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‘Cold, Calculating Political Economy’: Fixed costs, the Rate of Profit and the Length of the Working Day in the Factory Act Debates, 1832-1847.

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Abstract

The paper re-analyses the evidence presented by pro and anti-regulation interests during the debates on factory reform. To do so it considers the interrelationship between fixed costs, the rate of profit and the length of the working day. The interrelationship casts new light on the lobbying positions on either side of the debate. It does so by comparing the evidence presented in the debates before parliament and associated pamphlets with actual figures contained in the business records of implicated firms. As a result the paper identifies the compromise position of the working day length compatible with reasonable rates of profit based on actual cost structures. It is thereby able to reinterpret the validity of the claims of contemporary political economy used to support the cases for and against factory regulation.

Key words: Factory Acts, working hours, rate of profit, cost structure, accounting records

JEL: J21, J31, K31, L50, L67, M4, N13, O14, O15, O38

Introduction

One of the starkest features of the industrial revolution, particularly in the textile industries was the rapid transition to factory discipline as a means of enforcing long working hours.¹ Notwithstanding the relatively minor effects of earlier legislation, the length of the working day had become a divisive political issue by the 1830s.² Shifts in excess of twelve hours contrasted with the leisurely structure of the working week under the cottage based outworking system.³ The ten-hour day, with associated better protection for younger and female workers was the principle demand of the labour movement on the one hand, conflicting on the other with the employer insistence on factory discipline and unregulated hours.⁴ The issue became the focus of a series of debates over factory legislation in the British parliament in the 1830s and 1840s, culminating in the Factory Act of 1847, which broadly resolved the issue in favour of the operatives.

In response, the Ten Hours movement, led in parliament by Lord Ashley (later Lord Shaftesbury), demanded regulation of the working week and further restrictions on child labour.⁵ To resist these demands, the employers (led by Henry and Edmund Ashworth, John Pooley, Robert Hyde Greg, Hugh Hornby Birley and Holland Hoole),

¹ For alternative perspectives, see Clark, G. 'Factory Discipline'.

² Peel's *Health and Morals of Apprentices Act* 1802 (42 Geo III c.73) placed in *loco parentis* responsibilities on masters employing orphans, and was widely regarded as ineffective. Harrison and Hutchins, *History of Factory Legislation*, p.17. The *Cotton Mills and Factories Act 1819* (59 Geo. III c.66) outlawed employment of children under 9 and limited the working day to 12 hours for children aged 9–16. In 1825 Sir John Cam Hobhouse's Bill resulted in a legislated 69 hour week and in 1831 Hobhouse brought in another bill proposing to limit weekly hours worked by children to 64, resulting in the *Labour in Cotton Mills Act, 1831* (1 & 2 Will. IV c.39) limiting the working day to 12 hours for all those under 18, and night work to those aged 21 and over. It also established a partial holiday on Saturday, and provided penalties for offences against the Act.

³ Pollard, *The Genesis of Modern Management*; Marglin, 'What do Bosses do?'; Thompson, 'Time, Work-discipline and Industrial Capitalism', p.73; Landes, *The Unbound Prometheus*, p.59; Reid, 'The Decline of Saint Monday'; Toms, 'Financial Control, Managerial Control and Accountability.'

⁴ Kirby and Musson, *Voice of the People*, Berg, *Machinery Question*, pp.232-236.

⁵ For a detailed analysis of the politics of regulation, see Robson, *On Higher than Commercial Grounds*.

enlisted the ideological support of the newly emerging discipline of political economy. To fulfil this commission, its leading representatives, including George Poulett Scrope and Nassau Senior, attempted to rationalize the rate of profit and justify long working hours (Senior's theory of all profit being made in the *last hour* of the working day).⁶

To elaborate their theories the economists used figures abstracted from the accounts of contemporary cotton firms. Evidence based on these figures was also presented to parliamentary commissioners in an effort to influence legislation and in pamphlets and speeches to influence public opinion. A parallel research project shows that abstracted figures used in the 1833 commission for one firm (Samuel Greg and Sons) differed from those recorded in archival accounting records.⁷ This paper contrasts the numbers used in the debates by the Ashleyites, the anti-regulation lobby, as published in contemporary pamphlets and given in evidence to parliamentary committees and a neutral data set taken from the archives.⁸ Further examples are used to generalize the underlying relationships between firms' cost structure, the rate of profit and the length of the working day. These parameters are used to reframe the political debates, for example illustrating the effect on profit of carrying out the legislative programme of the Ten hours movement in contrast with the status quo.

In doing so, the paper illustrates how accounting manipulations that were used to justify the political objectives of the liberal economic discourse in the 1830s and 1840s. These manipulations, and their analysis, reveal the extent to which accounting numbers were used for the purposes of business lobbying and to influence legislation, and also quantify the mendacious use of business records. The evidence is used to

⁶ Berg, *The Machinery Question*; Anderson, Ekelund, & Tollison, 'Nassau Senior as economic consultant.'

⁷ Toms and Shepherd, 'Creative Accounting in the British Industrial Revolution.'

⁸ Ashworth papers (AP), Greg Papers (GP).

answer the historical counterfactual question: *What was the length of the working week that could have been legislated, consistent with a reasonable rate of return to capital?* The answer to this question allows the legitimacy of the claims of political economists and the Ten Hours movement to be re-evaluated. It also provides evidence on the actual profitability of cotton firms in this period and tests the claims in the literature that these were rising at the expense of labour or falling in the face of low entry barriers and intensifying competition.⁹

In the next section the paper reviews the literature in three parts, first by considering how the case of the Factory Acts can enhance the literature on earnings manipulation in the face of regulation, second by considering the nineteenth century origins of the notion of profit and its relation to investment in fixed capital and thirdly by considering the *ex ante* literature on the economic motives of the supporters and opponents of legislation. The major elements implied in these debates, the specification of the employment contract, cost behaviour risk and the rate of profit are combined to structure the collection and analysis of accounting data. The following section analyses the evidence from a pro regulation, anti regulation and neutral standpoint, using the evidence to quantify the relationship between the length of the working day and the rate of profit. The final section, which concludes, shows that factory legislation did not pose the threat to profitability that employers feared and that a shorter working week was consistent with acceptable rates of profit. Even so, although profit rates were high, mill owners faced significant risk arising from their investment in fixed capital.

⁹ Allen, 'Engels' Pause'; Harley, 'Was Technological Change in the Early Industrial Revolution Schumpeterian?'

Accounting manipulation and factory regulation

Much of the literature on factory legislation is concerned with disputes and apparent misrepresentations over factory working conditions,¹⁰ not with claims and counter-claims about relative profits of private firms in the industry. At the same time, the literature on accounting and the manipulation of accounting numbers in the face of regulation has evolved from observing the behaviour of large publicly owned corporations where there is a separation of ownership and control.

Consequently, the accounting literature on earnings manipulation suggests that it arises from incomplete contracts and managerial incentives. Less is known about the determinants of earnings manipulation in competitive conditions where businesses are controlled by their proprietors. The level of manipulation would be expected to be low, because owners have little incentive to deceive themselves. The early Victorian cotton industry demonstrated many of the characteristics of a competitive market as large numbers of firms entered the rapidly growing industry. Accounting manipulation is less likely under these conditions, particularly when firms use similar technology.¹¹ However, international competition increases profit uncertainty and hence earnings manipulation.¹² Moreover, the political costs hypothesis suggests that threat of regulation or its presence might lead to accounting conservatism.¹³ This raises the question of whether mill owners, facing the threat of regulation with regard to child labour and the length of the working day used conservative accounting methods. Such a question is significant, because although there is a large literature on

¹⁰ Kirby and Musson, *Voice of the People*, p.396. Anon. *Misrepresentations Exposed* (attributed to John Doherty), contrasted real conditions in factories with Senior's account based on biased information from employers.

¹¹ Bagnoli & Watts, 'Oligopoly, Disclosure, and Earnings Management.'

¹² Tinaikar, & Xue, 'Product Market Competition and Earnings Management.'

¹³ Cahan, Chavis, & Elmendorf, 'Earnings Management of Chemical Firms', Watts & Zimmerman, 'Towards a Positive Theory'; Watts, & Zimmerman, 'Positive accounting theory.'

the ethics and regulation of Victorian employment practices,¹⁴ there has been no systematic investigation of how accounting was used to inform these debates and the extent to which accounting manipulation mitigated the timing and impact of regulation from the point of view of the mill owners. Accounting research on this subject thereby has the potential to contribute to the political, economic and social history of a question that has had a significant influence on the public understanding of Victorian Britain.¹⁵

The question is also an important one for accounting research, particularly the origins of modern accounting in the British industrial revolution. Although there has been much debate about the relative modernity and effectiveness of accounting during the industrial revolution, underpinned by a rich but contradictory body of empirical evidence,¹⁶ less attention has been given to the role of accounting manipulation. A possible reason is that the effects of any accounting manipulation would be nullified in competitive and associated efficient market conditions to the extent that accounting information was readily assimilated into price. On this point, two contradictory strands of the literature come into play. On the one hand there are economists, who since Alfred Marshall, have characterized the mid nineteenth century cotton industry as the archetypal example of perfect competition.¹⁷ Economic historians have supported the associated view of a competitive labour market, where for example workers surrender the freedoms of outwork for factory discipline in return for higher

¹⁴ For example, Hutchins and Harrison, *A History of Factory Legislation*; Robson, *On Higher than Commercial Grounds*, Humphries, *Childhood and Child Labour*

¹⁵ As evidenced by the continued popularity of the works of Dickens, Eliot etc and their antagonism towards political economy, Gallagher, *The Body Economic*; Gray, *The Factory Question*.

¹⁶ Brief, 'Nineteenth Century Accounting error', Pollard, *Genesis of British Management*, Hoskin, & Macve, 'The Genesis of Accountability'; Fleischman, Hoskin, & Macve, 'The Boulton & Watt Case'; Hoskin and Macve, 'Knowing More as Knowing Less'.

¹⁷ Marshall, *Industry and trade*, pp.602-3. Lazonick, 'Competition, Specialization, and Industrial decline.'

wages in the form of a 'disgust premium'.¹⁸ On the other, accounting historians present a consensus, dating back to Pollard, but built on by subsequent scholarship, that the development of accounting was not one of the major achievements of the British industrial revolution, and that indeed nineteenth century accounting adopted error prone and haphazard methods to deal with major issues such as depreciation.¹⁹ These contradictory messages suggest two alternative hypotheses: 1) that in a competitive economy with efficient markets, accounting manipulation was transparent and therefore ineffective as a method of misleading regulators, such that it had a negligible impact; and 2) that accounting was poorly practiced and understood, creating information asymmetry in favour of entrepreneurs with access to accounts and the opportunity to manipulate them for the purposes of public presentation, thereby leading to significant impact on regulation. The first hypothesis is an extension of the positivist approach in the sense that regulation is proportional to market imperfections which are mitigated by informational transparency. The second is based on a political economy of accounting,²⁰ suggesting that accounting was used for political purposes and appropriated by lobbyists for the purpose of 'regulatory capture',²¹ or resisting legislation altogether.

The role of laissez faire ideology is particularly interesting in relation to the two hypotheses, first, because it might, on the grounds of regulation being precluded by the absence of market failure, predict empirical support for the positivist competitive market explanation implied by the first hypothesis. On the other hand, historians of political economy and the Factory Acts have shown that laissez faire had

¹⁸ Clark, 'Factory discipline.'

¹⁹ Brief, 'Nineteenth Century Accounting error', Pollard, *Genesis of British Management*, Hoskin, & Macve, 'The Genesis of Accountability'; Fleischman, Hoskin, & Macve, 'The Boulton & Watt Case'; Hoskin and Macve, 'Knowing More as Knowing Less'.

²⁰ Cooper & Sherer, 'The Value of Corporate Accounting Reports.'

²¹ Mueller, & Carter, 'We are all managers now'.

its origins in the lobbying activities of the mill owners,²² lending some potential empirical support for 2).

To examine these hypotheses, it is necessary to investigate how lobbying interests in the debates on the Factory Acts used accounting information. To frame the analysis some account needs to be taken of what is already known about the motivations of the pro and anti regulation groups in framing their positions. Although led by Ashley, the pro-regulation lobby received support from certain mill owners, most famously Robert Owen and John Fielden M.P. A possible reason is that there is evidence supporting the view that it was in the interest of *all* employers' to curtail labour beyond a certain point. Elasticity of output with respect to daily hours worked was positive but less than one--implying diminishing returns to increases in working hours.²³

Most of the literature however, has tried to explain the differences of opinion between this group and the anti-regulation group led by Ashworth and Greg by highlighting divergent interests. Marvel proposes an "industry capture" argument suggesting that the purpose of regulation was to increase the cost of production of many of the smaller textile mills, thereby causing them to curtail their output. This would naturally lead to higher textile prices and so to increased quasi-rents accruing to the types of capital least affected by the Act, specifically metropolitan steam powered mills.²⁴ Support for reform was higher in mule spinning regions where demand for adolescents was higher than demand for juveniles or women.²⁵ According to Nardinelli, violators of the Factory Acts were indeed owners of small, isolated

²² Berg, *The Machinery Question*, and in relation to the Factory acts in particular, see Robson, *On Higher than Commercial Grounds*, pp.14-15.

²³ Atack, Bateman, & Margo, 'Productivity in Manufacturing'; Ashley, *The Ten Hours Bill*, p.15 argued that workers were only 50 per cent efficient in the last hour.

²⁴ Marvel, 'Factory Regulation', pp.387-8, 393.

²⁵ Gray, *The Factory Question*, p.105.

mills.²⁶

Even so, the weight of evidence in support of this hypothesis has not been sufficient to resolve the debate. Rose rejects the argument that rural water powered mill owners were the principal opponents of factory legislation arguing that their main concern was foreign competition.²⁷ Rose, Taylor and Winstanley also suggest that larger firms needed to work longer because of their higher fixed costs.²⁸ Although it is clearly the case that larger firms would have higher fixed costs, role of fixed costs and the relationship to the working day has not been fully explored.

The role of fixed costs, their impact of profit and the length of the working day were indeed of great interest to contemporary opinion, particularly the emerging discipline of political economy, which became the ideological mouthpiece of the anti-regulation group. Early nineteenth century writers on political economy paid considerable attention to theories of profit and profit accrual, in which they made implicit but important assumptions about cost behaviour. Feudal regulations against usury and in favour of just prices had tended to limit the notion of profit to rewards commensurate with risk or the physical and mental labour of the undertaker. The ordinary rate of profit, implying no risk, was therefore the official interest rate, which until the 1850s, was commensurate with the usury laws. Upward adjustment for risk, arising for example from overseas trade in politically unstable regions had long been accepted.²⁹

In the meantime, however, mill owners and other entrepreneurs were amassing

²⁶ Nardinelli 'The Successful Prosecution of the Factory Acts'

²⁷ Rose, *Firms Networks and Business Values*, pp.143-144.

²⁸ Rose Taylor and Winstanley '*The economic origins of paternalism*'.

²⁹ Ashley, *Economic History*. Toms, 'Calculating profit'.

large fortunes from their purely domestic activities.³⁰ A justification was therefore needed for these profits, which became more urgent as more stringent factory regulation threatened.³¹ There were two particularly useful aspects from the employers' point of view. First, there was the ideological argument of laissez faire, with its roots in Smithian economics. Although the Factory Act of 1833 did not concede the main demands of the Ten Hours movement, its passage nonetheless represented a defeat for the principle of Laissez Faire, particularly after 1836, when the inspection system was more rigorously enforced.³² The emphasis of political economy therefore shifted to a second, related issue, which was the challenge of theorizing the rate of profit. Ideologically this meant opposition to Hodgskin, Saint Simon and Owen who advocated the right of the labourer to receive the whole produce of labour.³³ Meanwhile, the 1820s marked a shift towards greater investment in fixed capital in the typical mill.³⁴ As a consequence, there was a more urgent need to justify and protect the wealth accumulations of factory owners in the face of their insistence on long working hours. Political economists looked to capital, especially fixed capital, to understand the sources of increasing returns and to the state to nurture its development.³⁵

Scrope identified two particular reasons why the rate of profit should be high in manufacture. The first, also advocated by Rae and Ramsey,³⁶ was as a reward for entrepreneurial labour, which was mental, or knowledge labour, rather than manual labour, and in addition to the ordinary rate of profit on capital there should be reward

³⁰ Cotton spinners for example sold directly to the market in Manchester not to the ultimate overseas customer.

³¹ Berg, *Machinery Question*.

³² Boyson, *The Ashworth Cotton Enterprise*, pp.165-166

³³ Berg, *Machinery Question*, pp.115-116.

³⁴ Berg, *Machinery Question*, p.110.

³⁵ Berg, *Machinery Question*, pp.124 and 139

³⁶ Rae, *New Principles*, p.195; Ramsey, *An Essay on Distribution*, pp.209-211.

for skill and trouble, according to the standard of remuneration ‘generally expected of his class’.³⁷ Second, Scrope argued that risks in manufacture were greater than in agriculture because fixed capital was more likely to be superseded by new inventions. In this sense, depreciation, or wear and tear, was viewed as appropriation of profit, as part of the insurance value of employing fixed capital. Embryonic theories based on capital maintenance promoted this approach, or the need to recover capital advanced with a return. Further compensation, in Scrope’s scheme, arose from the risks peculiar to the trade in which the capital was engaged. The remainder, the return obtained without labour or risk is the net profit, comprising compensation for sacrifice of personal gratification and insurance against the risk of loss of property.³⁸

The threat of legislation also promoted attempts to relate the accrual of profit to the length of the working day. Senior argued that because profit was a specific fraction of total cost then it followed that all profit was earned in the last hour of the working day, and therefore any reduction of the working day would eliminate the profit.³⁹ Although flawed, Senior’s arguments carried temporary weight because the ‘fixed cost’ problem was poorly understood.⁴⁰ Moreover, although the argument itself was incorrect, since reducing the working day would also eliminate cost in some proportion, the implied relationship was partially true insofar as some of the costs were fixed.

Summarising these arguments, it is clear that the rate of profit and the extent of fixed costs were important parameters that helped frame arguments for and against restrictions on the hours of labour. In the light of these differing positions, there is an

³⁷ Scrope, *Principles*, pp.209-211.

³⁸ Scrope, *Principles*, pp.158.

³⁹ Senior and Horner, *Letters on the Factory Act*, pp.4-5

⁴⁰ For example the ‘fixed cost’ problem, as identified by Edwards, ‘Some notes’, who concluded that whereas accounting methods were adequate for the purposes of the putting out system, once production had been internalized in factories, there was a subsequent failure to resolve the “fixed cost problem”.

opportunity to reanalyse the data and model the implied assumptions. Conducting such an analysis reveals the nature of contemporary assumptions about the relationship between the fixed costs, the rate of profit and the length of the working day. Setting up such a model, using the figures presented in the debates and from contemporary business accounts in the archives provides the opportunity to reassess employer justifications for the length of the working day.

Data and analysis

The first instance of accounting data being used to underpin a lobbying position was in the evidence presented to the FIC in 1833. Birley and Hoole, Edmund Ashworth and John Pooley gave evidence to the first Lancashire commission, chaired by John Welsford Cowell and Greg to the second commission chaired by Edward Carleton Tufnell.⁴¹ Their submissions contained strong similarities, and each presented evidence showing their perceived scale of fixed charges analysed by main category and presented scenarios showing the effect of these fixed charges on profits and/or wages assuming pro-rata reductions in outputs. When the debates on Ten Hour legislation resurfaced in the 1840s, similar calculations were undertaken by the anti regulation lobby, including one by the Ashworth brothers. These calculations were made on a separate sheet in one of Ashworth's ledgers and were intended as a response to a pro-regulation pamphlet published by William Kenworthy.⁴² In the pamphlet, Kenworthy reproduced substantial extracts of Fielden's speech in favour of regulation. Fielden, himself a cotton entrepreneur, like Ashworth had access to cost and profit data from his own firm, although the numbers cited in his speech were too

⁴¹ BPP (1833) 450. The two commissions collected evidence in parallel during the second half of 1833 and are listed as D1 and D2 respectively in the full report.

⁴² AP, Quarterly Stock Accounts, 'Calculations for Ten Hours Bill', p.111; Kenworthy, *Inventions and Hours of Labour*.

scant to sustain reliable further analysis. A speech by Lord Ashley in 1844 used several examples based on more comprehensive data, including the case of a spinning establishment comparable to the examples fielded by Greg, Birley and Hoole, Pooley and Henry and Edmund Ashworth.

To conduct an analysis showing the impact of fixed costs on the rate of profit allowing output to vary according to different assumptions about the length of the working data requires data on output, the perceived split of total cost into fixed and variable components, and the amount of capital invested. Further detail, on depreciation, interest, wages and other sundry components of cost are also helpful, as is data on the split between fixed and circulating capital. For these reasons three anti-regulation sets of evidence were selected on the basis of sufficient data: Greg's submission to the FIC in 1833, Birley and Hoole's submission to the FIC in 1833 and Ashworth's calculations in response to Kenworthy in 1844.⁴³ The pro-regulation evidence consists of only one data set, taken from Ashley's speech in 1844.⁴⁴ Although the selection of evidence is somewhat unbalanced in this respect, the Ashleyites appear to have relied less on accounting data than the employers' lobby, and this is perhaps unsurprising as the discourse of the Ten Hours movement was based on the sense of moral outrage over child labour and overwork, whereas the mill owners based their arguments on the threat of apparently cheaper overseas competition.⁴⁵

A third set of evidence, taken from the archives, is used as a means of auditing the evidence used by the pro and anti regulation lobbies. Greg and Ashworth papers both contain sufficient data to extract the measures for comparative analysis, which is

⁴³ BPP (1833), 450 D2, ev. Greg, pp.780-784; *ibid* D1, pp.729-730 ; AP, Quarterly Stock Accounts, 'Calculations for Ten Hours Bill'

⁴⁴ Ashley, *Ten Hours Factory Bill*, p.9.

⁴⁵ For example, Oastler, *Fleet Papers*; *British Labourer's Protector and Factory Childs Friend*.

done by re-performing their publicly disclosed data with equivalent data from their private business records.⁴⁶ For Greg, the averages of the previous five years' data, 1827-1831 inclusive, is used. For Ashworth, the profit and loss account for the quarter ended November 1845 is used.⁴⁷ These figures are appropriate because they appear in the ledger directly opposite the Kenworthy calculations and provide a very detailed contemporaneous analysis of costs.⁴⁸ No comparable archival records are available for the Birley and Hoole case, although their evidence appears to be a generalised abstraction rather than a specific firm. Even so, the Birley and Hoole figures can be reworked using assumptions consistent with the information shown in the Greg and Ashworth ledgers.

⁴⁶ AP, Quarterly Stock Accounts, GP, Partnership book, C/5/1/2/4.

⁴⁷ It is appropriate to use and aggregate examples from the 1830s and 1840s because the terms of the debate, on the Ten Hours question continued following the 1833 Act. All example cases are therefore based on cost structures of firms working a 69-hour week. It should be borne in mind that the fixed capital of a typical 1840s mill was larger than a 1830s mill, a point discussed in more detail below.

⁴⁸ AP, Quarterly Stock Accounts, pp.111-112.

Table 1: Comparative costs and profits

	(1) Anti regulation	(2) Pro regulation	(3) Archival evidence
Weekly output (lbs yarn)	14575	16000	17755
Fixed cost (£ per week)	117.55	19.25	85.43
Total cost (£ per week)	334.01	175.00	371.48
% Fixed cost	37.10%	11.00%	23.08%
Working week (hours) required to achieve profit after depreciation (before/after interest on capital):			
5%/zero	47.8	23.0	32.3
10%/5%	68.8	46.0	55.2
15%/10%	89.8	69.0	78.0
Implied profit rate of:			
69 hour week	8.25%	15.00%	15.02%
58 hour week	6.10%	12.83%	10.27%
Including interest on capital			
Operating leverage (elasticity of profit to change in output)	3.57	1.50	2.90

Notes: Costs are shown in decimal equivalent values

Sources: Compiled from respectively (1) BPP, *Factory Inquiries Commission*, (1833) ev. Birley and Hoole 450, D1, pp.729-730; *ibid*, ev. Greg, D2, pp.780-784; AP, Quarterly Stock Accounts, 'Calculations for Ten Hours Bill', p.111 (2) Ashley *Ten Hours Factory Bill*, 10th May, 1844, p.9, spinning establishment (3) GP, C5/1/2/4 Partnership book; AP, Quarterly Stock Accounts, Profit and loss account, 1845, p.112; BPP, *Factory Inquiries Commission*, (1833) ev. Birley and Hoole 450, D1, pp.729-730.

Table 1 shows a collation based on the underlying records summarising each political position (columns [1] and [2]) and data extracted from archival records, which is intended to represent an objective position (column [3]). Weekly output, shown as lbs of yarn spun is included to confirm the similar scale of operation

forming the reference point of each set of evidence. The second and third rows show the weekly fixed and total costs, with the proportion of fixed cost to total cost as a percentage in the fourth row, allowing the perceived scale of fixed cost between pro and anti-regulation lobbies to be evaluated. The next section of the table shows the required level of output, expressed in hours per week necessary to achieve specified levels of profit. Cases are considered ranging from zero profit after deducting interest on capital to 10%, or equivalently between 5% and 15% on a before interest basis. These activity levels are computed using price and margin data from the above sources⁴⁹ and computing the per hour profit (or contribution to fixed costs) after all variable costs have been deducted. Dividing this into the total fixed cost plus the target profit computed by multiplying the total capital by the rate of profit provides an estimate of the hours per week required to achieve that level of profit. These figures can then be interpolated, to compute the implied rate of profit before deduction of interest for the hours per week reflecting the status quo (69 hours favoured by the anti-regulation lobby) and the 58-hour week implied by a Ten Hours bill.⁵⁰ The final calculation in table 1 shows the elasticity of profit to a change in output. Also referred to as operating leverage, the figure rises in proportion to the percentage of fixed to total cost and provides a measure of risk from the investor's point of view.

The results in table 1 follow a clear pattern. The opponents of regulation estimate high levels of fixed cost, which in turn seems to justify the requirement for a long working week in order to earn a reasonable rate of return. High fixed cost estimates also lead to a high operating leverage ratio, but even accepting this is an overestimate, the notion of a 'reasonable rate of return' might be in the order of 10%,

⁴⁹ These were also checked against external sources, Huberman, *Escape from the Market*, table 6.10, pp.101-102.

⁵⁰ Grant, *The ten Hours Bill*, p.101, Factories (No.2) Bill.

in view of the presence of some fixed costs and the pronounced nature of the trade cycle affecting the cotton trade.⁵¹ In contrast the pro-regulation lobby produced low estimates of fixed cost, resulting in lower operating leverage, and also estimate higher levels of profit. In some cases these were clearly overestimated.⁵² The corresponding figures computed from archival data suggest a middle range of outcomes for these variables.

Effects of fixed costs

An important reason for differences between pro and anti regulation positions arose from their assumptions about cost behaviour. Ashley and others argued that certain categories of cost that the mill owners assumed to be fixed were actually variable. These included depreciation on plant and machinery, since they argued that depreciation was related to usage, not merely the passage of time.⁵³ The mill owners argued for high depreciation charges that remained constant regardless of use, because the rate of technical progress tended to increase obsolescence rates of sunk capital investments.⁵⁴ Even so, depreciation was not consistently charged by mill owners in their own business accounts, notwithstanding its value as a lobbying tool. Samuel Greg and Sons did not charge depreciation in their business activities before

⁵¹ Siegel 'The Real Rate of Interest', p.12, calculates the average arithmetic rate of return on equity for the period 1800-1990 as 7.81%. However, The differential between equity and bond returns was much lower in the earlier part of the nineteenth century (*ibid* figure 5). Long run estimates of the premium on risky investments suggest that a range of 3-8% over and above the risk free rate of investment, which c.1840 can be taken as 5%; Dimson, Marsh, & Staunton, 'Equity premiums around the world'.

⁵² Ashley, *Ten Hours Factory Bill* in the calculation on p.7, the net effect of all reductions was to reduce the total cost per pound of fixed charges for a 60 hour week compared to a 69 hour week. The result seems to arise from cumulative rounding errors applying pro-rata reductions, which was not the case in the other spinning establishment example used by Ashley *Ten Hours Factory Bill* on p.9 (and in table 1).

⁵³ Ashley, *Ten Hours Factory Bill*, p.7, pro-rata reductions in wear and tear allowance in tabulations; Kenworthy, *Inventions and the hours of labour*, 'amount of wear and tear... will be lessened in the same proportion' p.12, also cited in a speech by Fielden, BPP (1844) 1236.

⁵⁴ For example, BPP, (1833) 450, ev. Jackson, p.779; ev Greg, p.782. See also Marx *Capital I*, Ch.15, p.333, notes 64 and 70, quoting authorities from the 1860s (*Times*, 26th Nov., 1862 ; Rep. of Insp. of Fact. for 31st Oct., 1862, p. 19.)

1832.⁵⁵ Ashworth Brothers did charge depreciation but allowed the amount to vary from year to year. Depreciation was charged on the original cost of the asset and accumulated on the credit side of the account adjacent to the partner's capital account. Arrears of wear and tear, and their effects on associated interest charges, were adjusted through the partner's capital accounts. In this fashion, although depreciation was not deducted every year, the change in partner's wealth was correctly represented.⁵⁶ Depreciation then was perceived as a reserve or an appropriation of profit and this might explain its variable treatment, for example in good years, the partners making extra provision for the ultimate replacement of capital, which they would then be prepared to finance personally.⁵⁷

A second area of disagreement over fixed cost was the charging of interest on capital. The anti regulation lobby argued that interest was a necessary cost of production, although their business records showed that it was a method of appropriation to the partners capital accounts. The pro-regulation lobby argued that interest on the floating part of the capital was a variable cost of production, since the reduced output following from a shorter working week would lead to a corresponding reduction in the circulating part of capital. Fielden (Kenworthy) and Ashley both used this argument in the debates of the early 1840s.

⁵⁵ MCL, Partnership books, C5/1/2-4. New machinery account, Partnership book, C5/1/2/3; valuation, C5/1/1/3

⁵⁶ AP, Stock Books. Although applying a consistent depreciation rate, the effect of such adjustments was to correct missing depreciation through 'reserves', or accumulated partnership capital.

⁵⁷ For example at Quarry Bank the fixed capital was privately owned by Samuel Greg and rented to the mill partnership. Toms and Shepherd, 'Creative Accounting', p.15.

Table 2: Ashworth Accounts Analysis 1845

	(1) Cost assumption	Data per Accounts (69 hours)			Effect of 58 hours		(7) Total
		(2) Total	(3) Variable	(4) Fixed	(5) Variable	(6) Fixed	
Carriage of cottons	Volume based*	12	12		10.09		10.09
Carters wages	Volume based	16	16		13.45		13.45
Stable expenses	50:50	41	20.5	20.5	17.23	20.50	37.73
Brokerage	Volume based	28	28		23.54		23.54
Carding and preparing	Volume based	265	265		222.75		222.75
Scutching and picking	Volume based	45	45		37.83		37.83
Roving and sorting	Volume based	21	21		17.65		17.65
Stretching	Volume based	95	95		79.86		79.86
Roller covering	Volume based	3	3		2.52		2.52
Reeling and packing	Volume based	58	58		48.75		48.75
Incidental expenses	50:50	192	96	96	80.70	96.00	176.70
Overlookers and warehouse	Establishment**	46		46		46.00	46.00
Mechanics	Volume based	88	88		73.97		73.97
Cards	Volume based	87	87		73.13		73.13
Cloth brushes	Volume based	6	6		5.04		5.04
Ironmongery and castings	Volume based	106	106		89.10		89.10
Strap and roller leather	Volume based	62	62		52.12		52.12
Mill gearing repairs	Volume based	48	48		40.35		40.35
Spinning	Volume based	807	807		678.35		678.35
Salaries, travelling expenses	Establishment**	75		75		75.00	75.00
Coals	Volume based	204	204		171.48		171.48
Engineers wages	Establishment**	22		22		22.00	22.00
Gas	Volume based	35	35		29.42		29.42
Oil	Volume based	59	59		49.59		49.59
Tallow	Volume based	11	11		9.25		9.25
Rates and taxes	Period cost	9		9		9.00	9.00
Rent of mills	Period cost	80		80		80.00	80.00
Insurance	Period cost	45		45		45.00	45.00
Wear & tear and int. on capital	***	950	615	335	516.84	335.14	851.98
Rents receivable	Period revenue	-103		-103		-103.00	-103.00
Quarter total		3413	2787	626	2343.00	625.64	2968.64
Annual equivalent		13652	11149	2503	9371.99	2502.56	11874.55
Output lbs		80916					68016
Annual equivalent output		323664					272065
Cost (d per lb)		10.123					10.475
Increase (%)							3.477%
s d			10 1/8				10 4/8

Notes:

*All costs associated with goods in (eg cotton carriage and brokerage) and production processes (carding through to spinning) are assumed to be volume based and therefore variable costs.

**Overlookers, warehouse, salaries and travelling, engineers, although probably involving some variable element, are assumed to be 100% fixed.

***Spilt pro rata: interest on floating capital and depreciation on machinery assumed variable, interest on fixed capital and depreciation on land and buildings assumed to be fixed.

Source: AP, Quarterly stock accounts, November 1845.

John Welsford Cowell made a similar point ten years earlier in response to the evidence presented by Pooley and Ashworth, Greg and others to the 1833 commission. Although not of Whiggish sympathies to begin with, Cowell was unimpressed by the mill owners' apparent knowledge of business, and forced them to concede that reduced hours would cause a parallel reduction in floating capital investment.⁵⁸ Cowell commented in the minutes: 'The answer to no.9, as Mr Ashworth observed, took more than an hour...It struck me as singular that gentleman should be so well acquainted with the rate of wages on the Rhine and in the Netherlands, and yet require so long a time to settle a rough proportion between the fixed and circulating capital employed in their own business.'⁵⁹ A possible reason why Ashworth and Pooley discussed possibilities amongst themselves was that they wished to present a common view of the evidence most favourable to their case, rather than reflect actual business practice. Even so, the dispute reflected conceptual differences in the treatment of interest charges and depreciation, which remain important in today's debates on accounting.⁶⁰

Archival evidence does not provide the means of settling these conceptual disputes. However, it does provide a means of analysing the claims of the pro and anti regulation lobbies in more detail. Table 2 shows a detailed breakdown of the costs for Ashworth Brothers in November 1845. Column (1) shows the assumptions necessary to allocate total cost per the accounts (2) into their variable (3) and fixed (4) components. The detail in the Ashworth accounts is useful because it provides the means of splitting costs with reference to relatively small cost classifications, such

⁵⁸ BPP (1834), 167, Cowell's preface (pp.119-145) and footnotes in BPP (1833), 450, ev. Ashworth and Pooley, pp.679-680, ev. Birley and Hoole, p. 727, and Q1, p.726.

⁵⁹ BPP (1833), 450, ev. Ashworth and Pooley, pp.679-680

⁶⁰ For a summary Schroeder, Clark, & Cathey, *Financial Accounting Theory*, p.292.

that although some assumptions are necessary, as set out in the notes to the table, their individual effect is relatively small, thereby producing a potentially more accurate audit of cost behaviour. This would certainly be the case when compared with the aggregations into more generic cost categories used in the parliamentary debates.⁶¹ The total fixed cost for the quarter evidenced in table 2 was £625, or an annual equivalent of just over £2,500, much less than the £6,334 per year suggested by Boyson.⁶²

In addition to the cost breakdown and classification into variable and fixed categories, table 2 also shows the effect on variable (column 5), fixed (6) and total cost (7) of legislation restricting production to 58 hours per week. For the purposes of this calculation, variable costs are adjusted pro-rata to an output reduction implied by reducing from 69 to 58 hours per week, whereas the fixed expenses are held constant. The increase in cost per lb arising from the restriction can then be calculated. The table shows that the increase in cost would be from 10.123 d per lb to 10.475 d per lb, or a 3.447% increase (3/8d).

The difference in cost of 3/8d per pound corresponds closely to the difference of 3/8d articulated in parliament by Fielden, based on the figures supplied by Kenworthy. Such an increase, when applied as an input to the cost of woven cloth, amounted to 1/4d per yard. Fielden used this number to undermine the pessimistic forecasts of the mill owners of the consequences of legislation: ‘Are we so near ruin, that an advance of one farthing per yard on our cotton cloth would irrevocably seal our fate? If so, how important an element of national prosperity, is the labour of these

⁶¹ For example, excluding labour and raw material, Ashley and Greg used only four cost categories; Ashley *Ten Hours Factory Bill*, 10th May, 1844, p.9, BPP (1833), 450, ev.Greg, p.784.

⁶² Boyson, *The Ashworth Cotton Enterprise*, p.59, refers to a calculation by Henry Ashworth, that overheads were such in a 52,000 spindle mill that it did not pay to stop it until losses exceeded £6,334 a year. See also BPP (1846) 411, pp.336-337.

poor people! How praiseworthy is their exemplary patience under their complicated sufferings!’⁶³ Fielden thus used the evidence from Kenworthy’s account to great polemical effect. Evidence from the Ashworth archive seems to support the assertion of marginal impacts on production costs.

If the effects were so marginal, however, the strident opposition of some mill owners to legislation remains to be explained. Some have argued, as noted earlier, that opposition came from the owners of more marginal water-powered mills who would have suffered competitive disadvantage in the event of restriction on hours,⁶⁴ but there seems to be no correlation between type of mill and the attitudes of lobbyists on either side. Certainly Greg and Ashworth relied on water, but were nonetheless leading concerns in terms of the scale of their investments. Hoole meanwhile was the proprietor of a steam-powered mill in Manchester, at the metropolitan centre of British industrialisation. Fielden on the other hand was in a remote location, although a significant investor in steam power.⁶⁵

Table 1 is suggestive of other reasons why mill owners in general would not welcome legislation, notwithstanding their individual political differences. Most importantly, the rate of profit on capital can be seen to be sensitive to assumptions about the cost of production in relation to enforced reductions in output. The neutral position in table 3, using the archival evidence, suggests that a working week of 58 hours would be consistent with a rate of profit over ten per cent and that the working week could be set as low as 55 hours per week and still allow 10 per cent profit to be achieved. Even so, this would represent a cut of around 5% in the rate of profit

⁶³ Fielden, BPP (1844) 1236.

⁶⁴ Ashworth’s opposition was based on water power dependence according to Boyson, *The Ashworth Cotton Enterprise*, p.160. Foster ‘The Making of the First Six Factory Acts’ for example argues that Scots mill owners, largely water-powered, specifically charged the Lancashire mill owners with rigging the Act in their own interest. pp.4-5.

⁶⁵ Anon. ‘The Fieldens of Todmorden’, p.420.

achievable under the same conditions with a 69-hour week. A reduction of one third in the rate of profit would perhaps provide a compelling reason for at least some employers to oppose the measure, particularly those, such as water-powered mills that were subject to output restrictions arising from weather related risk and for those more specialised mills most vulnerable volume based variations arising from the trade cycle. It is noteworthy that the cut in the rate of profit suggested by the archival evidence in table 1 is proportionately less than the reduction implied by the figures used by the anti-regulation lobby. Here the fall is only from 8.25% to 6.10%, and is explained by the low rate of profit assumed in the evidence presented for this purpose. The pro-regulation lobby, naturally, presented an apparently higher rate of profit (15%) for their purposes, which is nonetheless more consistent with the archives. Factory inspector Leonard Horner, writing to Senior, provides some support for the notion of 10% as the minimum average rate of profit: 'I am not clear as to the accuracy of your statement on the rate of profit in the cotton trade. It is very possible that, at the particular time of your inquiry, ten per cent may have been the average net profit, on spinning, coarse and fine, and power-loom weaving; but the vast fortunes which have been made in the course of a few years, and in so great a number of instances, in all parts of the country where the cotton manufacture is carried on to any extent, by men who began without a shilling, and entirely on borrowed capital, for which they had to pay a heavy interest, prove to my mind that the average rate of net profit, in any period of five years since the cotton trade rose into consequence, must have greatly exceeded ten per cent in well-managed factories'.⁶⁶ The pro-regulation lobby however, assumed that only a small proportion of costs were fixed (11%), such

⁶⁶ Leonard Horner, (Horner and Senior, *Letters on the Factory Act*), provides some support for the notion of 10% as the minimum average rate of profit.

that the effect on profit of shorter hours was proportionately less. If the archive evidence is believed, then the conclusion is that the ex ante assumptions about the profit rate under existing conditions made by the Ashleyites was about right, as was their assumption about the cost of production. However, they underestimated the incidence of fixed costs, which although only a small proportion of total costs according to the archival evidence, were even so proportionately higher than suggested by the pro-regulation lobby, leading to a leveraging downward of the projected profit rate under conditions of shorter working hours.

Foreign competition

In addition to the direct effect on profit, the anti-regulation lobby also repeatedly cited the threat of foreign competition. Hoole drew attention to the Swiss cotton industry, which can be better understood as part of a wider lobby for free trade.⁶⁷ Witness after witness in the anti-regulation lobby alerted the parliamentary commissioners to the danger of foreign competition. Robert Hyde Greg presented figures that showed spinning wage costs to be 50% higher in Manchester than Switzerland.⁶⁸ Even so, these arguments were not universally believed. Unsurprisingly, Ashley was one who remained to be convinced. He argued that the melancholy forebodings given in evidence at committees of 1816, 1818 and 1819 of loss to the foreigner were not fulfilled. The claimed loss of profits since 1819 was belied by large increase in factories since then and support of MPs like Fielden, the members for Salford,

⁶⁷ Holland Hoole, *Letter to Althorpe*, p.14 argued the government should immediately repeal duty on raw cotton and other duties on consumption. The Swiss cotton industry was probably singled out for its free trade associations, through its importation of raw cotton imports through the Freeport of Genoa, not because it posed a serious threat to Lancashire.

⁶⁸ BPP, (1834), 167, Cowell's Preface, p.399; 1.855d per lb in Manchester, 1.236d in Switzerland. Cowell estimated the differential as 38% (the ratio of 4:2.9), *ibid*, p.394.

Ashton, and Blackburn.⁶⁹

More significantly, Cowell, in his capacity as chair of one of the parliamentary commissions of 1833, discounted all the evidence of Ashworth, Greg and Hoole, and did so on the grounds of their misleading use of accounting information, as noted earlier with respect to the treatment of fixed and circulating capital by Birley and Hoole. In his report, Cowell declared that if the evidence of Ashworth and Pooley were correct about lower wages at Ghent, ‘the wonder is that the English spinners should not have been totally ruined long ago’, noting also that Belgian spinners were lobbying their government for protection against English competition.⁷⁰

Cowell supposed costs were lower in England because the mule length was wider by greater proportion than the differential in daily wages. Acknowledging evidence that foreign workers were paid less by the hour than British workers, he pointed out that these representations failed to take into account productivity differentials, noting that the typical British spinner minded three times the number of spindles compared to a German spinner. Cowell's comparison was frustrated by the failure of the Ashworth Brothers, Greg and Hoole to supply data that he knew they must have access to, namely the wage cost in terms of payment for work done.⁷¹

In an attempt to remedy this information gap, Table 3 shows comparative spinning costs in Mulhausen⁷² and Lancashire. Mulhausen featured in evidence provided by to the 1833 commission by Edwin Rose, an operative machine maker whom Cowell considered an independent and reliable witness, and whose evidence he

⁶⁹ Ashley, *Ten Hours Factory Bill*, pp.10 and 14.

⁷⁰ BPP (1834), 167, Cowell's Preface p.401.

⁷¹ Cowell's frustration was justified. His report noted that spinners in Manchester used detailed payment schedules arranged by mule length and yarn fineness count (Hanks/per lb). BPP (1834), 167, Cowell's Preface, pp.383-384.

⁷² Mulhausen (Mulhouse), with 500,000 spindles in 1828, was the centre of the cotton trade in Alsace, described as the ‘Lancashire of France’, Hammond and Hammond, *Rise of Modern Industry*, pp.47-48.

drew upon for the purposes of establishing a comparison with Lancashire.⁷³ The table shows the number of spindles per mule and operatives per pair of equally sized mules for the typical mill producing coarse 40s yarn based on evidence collated in Cowell's preface. The total wages per team of three (in both cases a spinner and two juvenile assistants) were obtained from the same source.⁷⁴ Making reasonable assumptions about output per week on the basis of the data contained in table 1 and the example cited by Ashley of a typical mill producing 36s yarn and the average mill size according to the number of spindles,⁷⁵ it is possible to compute the wage cost in d per lb of output. As a check it can be noted that the wage cost per week of £66 corresponds quite closely to the wages paid to the spinning department in the Ashworth Brothers accounts (table 2), and that the number of personnel of 120, split approximately 40:80 between spinners and piecers corresponds reasonably to the establishment breakdown from the 1833 survey tables.⁷⁶ The table computes comparative figures for Mulhausen, holding mill size and output constant with the Lancashire average,⁷⁷ but allowing the number of mules to vary according to respective mule length.

⁷³ BPP (1834), 167, Cowell's Preface, p.394.

⁷⁴ See in particular, BPP (1834), 167, Cowell's Preface, p.395.

⁷⁵ Ashley, *Ten Hours Factory Bill*, p.9

⁷⁶ AP, Quarterly stock book, eg for November 1845, per table 2 above, is £808. BPP (1834), 167, Cowell's Preface, example Mills A, B, C, pp.387-388.

⁷⁷ Similar sized factories operated at Mulhausen, for example Naegely's mill with 37,000 spindles (Ure, *Cotton Manufacture*, p.84).

Table 3: Comparative spinning costs, Mulhausen and Lancashire

	Mulhausen	Lancs
Spindles per mule	200	375
Spindles per team	400	750
Operatives per mule set:		
Spinners	1	1
Juvenile assistants	2	2
Total	3	3
Wages per day (d)	48	66
Wages per week (d)	288	396
Spindles per capita	133	250
Output per week lb	16000	16000*
Spindles	30000	30000**
Mule pairs	75.00	40.00
Output per set	213.33	400.00
Wage cost d per lb	1.35	0.99
Wage cost per week £	90	66
Total spinning dept personnel	225	120

Notes: * Ashley, *Ten Hours Factory Bill*, p.9 average output per week for an establishment spinning 36s yarn. ** Based on data in BPP, (1834), 167, p.396 for number of spindles and number of mills in Bolton implying an average size of 34,000 spindles per mill.

Sources: Compiled from data in BPP (1834), 167, Cowell's Preface, pp.382-401.

Table 3 shows that the cost per lb was indeed lower in England than in Mulhausen, 1.35d compared to 0.99d, or c.36%. The only reason is the difference in

efficiency arising from mule length, since in table 3 the cost per lb is computed holding all other factors constant. According to Greg, the machinery he observed at Mulhausen 'was good and on the newest principle'.⁷⁸ The differential arises notwithstanding the higher wages paid per team of one spinner and two juvenile piecers (48s compared to 66s) or 37.5%.

The evidence from table 3 confirms the insubstantial nature of the threat of overseas competition and also shows that the proposed regulation of the working week would not damage profits in the context of technological improvement. Indeed mule widening provided the opportunity for increasing both wages and profits. The wage lists, which provided detailed breakdowns of payments by mule length suggested this was exactly what occurred, showing clearly that the proportionate reduction in payment per lb was less than the increase in output that would determine the total wage.⁷⁹ Comparing table 3 and table 1 it is evident that the 36% increase in cost necessary to invoke the threat of competition from Mulhausen would imply a working week of 69 hours and a profit rate of 0% if the compromise figures are suitably adjusted.⁸⁰ Anything less than 69 hours, as implied by proposed legislation would therefore appear to threaten the ruin that the mill owners claimed.

In other words their claims were only supportable on the basis of an over-simplified abstraction and by discounting the effects of the greater productivity of the Lancashire mules. On the basis of this evidence it must be doubted whether Lancashire mill owners seriously believed their own rhetoric about the threat of

⁷⁸ BPP (1834), 167, Cowell's Preface, p.400. Cowell used this assumption based on evidence from Robert Hyde Greg of a mill at Salerno, recognizing that if technically equivalent, the Mulhausen mules were inferior due to their lower capacity.

⁷⁹ BPP (1834), 167, Cowell's Preface pp.383-384; Manchester lists of prices, 5th March 1831 and 20th March 1829.

⁸⁰ Assumptions are as in column (3) of table 1 with an increase of 37.5% to total (wages) cost, resulting in a working week of 68.7 hours if profit including interest on fixed capital is equal to zero. To achieve a 5% return would imply a working week of 82 hours.

foreign competition. Indeed, factors such as mule length, speeds, number of operatives, hours worked and wage rates were well known, as was the capital cost of machinery, computed on a per spindle basis.⁸¹ In view of such transparency, and the continued rapid entry of new firms and the fortunes made in the business pointed out by Ashley, it is unlikely that fear of foreign competition was genuine and was created more for the purposes of lobbying. It can thus be discounted as a genuine reason for opposition to factory reform.

Even so, the industry dynamics illustrated above and in particular in table 3 offer a possible competition based explanation of mill owner behaviour. Because technology was advancing rapidly, manifested in terms of faster and wider mules, incumbent firms faced continuing threat from new entrants. Once constructed, mills could not always be adapted to accommodate longer mules and it was costly to do so if it involved the scrapping and replacement of expensive and still productive smaller mules. New entrants on the other hand could erect purpose built factories to accommodate wider mules. Incumbent firms therefore faced corresponding competitive disadvantage and pressure to work longer hours. Other things being equal, a firm using 324 spindle mules would need to work 22% longer than a firm using 396 spindle mules to achieve the same output and the same value added, however divided between capital and labour.⁸²

The anti-regulation lobby anticipated the efficiency-based arguments. Writing in 1837, in direct response to Cowell, Robert Hyde Greg suggested that mule

⁸¹ These were the variables most commonly referred to in the 1833-1834 inquiries (BPP, 450, ev Greg, Birley and Hoole, 167, Cowell's preface) and in the 1840s debates (Ashley, *Ten Hours Factory Bill*, Fielden, BPP (1844) 1236).

⁸² Such motivations are consistent with the literature that has considered the disadvantage apparently suffered by smaller, more remote water powered mills as a consequence of the 1833 Act, specifically by looking at the differential pattern of prosecution. Nardinelli 'The Successful Prosecution of the Factory Acts'

widening did not cheapen production because the number of stoppages multiplied in direct proportion to the length of the machine, and all costs, including piecers' wages would vary accordingly. Spinners wages would not, but according to Greg these made up only a small proportion of the total.⁸³ If Greg believed his own analysis, he would have little to fear from British competition in a regulated environment, and much to fear from foreign firms paying low wages and working long hours. It should also be noted that Greg was now using arguments based on the variability of cost, rather than highlighting the risk of fixed capital investment. Even so Greg was still without an explanation for the rapid expansion of production in Lancashire and only partially dealt with Cowell's more detailed evidence and argument. Cowell showed the effects of mule widening on personnel in three mills, which combined, would reduce the number of adult spinners by 75 and increase the number of child piecers by 57.⁸⁴ The total labour cost saving was £93 15s, which would increase the rate for the retained workers but also increase their productivity thereby further cheapening the cost of the finished goods, thereby explaining the rapid advance of the industry into new markets.⁸⁵ By comparison to the mill owners' claims, then Cowell's evidence and analysis was more detailed and corresponded more closely to empirical reality. His report came once the 1833 Act had been passed for political motives, but was important in framing the debates that continued into the 1840s, when these arguments eventually prevailed.

⁸³ Greg, *The Factory Question*, pp.101-102.

⁸⁴ BPP (1834), 167, Cowell's *Preface Report*, p.387-388. Mill A 25 pairs combined into 13 pairs of 636 per mule, 25 adults spinners dismissed and 9 additional piecers employed; Mill B, 20 pairs of mules combined into 10 pairs of 648 per mule, 10 adults spinners dismissed and 7 additional piecers employed; Mill C, 103 pairs of mules combined into 50 pairs of 648 per mule, 53 adult spinners dismissed and 41 additional piecers employed.

⁸⁵ *Ibid*, pp.388-389.

Ideological theories of profit

As the evidence reviewed thus far has suggested, a further explanation for the mill owners' stance was the need for consistency with the lobbying position and the ideological support that was enlisted from the newly emergent discipline of political economy. To admit to any regulation was to surrender the leading principle of newly emergent discipline of political economy, *laissez faire*.⁸⁶ Earlier Factory Acts, in 1802 and 1819, notwithstanding their limitations, directly challenged the doctrine and the 1833 Act, with inspectors' rights of access to factory premises and fines for factory owners, represented a significant defeat.

A reinterpretation of *laissez faire* was needed that allowed for the regulation of child labour but resisted the more general demands of the Ten Hour committees.⁸⁷ Senior was invited to visit the mills and his observations led him to develop the theory that all profit was earned in the last hour of the working day.⁸⁸ Senior enlisted the arguments of Henry Ashworth, who suggested: 'when a labourer lays down his spade he renders useless for that period a capital worth 18 pence. When one of our people leaves the mill, he renders useless capital that has cost £100'.⁸⁹ In other words, the investment in fixed capital, procured on behalf of the operative, confronted the mill owner with substantial risk in the event of restrictions on the working day.

As a consequence, the pro-regulation lobby presented a consistent and pessimistic line on the profitability of the mills and the risks faced by their enterprises. In 1833, for example, Ashworth changed his position on the required working day from 11 hours to 12 in line with Senior's arguments.⁹⁰ Nonetheless, the

⁸⁶ Robson, *On higher than Commercial Grounds*

⁸⁷ Robson, *On higher than Commercial Grounds*, pp.151-152.

⁸⁸ Senior and Horner, *Letters on the Factory Act*, pp.4-5

⁸⁹ *Ibid*, p.7.

⁹⁰ BPP (1833), 450, p.1104. Boyson, *The Ashworth Cotton Enterprise*, p162.

argument was more of a lobbying position than statement of economic reality. As the data in table 1 show, shorter hours were possible in combination with reasonable rates of profit. In contrast to Senior's theory, the calculations in table 1 show that a substantial proportion of costs (c.80%) varied with output.⁹¹

Conclusions

Although Senior's theory was flawed insofar as some costs were variable, the presence of some fixed costs arising from their investments inevitably worried the cotton entrepreneurs. Fixed capital investment on the scale required by the capital intensive second phase of industrialization was a new phenomenon, and as table 1 suggests, the associated risk provided their principle motivation in resisting legislation. In summary, the rate of profit was higher than the anti-regulation lobby cared to admit, even with carefully arranged and consistently pessimistic evidence. Nevertheless, regulation and the impact of fixed cost effects meant that the consequential cut in profit would be greater than the either pro or anti regulation lobby realised, even though the consequential rate of profit would not lead to the collapse of the industry in the face of foreign competition.

Even when the ten-hour day was finally implemented in the 1847 Factory Act there is no evidence that the rate of profit reduced as a consequence. Indeed the industry continued to expand, principally because capital improvements generated further productivity gains like those pointed out by Cowell, such that the industry continued to be attractive for new investment. All of which is consistent with one of the main empirical findings of the paper, that the working week could be restricted

⁹¹ Fixed costs are typically around 20% in columns (1)-(3).

whilst still maintaining an adequate rate of return on capital. In short, the ten-hour working day was compatible with an average rate of profit in excess of ten per cent.

The absence of an established and accepted theory of profit added complexity to the debates surrounding factory legislation, particularly when the protagonists used accounting evidence to support their arguments. Without accepted standards of accounting for items such as depreciation and only inchoate theories of the rewards for enterprise there was considerable room for interpretation. Indeed, poor understanding of accounting limited the quality of analysis conducted by contemporaries. Absence of sanction for proprietors exaggerating figures was based on ignorance of accounting, and entrepreneurs could say what they liked about their accounts and expect to be believed. Cowell was an exception and conducted a skilled analysis, reinterpreting their figures. He was ignored by legislators the 1830s, but not by the wider public⁹² and his conclusions began to underpin a groundswell of support for legislation in the 1840s. With this exception, inaccurate accounting obstructed regulators, whilst their general tolerance of cavalier abstractions of accounting data is suggestive of a highly inefficient capital market. The industry's ability to sustain a legislated shorter working week after 1847 is testimony meanwhile to the high, if unstable rate of profit.

⁹² For example, *Mechanics Magazine*, 'Proofs that Wages on the Continent are not lower than in England,' published a digest of Cowell's analysis. It was also readily assimilated by economists, for example, Carey, *Principles of Political Economy*, p.145.

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