level.

It is also worth noting that, while girls were often seen and trained as future homemakers and boys were prepared with the skills and dexterity to fulfil their future breadwinning roles, a child's sex does not seem to be the key factor in determining the under-enumeration rate of children in the CEBs.[61] If anything, boys were more likely to be mis-recorded. Among the 63 male half-timers at SM, 40 per cent were mis-recorded as a 'scholar'. The corresponding figure for the female half-timers was 35 per cent. A higher rate of mis-recording among the male half-timers can also be found at QBM. Among the 15 male half-timers, 7 were mis-recorded as a 'scholar', while the corresponding figure for those 16 female half-timers was only 4.

Interestingly, the proportional split between 'scholar' and cotton-manufacturing-related occupational titles in the CEBs coincidentally reflects the division of time spent between school attendance and factory employment among the half-timers. However, this coincidence at the aggregate level should not be interpreted as evidence that census enumerators, householders, and half-timers made a deliberate effort to record children's occupations in such a way that it reflected the time inputs between schools and factories. There was no census recording mechanism in place to potentially coordinate such an effort. Neither was capturing the time division between different activities the aim of occupational recording in the census. At the individual level, the recording of those half-timers as a 'scholar' still represents a mis-recording of child employment. However, the question remains as to why some children in factories were accurately recorded while others were not. This will be the focus of the next section.

[60] Four of them had their occupational columns left blank. We take them as cases of under-reporting as well.

[61] Griffin, *Breadwinner*, p. 36.

TABLE 1 Number of half-timers returned as 'scholar' in 1851 CEBs by enumeration district, Strutt Mills.

Enumeration district identifier	Enumerator	No. of half-timers identified from Strutt Mills	No. of 'scholars'
1	John Boden	33	12
6	William Allsop	25	3
4	Joseph Pym Jr	16	5
11	Thomas Jennison	13	4
16	Thomas Milward	13	5
13	Joseph Spencer	11	5
2	Thomas Riley	8	2
3	Timothy Taylor	7	4
14	Thomas Smith	7	3
5	William Wragg	5	2
1c	William Hawkins	4	4
12	John Mellor	3	2
7	John Malin	2	2
15	Joseph Taylor	2	1
10	John Spencer	1	0
10c	William Beeson	1	1
1a	George Beardmore	1	1
1b	Joseph Hopkinson	1	1

Source: DRO, D6948/J/6/3, D6948/J/7/4, D6948/H/6/1.
Note: Enumeration district identifiers and enumerators' names were recovered by searching individual census images within FindMyPast.co.uk.

IV | EXPLAINING THE UNDER-REPORTING

In a study analysing the census enumeration of married women's work from their husbands' occupations, You identified that census enumerators displayed an elevated level of idiosyncratic preference.[62] For instance, whilst some enumerators recorded all women married to farmers within their enumeration districts as 'farmer's wife', others recorded them all as having no occupation. Such enumeration idiosyncrasy ignored the true form of women's work and obscured the occupational reporting in the CEBs. Given the increasingly protective attitudes towards childhood and the stigmatization of child labour in the Victorian era, it could also be the case that some census enumerators completely ignored child labourers, and instead of accurately recording their work in factories, recorded what they should have been doing according to the social ideals of the time.[63] To test this hypothesis, we analyse the enumeration of child labour by enumerators.

Those 153 half-timers from SM who were successfully linked with the 1851 CEBs came from 18 enumeration districts within 2 registration sub-districts. The number of half-timers and misspecified 'scholars' among them in each enumeration district is reported in table 1. Only 6 enumeration districts contained more than 10 half-timers. Collectively, they accounted for the majority of the half-timers employed at SM during the census week. Notwithstanding the variation in their

[62] You, 'Working with husband'.

[63] Frost, *Victorian childhoods*, pp. 143–63; Jordan, *Victorian childhood*, pp. 305–22; Hendrick, *Child welfare*, pp. 24–37.

rates of mis-reporting half-timers as scholars, none of these enumerators ignored the child labour within their district completely. There were enumerators who recorded all the half-timers within their enumeration district as 'scholar'. However, the number of observations in each of these districts was small. It is difficult to draw meaningful conclusions from these districts. Furthermore, the mis-recorded half-timers from these districts altogether only accounted for just over 15 per cent of all the mis-recorded half-timers from SM. The number of observations becomes much smaller at QBM, but a similar argument still holds. As far as the child labour at these two cotton mills is concerned, it is evident that the overall under-enumeration of the half-timers' work did not result from the selected enumerators' idiosyncratic preference of listing all children as scholars.

If the census enumerators' idiosyncratic preferences were not the main driver behind the under-enumeration of child labour in general, could it arise from householders' ignorance to children's factory work? Were there households that simply did not report their children's employment at all? As multiple family members were normally employed in the cotton factory at the same time, we can potentially test this hypothesis by identifying families with more than one child employed at the cotton mills and checking their occupational recordings.[64] The answer is not straightforward.

We identified 23 sibling groups where both siblings worked as half-timers at SM during the census week, which fall into three distinct enumeration scenarios. First, in 11 sibling groups, both siblings were accurately recorded with a cotton manufacturing occupational title, representing the most straightforward cases. Second, in five sibling groups, although both siblings worked as half-timers during the census week, only one was recorded with a cotton manufacturing occupational title, while the other was listed as 'scholar'. These cases are more puzzling, as both children were working in the same mill at the same time. Birth order appears to play an important role here, as it was consistently the younger sibling, with a shorter employment duration, who was mis-recorded as 'scholar'. Third, the remaining seven sibling groups had both siblings recorded as 'scholar'. However, this does not necessarily indicate that householders entirely disregarded their children's economic function and their paid labour. Closer examination reveals that five of these sibling groups included at least one older sibling outside the group. As in the second scenario, these older siblings, who were no longer half-timers, were recorded with a cotton manufacturing occupational title. For example, in the Booth family, Eliza (age 12) and Mary (age 9), both half-timers, were mis-recorded as 'scholars'. However, their older siblings, Lydia (age 15) and Charles (age 14), were recorded as 'cotton factory'.

Overall, the enumeration scenarios mentioned above show that there were rarely any cases where householders were completely oblivious to their children's economic function as wage earners and mis-reported all their children's gainful employment in the census. Some householders were selective in reporting their children's gainful employment in the cotton mills, and when they did, it was almost always the younger child's employment that was lost in the householders' deliberation and selection. We will return to the possible reasons behind this later. For now, it is worth noting that, as a matter of fact, amongst all the 57 half-timers at SM who were mis-recorded as 'scholar', 42 had older siblings. All these older siblings but four were given an occupational title, with most being related to cotton manufacturing. Meanwhile, none of their younger siblings aged above 8 years were given an occupational title. Similarly, amongst all the 11 half-timers at QBM who were mis-recorded as 'scholar', all but one of their older siblings was recorded with an occupation, while none of their younger siblings were given an occupational title. As a result of

[64] Griffins, *The Lancashire working classes*, pp. 101–4; Anderson, 'Sociological history', pp. 320–4; Joyce, *Work, society and politics*, p. 54.

householders' tendencies to under-report younger children's employment, the half-timers who were mis-reported as 'scholar' were on average younger than those who were correctly recorded with a cotton manufacturing occupation. At SM, the former were on average 0.6 years younger than the latter – 9.6 as opposed to 10.2 years old, and at QBM, 9.4 as opposed to 10.6 years old.

Several factors likely contributed to householders' bias against accurately enumerating younger children's factory employment. Younger children, often newer to factory work, were likely employed for shorter periods than their older siblings. This may have made householders place less importance on their role as wage-earners. Additionally, half-timers' wages were significantly lower than those of their older siblings in full-time employment, reinforcing the focus on older children's greater financial contributions.[65] Younger children's wages were likely viewed as a supplementary 'top-up' rather than essential to the household's survival, making their employment appear less economically significant. Younger children's employment was then more likely to be seen as a childhood stage preparing for their adult employment rather than strictly a wage-earning activity contributing directly to the household economy. This perception was likely amplified by their shorter employment duration and lower earnings. In contrast, their value in domestic tasks might have been more apparent to parents, further diminishing the recognition of their factory roles. Furthermore, younger children often entered the workforce temporarily to address short-term financial pressures, such as a family member's illness or seasonal unemployment. The transient nature of their employment likely prevented householders from viewing them as 'proper' factory workers, contributing to the lower census enumeration rates for younger children. Finally, some parents may have placed their children in factory employment before they reached the minimum legal age due to financial pressures.[66] In such cases, parents were likely to conceal their younger children's employment status in the census to avoid the risk of their actions being detected in an official record.

The possible causes listed above, however, should not be generalized as a universal rule. Individual cases can deviate from general expectations. The enumeration of the Gaunt sisters, Salome and Jemima, in the 1851 census, is illustrative. Both Salome and Jemina were 9 years old as recorded in the 1851 census. Both sisters joined SM at the same time, on 3 September 1850. Both worked continuously at SM. Both were earning the same half-timer's wage rate. Salome left SM in April 1852 while Jemima continued in her employment. However, despite their same age, same entry date, and Jemima's longer employment duration, Salome was returned as a 'factory scholar' in the 1851 CEBs while Jemima was only returned as a 'scholar'. It is possible that Jemima was a few months younger than Salome or perhaps her contributions at home were deemed more significant. The exact reason for this discrepancy will likely remain unknown. However, the general pattern of under-recording younger children's employment nevertheless suggests that householders perceived their children's socio-economic roles differently, influenced by factors such as age, duration of employment, domestic functions, and relative contributions to the household budget.

[65] For example, as can be shown from the QBM wage book in 1851, half-timers' weekly wage rates were fixed at 1s 3d with no progression until they started full-time employment. The starting weekly wage rate for full-time employment was 2s 6d, which typically increased yearly.

[66] Factory inspectors and factory surgeons acknowledged and were concerned about the scale of parents overstating children's age so that they can start work in factories earlier than legally allowed. See Horrell and Oxley, *Gender bias*, p. 53.

V | RECONSTRUCTION OF CHILDREN'S LABOUR FORCE PARTICIPATION RATE

The census recording of child labour has been shown to be inaccurate.[67] However, due to the lack of direct evidence from archives, there have been no studies that have linked individual child labourers from employment records with the census to estimate the scale of under-enumeration of child workers in the census. As shown in the previous sections, by linking the half-timers from the factory employment records with the 1851 CEBs, we demonstrate for the first time that the census reporting of child labour aged between 8 and 12 years at cotton mills in Greater Manchester and Derbyshire was only two-thirds of its true level. Furthermore, we have shown that the under-enumeration of child labour at these mills was not driven by localized factors such as individual enumerators' idiosyncratic reporting. Rather, it was the result of something more intrinsic to householders' economic psychologies. These factors – such as age, length of employment, and relative contributions to the family budget – are likely to be exogenous to contextual factors at the factory, regional, or even sectoral levels. This means we can apply the estimated under-enumeration rate from our study, not with an inappropriate level of confidence, to reconstruct the level of child labour in cotton manufacturing, textile manufacturing, or even other economic sectors. The results are presented in table 2.

The unrevised figures from the 1851 CEBs in column I show that just under 15 per cent of the children aged between 8 and 12 years were returned with an occupational title. Among them, nearly 30 per cent worked in agriculture. Occupations in the tertiary sector such as servants, sellers, and messengers cover almost a quarter of children's total employment in this age group. The secondary sector accounts for the largest share of nearly 40 per cent. Less than half of the secondary sector was engaged in the textile industries including cotton, wool, silk, and others.[68] In the cotton industry alone, just over 1 per cent of the children aged between 8 and 12 years were employed in this modern factory-based industry (participation rate of 14.6 per cent * cotton's share of employment 6.9 per cent). They accounted for 17 per cent of children employed in the secondary sector (cotton's share of employment 6.9 per cent/secondary sector's share of employment 39.4 per cent) and 7 per cent of children's total employment in this age group, respectively.

Column II in table 2 presents our revised figures for child labour in the age group 8 to 12 years by applying a correction factor of 3/2 to their census-reported number of employments in cotton manufacturing in England and Wales. Cotton manufacturing, despite being paradigmatic of the Industrial Revolution, was still a small industry in terms of employment size even as late as the mid-nineteenth century.[69] Though child labour formed an integral part of the cotton workforce, given the cotton industry's overall small size, its contribution to child employment remained small. Even with the revised figure, this fundamental message remains the same. The relative sizes of the primary, secondary, and tertiary sectors in children's employment are broadly the same. The proportion of children aged between 8 and 12 years in the cotton industry remained small at only 1.5 per cent (participation rate of 15.1 per cent * cotton's share of employment 10 per cent). It accounted for less than a quarter of children's employment in the secondary sector (cotton's share

[67] Robic, 'Where are the children', pp. 295–302; Kirby, *Child labour*, p. 12; Burnette, 'Child day-labourers', p. 1095.

[68] We use the late Tony Wrigley's primary, secondary, tertiary (PST) occupational classification scheme. Employment in textile industries include those in the manufactures of specific materials such as cotton, wool, worsted, linen, silk, and coarse fabrics, as well as those recorded simply as 'spinners' and 'weavers' whose manufacturing materials were not specified in the census.

[69] Shaw-Taylor and Wrigley, 'Occupational structure'; Crafts, *British economic growth*.

TABLE 2 Share of children's (8–12 years old) employment in different sectors based on CEB data and correction factor from SM and QBM.

	Column I: unrevised from 1851 CEBs, %	Column II: revised employment in cotton by 3/2, %	Column III: revised employment in textiles by 3/2, %	Column IV: revised employment in all sectors by 3/2, %	Column V: revised employment in textiles by 3/2 and other sectors by 3, %
Primary	28.8	27.8	26.6	28.8	37.6
Secondary	39.4	41.4	44.1	39.4	20.8
Textiles	*16.8*	*19.6*	*23.3*	*16.8*	*10.9*
Cotton	*6.9*	*10*	*9.6*	*6.9*	*4.5*
Tertiary	23.2	22.4	21.4	23.2	30.3
Unspecified labour	8.5	8.3	7.9	8.5	11.2
Labour force participation rate	14.6	15.1	15.8	21.8	33.4
No. employment	284 938	294 793	308 891	427 407	654 115
No. observations	1 956 954	1 956 954	1 956 954	1 956 954	1 956 954

Source: Correction factor of 3/2 is calculated on the basis of record linkage between half-timers' records from D6948/J/6/3, D6948/J/7/4, D6948/H/6/1, C5/4/5/3, C5/4/4/2, and search results pertaining to those half-timers from FindMyPast.co.uk. Unrevised share of employment figures presented in column I is calculated directly from Schurer, Higgs, and FINDMYPAST LIMITED, *Integrated Census Microdata*.

Note: In col. I, those employed in unspecified textile branches are reallocated to different branches, that is, wool, worsted, cotton, linen, etc. according to each branch's relative employment size within textiles.

of employment 10 per cent/secondary sector's share of employment 41.4 per cent). Furthermore, children's labour force participation rates in this age group hardly changed. It remained at about 15 per cent. Even if we assume that the level of census under-reporting of child labour from the two cotton mills covered in our study apply to the wider textile industries (as shown in column III), the impact is still negligible. The labour force participation rate of children aged between 8 and 12 years remains below 16 per cent.

As mentioned before, individual child labourers' employment records are hard to come by. The fortunate survival of children's employment records from the two cotton mills in this study is mostly due to the centralized nature and large scale of these mills. However, this was not the norm in most economic activities, such as street selling, personal services, and agriculture, which employed many young children. Children's employment in these economic activities was not, as expected, accompanied by any systematic exercise of statistical collection by their employers or by the children themselves. The lack of direct evidence means that, although children's employment outside the textile industries was also likely to be under-reported in the census, it is almost impossible to determine specific correction factors for other economic sectors.[70] Even without any statistical precision, conceptually the scale of the census under-reporting of child labour in other sectors, in comparison with that in the textile industries, is difficult to gauge. On the one hand, the more ad hoc and irregular nature of children's employment in other economic sectors likely meant they were more prone to escaping the attention of householders and enumerators, necessitating a greater correction factor. On the other hand, their relative time input into gainful employment was likely smaller than that of their counterparts in cotton mills, in which case a smaller correction factor for other economic sectors would be more appropriate.[71] These countervailing factors imply that the cotton-specific correction factor of 3/2 may be applied to other economic sectors with some confidence as well. As shown in column IV, even with this exercise, the revised labour force participation rate is still just above 20 per cent. For demonstration purposes, we apply another upward revision, maintaining the correction factor of 3/2 for textile industries while assuming the census under-reported children's labour in other sectors by a factor of 3. Even with this more extreme adjustment (column V), the re-estimated labour force participation rate for children aged 8 to 12 years rises to just over 33 per cent. To put this into context, the

[70] Agriculture may be an exception. Child day-labourers were often employed together with their fathers in the field. They were normally recorded as 'someone's boy' or 'someone's girl' in farm accounts. Thus in theory, it is possible to undertake a similar exercise to check the accuracy of the census reporting of child labour in agriculture and arrive at an agriculture-specific correction factor. One example of linking child labour in farm accounts with the CEBs can be found in Burnette, 'How skilled were English agricultural labourers'. Another possibility is to trace individual child workers interviewed in various parliamentary investigations to the corresponding CEBs. These parliamentary investigations covered a wide range of economic sectors. Hence, it may be possible to arrive at sector-specific correction factors. For example, Gatley, in an early paper, identified children working in pin production in Warrington from parliamentary reports, traced them to the 1841 census, and demonstrated the scale of census under-reporting. See Gatley, *Child workers*. However, either method would require systematic and substantial investigations of primary and secondary sources, which is beyond the scope of this paper. Future research may fill this gap.

[71] Concrete and systematic evidence on child labour's working hours in different economic sectors are scarce. However, albeit the suggestion of part-time employment from the term 'half-timer', these children worked in textile factories for 6.5 or 7 hours per day regularly throughout the year. In terms of total time input into waged employment, they were most likely to surpass their counterparts in other economic sectors, such as agriculture. For example, children of similar ages in agriculture worked longer hours, often 9 to 10 hours, per day when they were employed. However, their employment was seasonal. Most of them were employed for just a few weeks throughout the year. Their total time input into waged employment would be much smaller than the half-timers in textiles. See 1867 (3796) XVI, *Children's employment (trades and manufactures) royal commission 6th report*, passim.

unrevised labour force participation rate for children aged 13 to 17 years, derived from the CEBs, is 62 per cent. Consistent with findings from autobiographical studies that cover the earlier classic period of industrialization, child labour in early adolescence was not the norm. It only became nearly universal from mid-adolescence.

We also develop an auxiliary method to check the robustness of the re-construction method above. We calculate the ratio of the number of half-timers to the number of adult men recorded in the factory wage books and apply this ratio to the number of adult male cotton workers recorded in the census.[72] As the reporting of adult male occupations is believed to be fairly accurate, this will give us a reasonable estimation of child labour in cotton manufacturing.[73] Mid-century wage books survive for QBM but not SM. Therefore, the following exercise is based only on the evidence from QBM. A sample page from QBM wage books is included in appendix 3.

In QBM's wage books, each employee's agreed wage rate and actual wage received, along with their production department such as carding, spinning, and weaving, amongst others, were reported on a weekly basis. Every employee's first and last names were recorded. Hence, it is easy to identify their sex. While employee ages are not reported in the wage books, we can nevertheless identify the half-timers via their names recorded in the age certificates and school attendance records. It is also worth noting that, even without cross-checking names from these two sources, we can still successfully identify half-timers on the basis of the information recorded in the wage books alone. Upon close inspection, all the half-timers' wage rates were set at 1s 3d per week, no matter the department in which they were employed. As shown in appendix 3, the half-timers were numbered in a separate sequence. On the basis of this information, we can identify 36 half-timers from the wage books between 6 March and 17 April 1851.[74] Recall that we have independently identified 34 half-timers employed at QBM during the census week from the age certificates and school attendance records. The two half-timers who appeared in the wage books but not in our sample from the age certificates and school attendance records joined the factory only after March. This gives us extra confidence that age certificates and school attendance do not systematically omit recording half-timers and our method of identifying half-timers is valid.

In table 3, we report the number of half-timers and adults employed at QBM by production department between 6 March and 17 April 1851. To ensure that the composition of the workforce during this period was not an outlier, we also repeat the same exercise for the time periods around March in 1849, 1850, 1852, and 1853. The results are reported in appendix 4. Together, these tables present that total employment, the number employed in each department, and the composition of workforce in each department remained remarkably stable. Child labour was continuously concentrated in a small number of production processes. Regarding our study period in 1851 specifically, half-timers made up about 9 per cent of the total workforce at QBM and the ratio of half-timers to adult male workers was about 1:4.5. It should be noted, however, that large-scaled manufactures such as QBM, as it will be argued in the next section, were better positioned to employ child than their smaller counterparts. Thus the ratio of 1:4.5 should perhaps be considered as an upper-end estimation for the entire cotton industry.

By applying this ratio to the census recording of adult men employed in cotton manufacturing, we arrive at an alternate estimate of the number of young children employed in cotton

[72] In the wage books, we categorize all men who were not half-timers as adult men. In the census, correspondingly, adult men are those aged 13 years or older.

[73] Shaw-Taylor and Wrigley, 'Occupational structure'.

[74] No single week in the wage book coincides with the census week. For simplicity of records extract, we use these 7 weeks as employees employed at any time during these 7 weeks are reported on the same pages.

TABLE 3 Employment in each department in Quarry Bank Mill between 6 March 1851 and 17 April 1851.

	No. of half-timers	No. of adult men	No. of adult women	Total
Scutchers	0	13	0	13
1st card room	4	9	9	22
2nd card room	0	0	17	17
3rd card room	5	11	0	16
1st spinning room	0	2	15	17
2nd spinning room	0	1	12	13
3rd spinning room	0	2	14	16
Mule attic	4	5	0	9
4th mule room	3	24	0	27
5th mule room	4	9	6	19
Winding	16	1	25	42
Making up	0	1	0	1
Warping	0	5	0	5
Odd hands	0	14	4	18
Mechanics	0	14	0	14
Warehouse	0	13	4	17
1st weaving room	0	18	0	18
2nd weaving room	0	1	40	41
3rd weaving room	0	12	0	12
4th weaving room	0	1	33	34
5th weaving room	0	9	26	35
Total employment	36	165	205	406

Source: C5/1/15/6.

Note: We identify employee's sexes by their first names. Employees' ages are not reported in the wage books. However, as half-timer's weekly wage rate was fixed at 1s 3d and the starting wage rate for full-time employment was 2s 6d, we identify adults, that is, older than 13 years of age, as those whose weekly wage was at least 2s 6d.

manufacturing in England and Wales. There were about 110 000 male workers aged 13 years or above in the 1851 census with a specific cotton manufacturing occupational title in the census. Furthermore, there was a roughly equal number of adult men with a broader textile manufacturing occupational title, such as spinner and weaver, without specifying the materials they worked with. We proportionally reallocate these unspecified textile occupations to different sectors, such as wool, worsted, cotton, and silk, on the basis of the number of adult men employed in each.[75] By conducting this exercise, we estimate that there were more than 150 000 adult men employed in cotton manufacturing. Applying the ratio of 1:4.5, we estimate that there were about 34 000 children aged between 8 and 12 years employed in cotton manufacturing in England

[75] Among those aged 13 years or older in the 1851 CEBs, there were 68 193, 14 403, 109 306, 7578, 4117, and 34 424 people recorded with in the manufacturing of specific materials – wool, worsted, cotton, linen, coarse fabric, and silk, respectively. Hence, there were 238 021 adults employed in textile industries with specified materials, and cotton covered 45.9% of them (109306/238021). But in addition, there were also 104 346 adults working in textiles with unspecified materials, who were simply recorded as 'spinners' and 'weavers'. We assume workers in different textile industries were equally likely to be returned with unspecified materials. Therefore, we apply 45.9% to 104 346. In total, we then estimate there were 109 306 + 45.9% * 104 346 adults employed in cotton manufacturing.

and Wales in 1851. Recall that, on the basis of a different method and using evidence from a different factory, we earlier arrived at an independent estimate of just below 30 000. Given that the children-to-adult-male ratio for the entire cotton industry was probably below 1:4.5, the difference between these two estimates is indeed small. Our estimations are reasonably robust.

VI | TECHNOLOGY, LEGISLATION, AND CHILD LABOUR

Apart from its implications on children's labour force participation rates and occupational structure, our re-estimate also invites reconsideration on the timing of and the reasons for the rise and decline of child labour. In her seminal study using working-class autobiographies, Humphries argued that child labour intensified during the central period of the Industrial Revolution – the 1790s to 1850s – with factory employment at the forefront of this trend.[76] The initial intensification of child labour is attributed to factors such as the fragile breadwinning capacities of adult men, increasing dependency ratios, and early industrial technologies that aimed to utilize cheap child labour.[77] Child labour subsequently declined from the mid-nineteenth century onwards, with rising male wages, improved technologies, and state legislations being used to explain this later trend.[78]

Regarding textile industries specifically, Nardinelli reached different conclusions. He concurred that child labour intensified in the early stage of the textile industrialization in the late years of the eighteenth century.[79] However, largely based on the evidence of parliamentary inquiries presented in the 1816 *Royal Committee's Report on Child Labour*, the 1834 *Factory Inquiry Commission's Report*, and the *Factory Inspectors Reports* between 1835 and 1890, he argued that the employment of children under 13 years in textile factories was already in decline in the first few decades of the nineteenth century before the introduction of the first effective factory legislation in 1833.[80] Child labour in textile factories further declined until 1860, after which it started rising again until the 1880s, when the introduction of compulsory schooling halted the trend and further limited children's employment in factories.[81]

Our re-estimate, based on direct evidence from factory records, casts doubt on key aspects of Nardinelli's proposed timeline and the reasons underlying it. Quoting directly from factory inspectors' reports, Nardinelli found that the number of children aged under 13 years employed in textile factories fell from 56 000 to 33 000 between 1835 and 1838. In relative terms, child labour's share of the workforce halved from 15.9 per cent in 1835 to 7.9 per cent in 1838 and further declined to 6.8 per cent in 1850. Referring to our estimates, it can be shown that, even if we only revised up children's employment in cotton, there would still have been 58 000 children aged under 13 in the textile industries by 1851 (table 2 column II), and the corresponding figure would have been 72 000 if we apply the correction factor from cotton to all other textile industries. The strict decline of child labour immediately after the introduction of the 1833 Factory Acts did not happen. Instead, our estimates align closely with Horrell and Humphries' earlier findings, suggesting that, despite

[76] Humphries, *Childhood and child labour*, p. 9.

[77] Ibid, p. 366–7.

[78] Ibid, p. 370; Nardinelli, *Child labour*.

[79] Nardinelli, 'Child labor', p. 743.

[80] Ibid., pp. 743–45.

[81] Nardinelli, 'Child labor', p. 744, see tab. 2.

TABLE 4 Adult, young person and children's share of the labour force in Strutt Mills, 1838–44.

	1838	1839	1840	1841	1842	1843	1844
Adult share, %	40.7	45.2	44.4	42.6	49.9	50.1	55.9
Young person share, %	35.1	30.3	31.5	30.5	31.2	34.6	32.6
Children share, %	17.9	19.5	19.1	22.0	18.9	15.3	11.5
Total employment	1187	1172	1170	1173	1105	1087	1059

Source: DRO: D6948/H/8.

Note: Children refer to those aged under 13 years, young persons refer to those aged between 13 and 18 years, and adults refer to those aged over 18 years.

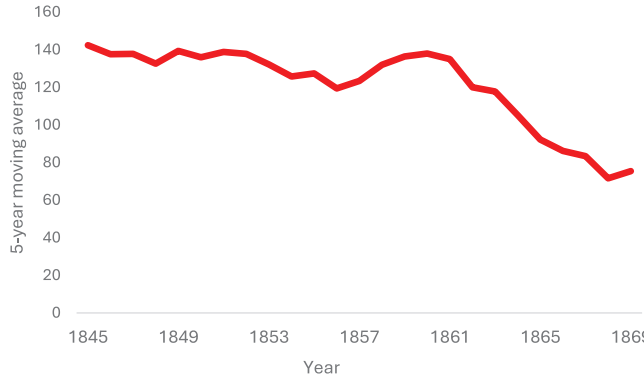

FIGURE 1 Number of children under 13 years employed in the Strutt Mills, 1845–69, 5-year moving average.

Source: DRO, D6948/H/6/1-4 and D6948/H/8.

shifts in the sectoral distribution of their employment, children's labour force participation rates remained remarkably stable between the late 1780s and early 1870s, with participation in factory production even showing an increase during this period.[82]

Evidence from the SM further supports our argument. Between 1838 and 1850, the Strutts recorded the monthly numbers of children aged under 13 years, young persons aged between 13 and 18 years, and adults aged over 18 years by sex employed in the mill. Table 4, taking employment numbers in March, presents the changes in child labour's share of the Strutt labour force between 1838 and 1844. Despite the drop in 1844, there is no discernible trend suggesting a decline in child labour. If anything, its share of the overall workforce actually increased until the early 1840s. SM stopped recording the number of adults employed from 1845 onwards and stopped the recording of employment altogether from 1851 onwards. Thus, unfortunately, we cannot extend the analysis above for the period beyond 1844 to arrive at a long-run estimate of child labour's share of the overall workforce at the SM. However, we can nevertheless recover the absolute number of children under 13 years employed at Strutt between 1851 and 1871 from age certificates. To smooth out the yearly fluctuations, we show the 5-year moving average of the number of children under 13 years employed in the SM between 1845 and 1869 in figure 1. While the long-run decline in child labour is undisputable, the decline was not continuous. The average number of children under 13 years employed at the SM remained stable between 1845 and 1860. The most significant decline occurred

[82] Horrell and Humphries, 'The exploitation', pp. 492–4.

after 1860, coinciding with the period during which Nardinelli suggests there was a resurgence of child labour in textile factories to offset labour input losses caused by the half-time system.

Our revised time trend has important implications in understanding the impacts of technological developments, legislation, and labour market fundamentals on children's employment. It has been argued that the maturity of industrial technologies limited the use of child labour.[83] Our results show that this relationship is more nuanced. At the SM, even as late as the early 1840s when they were reaching the forefront of technological development in the industry, children under 13 years still accounted for about 20 per cent of the entire workforce. It was significantly higher than the national average of below 10 per cent suggested by factory inspectors' reports for the same time period.[84] Child labour's share of QBM's workforce in 1851 was lower than the corresponding figures at the SM in the 1830s and 1840s, at around 9 per cent, but it was still higher than any national averages reported by the factory inspectors between 1838 and 1856.[85]

As alluded to before, SM and QBM were very technologically advanced cotton mills, and yet they kept utilizing child labour on a large scale. The maturity of industrial technologies did not squeeze out children's employment opportunities in the leading textile factories, nor did it diminish employers' economic incentives to employ children. If anything, technologically advanced factories operating on a large scale were perhaps more likely to keep using child labour as they were better positioned to mitigate the extra costs of employing children, such as setting up schools, paying for education fees, and creating a relay system amongst half-timers. In this regard, industrial organization played a more significant role than any substitutional effect of technology in sustaining the use of child labour.

Indeed, the supposed effect of technological development substituting adult labour for child labour is an overly simplistic and insufficient theory to fully explain what occurred in practice. Instead, a redistributional effect is observed. While technological change did eliminate the need for some child workers in certain specific processes, the expansion of production meant that many children were absorbed into other areas where their labour was still in demand. By 1851, as presented in table 3, all child half-timers employed at QBM worked in winding (16), mule spinning (11), and carding (9). Notably, no children were employed in spinning rooms one–three, which housed the throstle spinning operations. In the early days of water frame spinning – the precursor to throstle technology – it is well known that a significant proportion of children were employed in roles such as piecing threads and bobbin doffing. However, as the technology in spinning improved to reduce thread breakages, the need for child piecers declined. This technological shift, coupled with a more skilled, older workforce over time, effectively eliminated child labour in throstle spinning, as seen at QBM. But at the same time, the overall expansion of production meant that the reduced need for children in throstle spinning was offset by increased demand in other processes, such as winding and carding. The carding engine, for example, which initially relied on child labour, had seen relatively little development between Arkwright's time and the mid-nineteenth century, still requiring numerous manual interventions that were presumably still well suited to child workers.[86] Furthermore, mule spinning, still a less mature technology in 1851 than throstle spinning, continued to require child labour as piecers and minders. At QBM, this shift demonstrates how uneven technological advancements across different production processes could redistribute, rather than eliminate, child labour within the cotton industry.

[83] Nardinelli, 'Child labor', p. 745.

[84] Nardinelli, 'Child labor', p. 744, see tab. 2.

[85] Ibid.

[86] Baines, *History of the cotton manufacture*, p. 179; Singer et al., *A history of technology*, vol. IV, pp. 283–4.

Our data do not allow us to examine the period before 1838. We cannot directly test the claim that child labour was already in decline before the introduction of first effective factory legislation in 1833. The high and stable level of child labour at SM, at least before 1844, suggests that it is unlikely that child labour was significantly higher or had already undergone a notable decline before 1833. The legislative interventions on child labour were not the result of the state's response to an already declining trend of child labour set off solely by economic factors such as rising male wages and technological change. A broader nexus of social, cultural, and economic factors, rather than an over-reliance on the neo-classical framework, is needed to understand the British state's intervention in child labour in factories in the early nineteenth century.

The effectiveness of early factory legislation on reducing child employment, as alluded to before, was limited. The persistence of child labour, at least at the larger firms that could better afford the extra cost of employing children after 1833, deserves more scholarly attention. Apart from the direct benefit of cheap labour, one consideration must have been training the future workforce. Beyond technical skills, perhaps the most crucial set of skills required from the factory workforce was adherence to schedule, routine, and discipline.[87] This was often an alien set of skills for many first-time factory workers. Exposing and teaching the workforce these skills as early as possible likely raised their future productivities.

VII | CONCLUSION

By undertaking a novel linking process between primary source factory records on child labour – in particular, school attendance and age certificates – with the 1851 CEBs, this article has produced several new insights on the level and trajectory of child labour in nineteenth-century Britain.

We have shown that the 1851 census under-reported child labour (children aged between 8 and 12 years) in the cotton mills in Greater Manchester and Derbyshire by around one-third. This under-reporting was not due to the idiosyncrasies of enumerators. Younger siblings were more likely to be mis-reported, highlighting how parents perceived their children's socio-economic roles on the basis of factors such as the length of time they had worked in the factory and their contributions to the family budget when reporting their occupation.

The appraisal of the census' accuracy also has important implications for understanding the scale of child labour, as well as the timing and causes of its rise and decline. Our re-estimate of child labour in the cotton industry reveals that, while it constituted only a small portion of overall child employment, it remained a vital component of the workforce in this leading sector of British industrialization. By correcting for the under-reported figures, this study challenges previous arguments that child labour in textile industries had significantly diminished by the mid-nineteenth century. Child labour continued undiminished despite factory legislation such as the 1833 and 1844 Acts. It also continued to thrive with the introduction of innovative technologies, as shown in the analysis of factory records. Indeed, the maturation of steam-powered mechanization did not lead to an immediate decline in children's employment in the cotton industry, nor were the restrictions imposed by early factory acts fully effective. If anything, it was the large-scale, technologically advanced factories that were better positioned to absorb the extra hiring costs arising from the restrictive legislations and able to keep employing and re-deploying young children in the various processes of textile production. Due to their low cost, their suitability for certain production processes, and their potential to become a well-trained future workforce,

[87] Galbi, 'Child labour', p. 358.

children continued to be a valuable labour source until at least the mid-nineteenth century. As Humphries aptly noted: 'child labour was not anachronism inherited from a more brutal past. Instead, it looks to have been reinvented and propagated in the crucible of industrialisation'.[88]

ACKNOWLEDGEMENTS

We thank two anonymous referees for their valuable comments. We would also like to thank the archivists at the Derbyshire Record Office and the Greater Manchester County Record Office for their assistance. We received useful suggestions from seminar participants at the Cambridge Group. The usual disclaimer applies.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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REFERENCES

Anderson, M., 'Sociological history and the working-class family: Smelser revisited', *Social History*, 1 (1976), pp. 317–34.
Baines, E., *History of the cotton manufacture in Great Britain* (1835).
Burnette, J., 'How skilled were English agricultural labourers in the early nineteenth century?', *Economic History Review*, 59 (2006), pp. 688–716.
Burnette, J., 'Child day-labourers in agriculture: evidence from farm accounts, 1740–1850', *Economic History Review*, 65 (2012), pp. 1077–99.
Chambers, J. D. and Barley, M. W., 'Industrial monuments at Milford and Belper', *Archaeological Journal*, 118 (1961), pp. 236–39.
Champman, S. D., *The early factory masters: the transition to the factory system in the Midlands textile industry* (Exeter, 1967).
Collier, F., *The family economy of the working classes in the cotton industry, 1784–1833* (1965).
Cookson, G., *The age of machinery: engineering the Industrial Revolution, 1770–1850* (Woodbridge, 2018).
Cooper, B., *Transformation of a valley: the Derbyshire Derwent* (Portsmouth, 1983).
Crafts, N. F. R., *British economic growth during the Industrial Revolution* (Oxford, 1985).
Crafts, N. F. R., 'Forging ahead and falling behind: the rise and relative decline of the first industrial nation', *Journal of Economic Perspectives*, 12 (1998), pp. 193–210.
Cunningham, H., 'The employment and unemployment of children in England c. 1680–1851', *Past & Present*, 126 (1990), pp. 115–50.
Dunlop, O., *English apprenticeship and child labour* (1912).
Engel, F., *The condition of the working class in England* (Penguin Classics edn. 2009).
Fitton, R. S. and Wadsworth, A. P., *The Strutts and the Arkwrights, 1758–1830* (Manchester, 1958).
Frost, G. S., *Victorian childhoods* (2008).
Galbi, D. A., 'Child labour and the division of labor in the early English cotton mills', *Journal of Population Economics*, 10 (1997), pp. 357–75.
Gatley, D. A., *Child workers in Victorian Warrington: the report of the children's employment commission into child labour* (Knowledge, Organisations and Society, Occasional Paper Series) (Stoke, 1996).
Goldin, C., 'Household and market production of families in a late nineteenth century American city', *Explorations in Economic History*, 16 (1979), pp. 111–31.

[88] Humphries, *Childhood and child labour*, p. 177.

Griffin, E., *Bread winner: an intimate history of the Victorian economy* (New Haven, 2020).
Griffins, T., *The Lancashire working classes c. 1880–1930* (Oxford, 2001).
Hammond, J. L. and Hammond, B., *The town labourer 1760–1832* (1932).
Hendrick, H., *Child welfare: England 1872–1989* (1994).
Heywood, C., *A history of childhood: children and childhood in the west from medieval to modern times* (Cambridge, 2nd edn., 2018).
Higgs, E., 'The tabulation of occupations in the nineteenth-century census with special reference to domestic servants', *Local Population Studies*, 28 (1982), pp. 58–66.
Higgs, E., 'Women, occupations and work in the nineteenth century censuses', *History Workshop Journal*, 23 (1987), pp. 59–80.
Higgs, E., 'Occupational censuses and the agricultural workforce in Victorian England and Wales', *Economic History Review*, 48 (1995), pp. 700–16.
Honeyman, K., *Child workers in England, 1780–1820: parish apprentices and the making of the early industrial labour force* (2016).
Horrell, S. and Humphries, J., '"The exploitation of little children": child labor and the family economy in the Industrial Revolution', *Explorations in Economic History*, 32 (1995), pp. 485–516.
Horrell, S. and Humphries, J., 'Women's labour force participation and the transition to the male-breadwinner family, 1790–1865', *Economic History Review*, 48 (1995), pp. 87–117.
Horrell, S. and Humphries, J., 'The origins and expansion of the male breadwinner family: the case of nineteenth-century Britain', *International Review of Social History*, 42 (1997), pp. 25–64.
Horrell, S. and Humphries, J., 'Children's work and wages in Britain, 1280–1860', *Explorations in Economic History*, 73 (2019), 101272.
Horrell, S. and Oxley, D., 'Gender bias in nineteenth-century England: evidence from factory children', *Economics and Human Biology*, 22 (2016), pp. 47–64.
Horrell, S., Humphries, J., and Weisdorf, J., 'Family standards of living over the long run, England 1280–1850', *Past & Present*, 250 (2021), pp. 87–134.
Horrell, S., Humphries, J., and Weisdorf, J., 'Beyond the male breadwinner: life-cycle living standards of intact and disrupted English working families, 1260–1850', *Economic History Review*, 75 (2022), pp. 530–60.
Humphries, J., *Childhood and child labour in the British Industrial Revolution* (Cambridge, 2010).
Hurt, J. S., *Elementary schooling and the working classes 1860–1918* (1979).
Hutchins, B. L. and Harrison, A., *A history of factory legislation* (1903).
Jordan, T. E., *Victorian childhood: themes and variations* (Albany, 1987).
Joyce, P., *Work, society and politics: the culture of the factory in later Victorian England* (Brighton, 1980).
Kirby, P., 'A brief statistical sketch of the child labour market in mid-nineteenth-century London', *Continuity and Change*, 20 (2005), pp. 229–45.
Kirby, P., 'How many children were 'unemployed' in eighteenth- and nineteenth-century England?', *Past & Present*, 187 (2005), pp. 187–202.
Kirby, P., *Child labour in Britain, 1750–1870* (2017).
Lane, J., *Apprenticeship in England 1600–1914* (Milton Park, 2005).
Levene, A., 'Parish apprenticeship and the old poor law in London', *Economic History Review*, 63 (2010), pp. 915–41.
Marx, K., *Capital*, vol. I (Penguin Classics edn., 2004).
Murray, R., 'Quarry Bank Mill: I. The story of the mill', *British Journal of Industrial Medicine*, 15 (1958), pp. 293–8.
Nardinelli, C., 'Child labor and the Factory Acts', *Journal of Economic History*, 40 (1980), pp. 739–55.
Nardinelli, C., *Child labour and the Industrial Revolution* (Bloomington, 1990).
Peers, S., 'Negotiating work: absenteeism at Quarry Bank Mill, Cheshire in 1790', *Transactions of Historic Society of Lancashire and Cheshire*, 158 (2009), pp. 29–58.
Pinchbeck, I. and Hewitt, M., *Children in English society*, vol. II, *From the eighteenth century to the Children Act 1948* (1973).
Rees, A., *The cyclopaedia*, Vol. XXII, *Manufacturing of cotton* (1820).
Robic, B., '"Where are the children?": the long decline of child labour in England and Wales (1870–1914)', (unpub. Ph.D. thesis, Sorbonne Univ., 2022).
Rose, M., *The Gregs of Quarry Bank Mill: the rise and decline of a family firm, 1750–1914* (Cambridge, 1986).

Shaw-Taylor, L. and Wrigley, E. A., 'Occupational structure and population change', in R. Floud, J. Humphries and P. Johnson, eds., *The Cambridge economic history of modern Britain*, vol. I, *1700–1870* (Cambridge, 2014), pp. 53–88.

Singer, C. et al., eds., *A history of technology*, vol. IV, *The industrial revolution c.1750–c.1850* (Oxford, 1958).

Thompson, E. P., *The making of the English working class* (1963).

Tuttle, C., *Hard at work in factories and mines: the economics of child labor during the British Industrial Revolution* (1999).

Ure, A., *The cotton manufacture of Great Britain* (1836).

Wilson, C., *England's apprenticeship, 1603–1763* (1984).

You, X., 'Working with husband? "Occupation's wife" and married women's employment in the censuses in England and Wales between 1851 and 1911', *Social Science History*, 44 (2020), pp. 585–613.

OFFICIAL PUBLICATIONS

1. Great Britain, *Select committee on state of children employed in manufactories of United Kingdom: minutes of evidence* (P.P. 1816 III)
2. Great Britain, Factory Act 1833 – *an Act to regulate the labour of children and young persons in the mills and factories of the United Kingdom*, (3&4 Will. c.103).
3. Great Britain, *Royal commission on employment of children in factories supplementary reports* (P.P. 1834 XX).
4. Great Britain, *Royal commission on employment of children in factories supplementary reports* (P.P. 1834 XIX).
5. Great Britain, *Factories Act 1844 - an Act to amend the laws relating to labour in factories, (7&8 Vict. c.15)*.
6. Great Britain, Children's employment (trades and manufactures) royal commission 6th report (P.P. 1867 XVI).

PRIMARY SOURCES

Derbyshire Record Office (hereafter DRO)

1. D6948/J/6/3, boy school attendance records 1848–1853.
2. D6948/J/7/4, girl school attendance records 1848–1853.
3. D6948/H/6/1-4, under 13 year olds age certificate book 1844–1872.
4. D6948/H/8, monthly employment numbers 1838–1850.
5. D6948/L/9, machinery overhaul and replacement ledger 1821–1823.

Manchester Central Library (hereafter MCL)

6. C5/4/5/3, school attendance records 1850–1852.
7. C5/4/4/2, under 13 year olds age certificate book 1850–1854.
8. C5/1/15/5, weekly wage book 1847–1850
9. C5/1/15/6, weekly wage book 1850–1853

DIGITAL DATASET

Schurer, K., Higgs, E. and FINDMYPAST LIMITED. (2024). *Integrated Census Microdata (I-CeM), 1851–1911*. [data collection]. *2nd edition*. UK Data Service. SN: 7481, DOI: http://doi.org/10.5255/UKDA-SN-7481-3

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: You, X., Tertzakian, A., 'Child labour and industrialization: Evidence from factory records and the 1851 British census', *Economic History Review*, (2025), pp. 1–26. https://doi.org/10.1111/ehr.70015