

# **Did the introduction of the 48 hour week in 1919 damage Britain's relative competitiveness?**

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## **Introduction**

Supply-shock explanations of Britain's poor growth during the 1920s have placed central importance on the 1919 reduction in British working hours – of around 13 per cent – as a key factor behind the deterioration in British labour productivity and industrial competitiveness. This literature largely ignores the possibility of any substantial 'productivity offset' to lower working hours from higher hourly productivity, despite considerable empirical evidence of major productivity offsets when hours are reduced from a high base-level. Furthermore, it does not acknowledge that working hours were reduced to around 48 per week for industrial workers in almost all industrialised nations at around this time – thus undermining any potential impact of the hours reduction on Britain's *relative* productivity.

We place the British working hours reduction in international context, showing that Britain's 1919 hours reduction was one of the lowest among 'old world' nations and that, internationally, there is no clear relationship between the extent of the hours reduction and changes in aggregate productivity growth. We also examine the absolute impact on British productivity, via case-studies of three of Britain's most important export industries – coal, cotton textiles, and iron and steel. The analysis shows that much of the lost weekly productivity from the hours reduction was made up by increased hourly productivity, casting further doubt on the 'supply-shock' thesis.

## **The evolution of the `supply shock' thesis**

In 1919 Britain underwent its largest ever reduction in working hours, of around 13 per cent. The economic impact attracted little attention until 1975, when J. A. Dowie put forward a new explanation of Britain's poor economic performance during the 1920s, in which the 48 hour week played a central role. Dowie argued, that this, together with rapid wage growth, drove up prices and thus provided a powerful "cost-push" explanation of Britain's post-war inflationary boom.<sup>1</sup> Dowie was careful to qualify his claims regarding any significant relationship between the hours reduction and unit labour costs, arguing that there was little firm empirical evidence and only going so far as to express `serious doubts about arguments for a virtually complete, or even substantial, productivity offset to the 1919 change'.<sup>2</sup> However, his thesis was taken up, without these caveats, by Stephen Broadberry – who argued that the eight hour day had played a central role in undermining British labour productivity.<sup>3</sup>

Dowie and Broadberry's supply shock explanation of Britain's 1920-21 recession has proved controversial. For example, David Greasley and Les Oxley found that the First World War constituted a more powerful negative macroeconomic

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<sup>1</sup> Dowie, "1919-20 Is in Need".

<sup>2</sup> Ibid., pp. 432 and 445.

<sup>3</sup> Broadberry, "Aggregate Supply"; idem, "The Emergence of Mass Unemployment".

shock to Britain's competitiveness, as demonstrated by the deteriorating ratio of British to American industrial export prices, which peaked in 1917-18 rather than during the post-Armistice period. The 1919-20 supply shock was relegated to a subsidiary role, merely hindering the restoration of British competitiveness.<sup>4</sup> Similarly, Barry Eichengreen found that British GDP growth during the 1920s represented a negative outlier compared to other European nations, with particularly poor growth during 1920-27 (relative to that predicted given the relationship between growth over this period, and during 1913-20, for his sample of countries).<sup>5</sup> Yet Dowie and Broadberry's narrower argument that the 1919 hours reduction increased hourly labour costs, without any significant compensating increase in labour productivity (and that this in turn damaged Britain's relative productivity), has generally been accepted uncritically in recent studies.<sup>6</sup>

### **The eight hours movement**

The campaign for shorter working hours originated in nineteenth century social reform movements and initially focused on the hours of women and children. By the second half of the nineteenth century attention had moved to a general eight hour day, again mainly advocated on social grounds. This took on an international dimension after being adopted as one of the main goals of the International

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<sup>4</sup> Greasley and Oxley, "Discontinuities in Competitiveness."

<sup>5</sup> Eichengreen, "British Economy," pp. 322-23.

<sup>6</sup> See, for example, Hatton, "Unemployment and the Labour Market," pp. 384-85; Middleton, *Government*, pp. 285-86; and Eichengreen, "British Economy," p. 324. Glynn and Booth, "Emergence," noted Broadberry's neglect of potential productivity offsets and his failure to examine whether the introduction of the eight hour day had any counterpart overseas, but provided no evidence on these issues.

Workingmen's Association (First International) at its 1866 Geneva conference.<sup>7</sup> Economic arguments were strengthened from around the 1890s, in the light of evidence that shorter hours were not detrimental to productivity. American-inspired scientific management ideas and fatigue research began to influence European conceptions of the optimal working week. America was viewed by European reformers as having developed a system of short hours and high wages, which they contrasted with the European system of long hours to compensate for managerial inefficiencies.

The scientific management movement also offered improved techniques for assessing the productivity impact of shorter hours. A significant volume of studies were undertaken from the early 1900s, their number and sophistication increasing markedly during the First World War. For example, a large number of government-sponsored studies were initiated in Britain, after war-time increases in working hours had proved counter-productive (initially raising output, but leading to a substantial fall in productivity after several months, together with major problems of bad timekeeping and absenteeism). These and similar studies in other countries indicated that productivity was optimised by setting hours at a level which avoided severe fatigue, collectively providing a powerful efficiency argument in favour of a shorter working week.<sup>8</sup>

A February 1919 conference of British employers and workmen recommended a statutory 48 hour week.<sup>9</sup> This reflected not only the new industrial fatigue evidence, but the post-Armistice political climate in which workers rallied round the 48 hour

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<sup>7</sup> Evans, "Work and Leisure," p. 36.

<sup>8</sup> Cross, *A Quest for Time*, p. 115.

<sup>9</sup> Bowley, *Prices and Wages*, p. 100.

week as the key 'peace dividend' for their war-time sacrifices, while employers and government feared widespread industrial and political unrest if these demands were not met. Dowie was correct in identifying this unrest as a major immediate cause of the hours concession – though he failed to acknowledge that this was an international phenomenon. Indeed the international nature of the campaign facilitated its acceptance by individual governments, in the context of an international hours standard that would prevent destructive inflation of working hours in the same way that the gold standard prevented competitive devaluations.

The end of the War witnessed the foundation of the International Labour Organisation (ILO), one of the objectives of which was the international establishment of the eight hour day and 48 hour week. A 1919 International Labour Conference adopted the hours of Work (Industry) Convention – known as the Washington Convention - establishing the eight or nine hour day and 48 hour week for industrial establishments. By August 1919 Austria, Czechoslovakia, Denmark, Finland, France, Germany, Italy (for railways), Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Switzerland, and the USSR (among others) had already adopted some form of eight hours legislation. By 1922 these had been joined by Argentina, Belgium, Bulgaria, Costa Rica, Greece, Latvia, Lithuania, Peru, Sweden, and Yugoslavia.<sup>10</sup> Meanwhile Britain, Italy, and the United States had also moved to a 48 hour standard, though by collective agreements rather than legislation.<sup>11</sup> Among the industrial exporting nations, only Japan retained a long working hours regime, often involving a 60 hour week.<sup>12</sup>

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<sup>10</sup> Evans, *Hours of Work*, p. 8; Cross, *Quest for Time*, pp. 134-35; TNA, LAB2/1586/B236/1930, "Recent reduction of hours of labour abroad", memorandum, September 1922.

<sup>11</sup> Evans, "Work and Leisure," pp. 38-39.

Britain moved to a 48 hour week almost entirely via industry- or firm- level collective bargaining (following the precedent of earlier British hours reductions, such as that to a 54 hour week during the early 1870s). The Federation of Engineering and Shipbuilding Trades had pressed for a 44 hour week as early as June 1918, negotiations with employers associations in these two industries leading to a 47 hour week, from 1 January 1919, in return for a pledge to try and maintain output. In December 1918 the rail unions (which were then under direct government control) obtained agreement for an eight hour day and the following months witnessed an avalanche of similar agreements.<sup>13</sup> Wages were usually adjusted so as to maintain weekly rates and, where workers were on piece-rates, these were generally (but not universally) raised so as to maintain weekly earnings - assuming existing hourly output.<sup>14</sup>

The survival of the international 48 hours regime was thrown into doubt following Britain's delay, and eventual refusal, to ratify the Washington Convention. Despite a widely-held government view that Britain, with its traditionally short hours, would be a net beneficiary from international legislation, vehement opposition from some employers' organisations tempered its enthusiasm.<sup>15</sup> Similarly, by the autumn of 1921, as the post-war boom abated, most countries witnessed pressure from employers for a longer working day.<sup>16</sup> However, extensions were generally confined to sectors which had secured working weeks of below 48 hours and even in Britain,

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<sup>12</sup> Evans, *Hours of Work*, pp. 8-9.

<sup>13</sup> Clegg, *History*, pp. 253-54.

<sup>14</sup> Bowley, *Prices and Wages*, p. 101.

<sup>15</sup> Cross, *Quest for Time*, pp. 164-65.

<sup>16</sup> TNA, LAB2/1586/B236/1930, "Recent reduction of hours of labour abroad", memorandum, September 1922

despite the absence of legislation and a considerable weakening of union power in the aftermath of the 1926 general strike, there were no significant instances of hours being raised above 48 per week. British employers appear to have treated longer hours as a bargaining point in wage negotiations rather than a concrete aim.

The eight hour day survived virtually intact and had begun to spread to commercial workers by the end of the decade.<sup>17</sup> Mass unemployment in the wake of the 1929-32 depression led to calls for further hours reductions as a recovery policy - by lowering unemployment and increasing demand (through giving workers greater leisure). Moves towards a 40 hour week in the United States were stimulated by the codes of fair competition introduced under the National Industry Recovery Act, which included standard hours of work (usually 40 hours). A 40 hour week was also required for all contractors supplying the federal government and, from 1937, for establishments engaged in inter-state commerce. Italy introduced a 40 hours week at the end of 1934 (accompanied by a proportional reduction in weekly wages), to combat unemployment; Fabrizio Mattesini and Beniamino Quintieri found that, for most sectors, this produced the desired positive employment effect.<sup>18</sup> Meanwhile Czechoslovakia adopted a 40-42 hour week in 1934, while France and New Zealand moved to 40 hours regimes in 1936 (though France suspended the 40 hours legislation following the collapse of the Popular Front government in May 1937).<sup>19</sup>

### **The relative impact on national productivity**

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<sup>17</sup> Evans, "Work and Leisure", pp. 39-40.

<sup>18</sup> Mattesini and Quintieri, "Does a Reduction," p. 419.

<sup>19</sup> Cross, *Quest for Time*, pp. 220-21.

Broadberry made no attempt to directly examine the extent of any compensating productivity offset of the British hours reduction from increased *hourly* productivity, instead relying on aggregate time-series data on labour productivity and real wages.<sup>20</sup> Substantial falls in output per man-year during 1919 and 1920 were taken as evidence of a major negative productivity shock from the 48 hour week.<sup>21</sup> Nor did he examine alternative explanations for this fall in output per man-year, despite the presence of obvious candidates. An upsurge in industrial disputes during 1919 cost 34,969,000 working days lost through strikes, compared to only 5,875,000 in 1918 and 5,647,000 in 1917. A heavy incidence of strike activity persisted during 1920 and 1921, with 26.6 million and 85.9 million working days lost respectively. 1919 also witnessed production disruptions owing to severe international shortages of materials, other inputs, and machinery, in industries such as engineering. Moreover, the extraordinary business boom experienced in many countries inflated raw materials prices to such an extent that their impact on production costs dwarfed any potential effect of shorter hours.<sup>22</sup>

If the fall in British productivity during 1919 and 1920 is directly linked to the working hours reduction, other industrialised nations which introduced the 48 hour week in around 1919 should have experienced similar reductions, varying in magnitude roughly in proportion to the extent of their reduction. Compiling an international data series on national working hours is problematic. National legislation on maximum hours usually exempted certain sectors and monitoring of hours (especially in exempted sectors) was often poor. Angus Maddison's frequently-used

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<sup>20</sup> Broadberry, "Aggregate Supply".

<sup>21</sup> Idem, "Emergence of Mass Unemployment."

<sup>22</sup> Milhaud, "Results," pp. 825-26.

data on hourly productivity prior to the First World War were based on an assumption that hours for other industrialised nations prior to 1913 paralleled those of Britain. He argued that this was probably reasonable, given that working hours for 1929-60 varied over time in a broadly similar fashion for most countries in his sample.<sup>23</sup>

However, as Michael Huberman has recently shown, working hours varied substantially by country in 1870 and, despite some convergence, in 1913 Britain still had lower hours than most of its principal competitors.<sup>24</sup> His analysis is based on data compiled by the U.S. Department of Labor, for weekly work-hours over 1850-1900. These have the advantage of being drawn from the same source, unlike national hours series, which often vary substantially in their sectoral coverage. Yet, as he acknowledges, there are biases in their underlying sources, including the limited representativeness of the firms covered, and the small number of observations for some European countries.<sup>25</sup> Moreover, his source terminates at 1900, and while values are provided for 1913, these are based on projections from the fitted values for 1870-1900 or, where possible, independent estimates.

For the purposes of the current analysis data are taken, wherever possible, from national data sources that provide estimates both for 1913 (or thereabouts) and 1920. As the analysis is concerned with the proportionate reduction in working hours over the First World War, using the same data source for dates before and after the war years should reduce the potential margin of error. Yet such series are available for only a few countries. Huberman's data are used in the absence of a 1913 benchmark and where no 1920 value is available we use estimates for 1929, originally collated by

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<sup>23</sup> Maddison, *Economic Growth*, p. 255.

<sup>24</sup> Huberman, "Working Hours."

<sup>25</sup> *Ibid*, pp. 969-72.

the ILO - as a review of available evidence suggests that working hours for European countries in the late 1920s were not generally significantly different from 1920 levels.<sup>26</sup>

**[Table 1 near here]**

If Broadberry's 'supply shock' thesis is correct, then all countries which introduced significantly shorter working hours in around 1919 should experience a step decline in productivity (rather than a trend break), which should vary between nations roughly in proportion to the extent of their working hours reduction, as shown in Figure 1. This relationship is examined for 13 industrialised nations for which hours data are available at/near 1913 and 1920, using GDP per capita as the closest available proxy for labour productivity.<sup>27</sup> Annual GDP per capita for 1900-1929 is regressed on a simple trend variable and two step dummies, for the First World War and for the 1919 hours reduction respectively. The results are shown in Table 2.

**[Figure 1 near here]**

In addition to the expected positive and significant general trend, these country-by-country regressions each produce a negative coefficient for the War (with the exception of a statistically insignificant positive relationship for Britain) and a negative relationship for the post-1918 dummy (significant at the 1 per cent level only for six of the 17 countries). However, there are numerous possible explanations for a reduction in growth rates during the 1920s compared to the pre-1914 period, given the

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<sup>26</sup> While in 'new world' countries, which had only a limited involvement in the First World War, working hours fell gradually over the Edwardian period and the war years (Whaples, "Winning," pp. 393-404), in Europe working hours were generally frozen at least their 1913 levels for the duration of the War. However, in the immediate aftermath of the war working hours were reduced across Europe to around a common 48 hours standard (for industrial workers) over a remarkably brief period of time.

<sup>27</sup> Maddison, *World Economy*.

more autarchic and unstable world economy which emerged after 1918. For a causal link between the hours reduction and the post-1918 step reduction in productivity growth to be plausible, there should be a strong positive relationship between the proportionate hours reduction in each country and its step reduction in per capita GDP growth.

**[Table 2 near here]**

This relationship is examined in Figure 2 (for convenience the step and hours reductions are both treated as positive values in the graph). In fact the two variables display a weak and insignificant negative correlation of  $-0.265$ ; countries such as Belgium, the Netherlands, and Italy – which experienced some of the largest proportionate reductions in working hours from 1919 – also being among those which fared best in terms of productivity growth during the 1920s relative to that before 1914. Given that the hours reduction was international and to a common 48 hour standard, a major impact on relative competitiveness would thus be unlikely. Furthermore, as discussed in the next section, there is also strong evidence that countries reducing hours from a higher 1913 base are not likely to have suffered a substantial adverse impact relative to low 1913 hours regime countries – as these would have enjoyed a greater productivity offset from increased hourly output.

**[Figure 2 near here]**

**The absolute productivity impact of the 48 hour week**

The huge empirical literature on the relationship between working hours and productivity highlights a number of key features relevant to the absolute productivity impact of the 1919 hours reduction. Studies generally indicate that, at least from a high hours base, a reduction can at least be largely offset by higher hourly

productivity. A review of 1,233 firm-level studies from the USA and UK by D. G. Brown found that 52 per cent of observations involving a decrease in hours indicated that this did not significantly reduce output.<sup>28</sup> E. F. Denison identified two key factors underlying the productivity offset; the 'personal effect' of reduced worker fatigue and the 'institutional effect' of employers modifying production to compress daily workloads into fewer hours.<sup>29</sup>

A review of international evidence on the impact of the eight hour day by Edgard Milhaud in 1925 indicates a substantial institutional effect, employers improving both mechanisation and the organisation of production to maintain productivity norms.<sup>30</sup> For example, hours reductions were often accompanied by a compression of the work day – reducing periods of relative inactivity arising from supply bottlenecks in sectors such as mining and metal working, or in-shift rest breaks for industries such as chemicals and public transport.<sup>31</sup> Managerial adjustments to shorter hours regimes might also include some element of substituting capital for labour, as relative factor prices had been effectively altered in favour of the former (assuming that capital is fully employed, for example in multiple shifts).<sup>32</sup>

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<sup>28</sup> Brown, "Hours and output," pp. 147-61. Conversely, only 8 per cent of studies involving an increase in hours indicated that the initial lower hours yielded the same output. Brown interpreted this lack of transposition as indicating that once an output level is achieved, employers and workers take whatever action is necessary to maintain that level under a shorter hours regime, to maintain profits and earnings respectively.

<sup>29</sup> Denison, *Growth Rates*, p. 59.

<sup>30</sup> Milhaud, "Results".

<sup>31</sup> Cross, *Quest for Time*, pp. 66-67.

<sup>32</sup> Evans, *Hours of Work*, pp. 67-68.

However, most attention has focused on the personal effect of reduced worker fatigue. This can increase productivity via a more rapid pace of work, improvements in the quality of work, and a lower incidence of accidents, illness, and absenteeism.<sup>33</sup> Studies indicate that the aggregate impact is strongly related to the length of the working week – for example, a reduction from 56 – 48 hours would be expected to yield a much larger productivity offset than one from 48 - 40 hours.<sup>34</sup> The productivity offset is also found to vary according to the extent of worker discretion over the pace of work, the degree of physical exertion involved, and whether remuneration is linked to effort (for example via piece rates).<sup>35</sup> Employee discretion over throughput is generally minimised in situations where machine-pacing governs the flow of work. During the early 1920s few British industries had adopted machine-pacing and workers often enjoyed significant discretion over production norms, even in capital-intensive sectors. For example, a 1922 investigation into hours and productivity in the engineering and shipbuilding industries reported spectacular results when employers switched from time to piece rates. Examples cited include mechanics fitting water-tight sliding shutters, where a 490 hour job on time rates was reduced to 150 hours on piece-rates, and riveters employed on a warship, who increased output from 176 rivets per squad per week to 722 following a switch to payment by results.<sup>36</sup>

Yet, drawing general conclusions from the wealth of firm-level empirical evidence is problematic. Substantial hours reductions, and associated studies, often

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<sup>33</sup> Bentick, *Industrial Fatigue*, p. 13.

<sup>34</sup> Evans, *Hours of Work*, pp. 70-71.

<sup>35</sup> Brown, “Hours and output,” pp. 149-52; U.S. Bureau of Labour Statistics, *Hours of Work*.

<sup>36</sup> Engineering and National Employers Federation et. al., *Working Hours*, pp. 18-19.

occurred during periods of unusual conditions, such as war-time or (as in 1919) considerable economic instability. They are also subject to strong methodological problems, mainly because in most real world situations other factors influencing productivity also come into play and are difficult to decompose. Furthermore, firms that pioneered reductions and subjected their productivity impact to detailed scrutiny using robust methodologies are likely to be atypical of their industries. There is also a danger of bias in both the reporting of results by individual firms and the selection of examples for broader studies. Campaigners for shorter hours often concentrated on examples that supported their cause, while firms and industries that had been compelled to reduce hours had an incentive to exaggerate productivity losses, especially where unions pressed for further reductions.<sup>37</sup> For example, employers claimed that a May 1916 reduction in the working day in U.S. anthracite coalfields from nine to eight hours had led to a substantial reduction in output. Yet the U.S. Dept. of Labour Statistics found that in 1916 output per man-day had actually risen by 2.9 per cent for miners and miners' labourers and by 1.4 per cent for all mining labour; the production decline actually being due to a reduction in employment.<sup>38</sup>

Britain's move to a 48 hour week was based on an expectation of a substantial productivity offset. The Factory Inspectorate had concluded that continuous spells of long hours lowered labour productivity, a result corroborated by government-

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<sup>37</sup> For example, a major 1922 study of the productivity impact of a 47 hour week in the engineering and shipbuilding industries was initiated only following union pressure for a further reduction to 44 hours, agreement eventually having been reached that this would be reconsidered following the investigation. Engineering and National Employers Federation et. al., *Working Hours*, p. 11.

<sup>38</sup> *Monthly Review of the United States Bureau of Labour Statistics* (August 1917), cited in TNA, RECO 1/801, note, n.d., c. January 1918.

sponsored and firm-level empirical studies.<sup>39</sup> Indeed, by 1917 there was a growing movement to reduce hours in several industries.<sup>40</sup> In order to assess the actual impact of the working hours reduction on British productivity, we focus on three key export industries - coal, cotton, and iron and steel. These were chosen for three reasons. Firstly, as major export industries producing mainly non-branded commodities with a high elasticity of demand, they were particularly vulnerable to any change in British cost conditions. Secondly, they encompass a range of industry-specific factors which might influence the productivity offset, varying substantially in physical intensity, continuous versus intermittent production, the extent of machine-pacing, etc. Finally, they minimise methodological problems. Their productivity can be measured using physical output rather than values, which is particularly important during this inflationary period. Furthermore, cotton and coal have unusually frequent productivity data, which provide a significant number of data points prior to the onset of the post-war depression.

### **Coal mining**

Given its leading role in British industrial production and exports, the severe interwar decline of the coal industry produced widespread contemporary and historical discussion, in which working hours featured prominently. Coal had traditionally been one of the most highly-regulated of British industries and was the only major industry in which working hours for adult males were controlled by statute prior to the First World War. Meanwhile, largely due to the heavy physical effort

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<sup>39</sup> See, for example, UK, Parliament, *Annual Report...for the Year 1918*; idem, *Annual Report... for the Year 1920*, p. 150.

<sup>40</sup> UK, Parliament, *Annual Report... for the Year 1918*, p. 2.

involved, hours had long been relatively low compared to other British sectors. An 1890 Parliamentary enquiry, covering over 95 per cent of underground workers, found that average shifts (including winding time) were 8 hours 45 minutes for coal-getters and 9 hours 12 minutes for other underground workers. However, there were substantial regional variations, with coal-getters in Northumberland and Durham working shifts of less than eight hours.<sup>41</sup>

The 1908 Coal Mines Regulation Act provided a legal maximum eight hour day plus one winding time (the time taken to lower or raise an entire shift of men; averaging about 30 minutes in 1925).<sup>42</sup> Given that a significant proportion of miners in Durham and Northumberland were already below this maximum, and that miners in Scotland, the South West, and the Midlands already had an eight hour day, its impact on national working hours was limited. Estimates indicate that the average time spent underground by all miners, and by non-hewers, were reduced by around 40 minutes and 50 minutes respectively.<sup>43</sup>

Coal mining involved heavy physical labour, often in cramped conditions, suggesting a relatively high productivity offset. Yet the aged infrastructure of many pits constrained the extent to which the working day might be compressed. Output per man-shift had been in long-term decline since at least the 1880s. The reasons behind this are controversial, though most accounts emphasise the ageing of pits, exhaustion of the best and most accessible seams, and associated increases in unproductive time spent travelling from the shaft to the coalface.<sup>44</sup> The First World War witnessed an

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<sup>41</sup> Rowe, *Wages*, pp. 50-51.

<sup>42</sup> UK, Parliament, *Royal Commission on the Coal Industry*, pp. 165-6. The Act came into force from July 1909 for most regions (January 1910 for Durham and Northumberland).

<sup>43</sup> *Ibid*, p. 166; Church, *History*, pp. 256-7.

<sup>44</sup> Church, *History*, pp. 471-3.

acceleration of the productivity decline, weekly output per man falling from 4.95 tons in 1913 to 4.2 tons during the first 20 weeks of 1919 (and average output per man shift from 1.0 to 0.89 tons).<sup>45</sup> This was generally attributed to the loss of skilled labour to the trenches.

The Seven Hours Act of 1919 reduced working hours for all miners to seven per shift, plus one winding time – or around 7.5 in total, from 16<sup>th</sup> July 1919.<sup>46</sup> Piece rates were raised so as to yield the same earnings as before the change. Meanwhile, the hours of surface workers, which had already been reduced to 49 from January 1919, were further reduced to 46.5.<sup>47</sup> The Coal Controller estimated that output would be reduced by around 10 per cent as a result of the 12.5 per cent reduction in productive working time spent at the coalface.<sup>48</sup> Yet over the last ten weeks of normal working, average weekly output per man, 4.197 tons, was only 2.25 per cent in excess of that for the ten weeks to 27<sup>th</sup> March 1920.<sup>49</sup>

**[Figure 3 near here]**

The existence of weekly output per person data for the months around the hours reduction (uniquely among British industries) makes it possible to examine the

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<sup>45</sup> UK, Parliament, “Coal output for 1919-1920”.

<sup>46</sup> Supple, *History*, p. 429.

<sup>47</sup> Bowley, *Prices and Wages*, pp. 148-9. Prior to January 1919 their working hours had varied from 51-58, being estimated by the Samuelson Commission to have averaged 54 in 1913 - UK, Parliament, *Royal Commission on the Coal Industry*, p. 171.

<sup>48</sup> UK, Parliament, “Coal output for 1919-1920”.

<sup>49</sup> The last ten weeks of normal working refer to the weeks ending 3<sup>rd</sup> May 1919 to July 12<sup>th</sup> 1919, with the exception of the week to 14<sup>th</sup> June 1919. If the last 16 weeks of normal working before the change (weeks ending February 8<sup>th</sup>-March 15<sup>th</sup>, May 3<sup>rd</sup> –June 7<sup>th</sup>, and June 21<sup>st</sup>-July 12<sup>th</sup> 1919) is taken as the bench-mark, weekly output per man experienced a larger fall, of 4.71 per cent, as productivity was already declining prior to the introduction of the eight hour day.

adjustment process in some detail.<sup>50</sup> Figure 3 shows weekly data for the weeks ending 8<sup>th</sup> February 1919 – 27<sup>th</sup> March 1920.<sup>51</sup> Econometric analysis of the adjustment requires the insertion of dummy variables to account for production dips during the 1919 Easter holidays; the week to June 14<sup>th</sup> 1919 (presumably a holiday); the August bank holiday; and the Christmas and New Year holidays. We did not control for the regional miners' strikes of July-August 1919, as they were confounded with the recovery rate.<sup>52</sup>

Figure 3 shows that, despite a substantial fall in weekly productivity at the time of the hours reduction, a rapid recovery followed. This is consistent with the empirical literature on the impact of hours reductions on productivity, which indicates that the productivity offset is only fully realised following a lag of several weeks, during which workers adjust to the new conditions and recover from the cumulative physical effects of long hours.<sup>53</sup> A substantial reduction in working hours could therefore be expected to produce an immediate fall in productivity roughly proportional to the fall in hours, followed by a steep rise in productivity over the following weeks, until a stable trend is re-established. We use a Bayesian linear model to analyse the scale of the immediate productivity loss and the extent and timing of the recovery. Previous research on discontinuities in British industrial

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<sup>50</sup> Some of this data are aggregated over periods of 2-4 weeks.

<sup>51</sup> This period was chosen so as to exclude the January 1919 Yorkshire and Fife miners strikes and the April 1920 Easter holidays.

<sup>52</sup> These include strikes in Lancashire, Nottinghamshire, and Derbyshire, which ended within a week, while those in South Yorkshire lasted until 14<sup>th</sup> August, and in West Yorkshire until 21<sup>st</sup> August. Clegg, *History*, p. 269.

<sup>53</sup> Bentick, *Industrial Fatigue*, p. 13; Hicks, *Theory of Wages*, pp. 217-18; Lipmann, *Arbeitszeitproblem*; Viteles, *Industrial Psychology*, pp. 465-70; Industrial Fatigue Research Board, *Report No. 6*, pp. 4-5.

production between 1879 and 1938 has assessed the extent and statistical significance of pre-established breakpoints, using Perron's extension to the Dickey-Fuller test.<sup>54</sup>

A Bayesian approach enables us to improve on this, by modelling a variable recovery point and a 95% credibility interval for it. In other words, we do not impose a pre-determined recovery point; rather the Bayesian model identifies the recovery point.<sup>55</sup>

We have estimated the following equation, with the assumption that the errors are normally distributed:

$$Y_t = \alpha + \alpha_2 h_t + \sum_{i=1}^2 \beta_i X_i + \gamma_1 T_1 (1 - h_t) + \gamma_2 S_t + u_t$$

where:

$\alpha_2$  = change in intercept after crash

$h_t$  = Dummy taking the value of 0 for  $t$  (number of weeks)  $< 24$ ; 1 for  $t \geq 24$

$X_i$  = two dummies - for the Easter and other holidays

$X_i' = X_i - \bar{X}_i$  i.e. the  $X$ s have been centred, to ensure that the model fitted well

$T_1$  = slope before crash

$S_t = [(R - t + 1)(z_t - 1)h_t - z_t]$ , i.e. slope during recovery, where:

$R$  = Recovery point

$z_t$  = Dummy taking the value of 0 for  $t < R$ ; 1 for  $\geq R$

The results are displayed in Table 3. The difference between the two intercept terms relates to the value of the recovery point, in other words the value at which weekly output per person stabilized after the crash and steep recovery. As  $X_1$  and  $X_2$  are centred, the value of the recovery point is to be calculated as  $\alpha + \alpha_2 - \gamma_2$ .

As expected, the Easter and other Holidays dummies present negative coefficients. It is interesting to note that the slope before the crash ( $T_1$ ) is negative, clearly indicating

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<sup>54</sup> Greasley and Oxley, "Discontinuities," pp. 82-100; Perron, "Great Crash."

<sup>55</sup> Gelman et al., *Bayesian Data*.

a decreasing trend in productivity (consistent with the longer-term productivity decline of the industry since at least the 1880s).<sup>56</sup>

**[Table 3 near here]**

One of the advantages of using Bayesian analysis is that it enables us to estimate the timing of the recovery point. The 95% credibility interval for the recovery point falls between weeks 29 and 33 of the data, with week 31 (i.e. the week ending 6<sup>th</sup> September 1919, six weeks after the first full week of the new hours regime) being the median value, which we take as the recovery point. The coefficient of  $S_t$  gives us the slope between the crash and the recovery point or, in other words, the speed of recovery. On the basis of this analysis we can model the crash and recovery associated with the hours reduction as shown in Figure 4.

**[Figures 4 near here]**

According to the model, estimated average weekly output per person before the reduction in working hours (for weeks ending 8 February - 26 July 1919) was 4.24 tons, whereas the same value calculated for the weeks after the recovery point (weeks ending 6<sup>th</sup> September 1919 – 27<sup>th</sup> March 1920) was 4.028 tons. This implies that the 12.5 per cent reduction in productive working time spent at the coal-face translated into a reduction in output per person of 5.1 per cent, or a productivity offset of 59.2 per cent. In other words, average hourly productivity after the recovery point was 8.4% higher than that for the period 8<sup>th</sup> February - 26<sup>th</sup> July 1919. The model also fails to show any statistically significant upward trend in productivity after the recovery point, rejecting the hypothesis that the recovery in output might reflect some longer-term break in trend arising from a return to peace-time conditions.

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<sup>56</sup> Church, *History*, pp. 471-73.

In addition to raising hourly output, the 1919 hours reduction produced a marked decline in absenteeism, as had been the case with the 1908 introduction of the eight hour day.<sup>57</sup> Yet, faced with declining profits and sales, the mine-owners pressed for both lower wages and a return to eight hours. Despite the rejection of this demand by the 1925 Royal Commission on the Coal Industry, conflict over this issue (together with proposed wage reductions) culminated in the 1926 general strike and a sixth months miners strike.<sup>58</sup> Following the miners' eventual defeat, daily hours for underground workers were increased to 7.5 in Yorkshire, Nottinghamshire, and Derbyshire, and for hewers in the North East, while other workers and fields returned to an eight hour day (some districts having a shorter Saturday shift, usually of six hours).<sup>59</sup> However this did not produce the improvements its advocates had expected, and employers acquiesced in a move to a general 7.5 hour day under the 1930 Coal Mines Act.

Internationally, as a 1928 ILO study demonstrated, differences in working hours between Britain and its principal competitors (several of which had also introduced substantial reductions in miners' hours in around 1919) played only a very minor role, if any, in its higher labour costs. Table 4 summarises the study's findings regarding coal workers' average earnings, per manshift and per hour, relative to Britain - based on direct enquiries for the year 1925.<sup>60</sup> While average earnings per manshift were substantially higher in Britain than its European competitors, hourly earnings only increased this differential marginally, especially for underground

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<sup>57</sup>UK, Parliament, *Royal Commission on the Coal Industry*, p. 174.

<sup>58</sup> *Ibid*, pp. 165-79.

<sup>59</sup> *Supple, History*, p. 253.

<sup>60</sup> International Labour Office, *Wages and Hours*.

workers. Thus, given the productivity offset indicated above, the overall impact of changes in relative working hours in 1919 on Britain's competitiveness was marginal. Conversely, the overvaluation of sterling imposed by Britain's return to the gold standard at pre-war parity is shown to have played a much more important role. The Table includes estimates for relative wages at purchasing power parity (based on relative food costs in mining districts). These indicate that Britain's high exchange rate substantially inflated its relative mining labour costs, dwarfing any impact of shorter working hours.

**[Table 4 near here]**

### **Cotton textiles**

Cotton textiles has received particular attention in studies of Britain's interwar competitiveness, both on account of its major contribution to industrial output and exports and due to the severity of its interwar decline. It also provides a good empirical candidate for analysis: technology was virtually static after 1900, new looms during the 1930s running no faster than those manufactured at the turn of the century and almost all production taking place in factories built prior to the First World War.<sup>61</sup> Furthermore, almost all workers were on standard piece rates, subject to nationally-negotiated revisions; changes in earnings, relative to piece rates, thus provide a monthly index of physical output. Conversely, longer-term productivity data are problematic, as evidence suggests that a long-term depression in the sector during

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<sup>61</sup> Jewkes and Gray, *Wages and Labour*; Gray, "Wage Rates," p. 4.

the 1920s, and a consequent move away of standardised production, depressed productivity.<sup>62</sup>

British textile plants had begun to experiment with shorter hours during the final years of the War. The Chief Inspector of Factories and Workshops' report for 1918 noted that some woollen mills had reduced hours from 55.5 to 49.5 without significant productivity loss. Instances were also reported in cotton weaving and dyeing where firms successfully abandoned pre-breakfast working. In course cotton doubling it was found that, despite the mechanised nature of the work, productivity was speeded up during the frequent 'doffing' of the machines (though lower savings were recorded for fine doubling).<sup>63</sup> In one typical case, a firm reduced net weekly hours from 55.5 to 49,<sup>64</sup> without any long-term reduction in overall output (which was improved on coarse counts, but worse on finer counts). In addition to eliminating low productivity 'pre-breakfast' work, productivity gains were attributed to the virtually complete elimination of bad-time-keeping and improved workers' health.<sup>65</sup>

Failure to agree terms following a January 1919 union demand for a reduction in the working week from 55.5 to 44 hours, with no reduction in weekly pay (assuming hourly productivity remained constant), eventually led to an 18 day strike

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<sup>62</sup> For example, in weaving the production of long runs of fairly standard cloth was common prior to 1914, but became exceptional during the interwar period, as firms reacted to declining markets (especially for standardised goods), by taking on smaller runs of more diversified products, including some that would have hitherto been considered outside their normal range of production. Firms also reacted to depression by switching to cheaper inputs, which resulted in a higher proportion of 'bad weaving' (i.e. breaks in the yarn during weaving). Gray, "Wage Rates," p. 14.

<sup>63</sup> Doffing is the operation of removing and replacing full bobbins.

<sup>64</sup> By moving the starting time from 6-8 am and eliminating the breakfast break.

<sup>65</sup> UK, Parliament, Annual Report... for the Year 1918, pp. 7-8.

from 23<sup>rd</sup> June, intervention by the Cotton Control Board resulting in agreement on a 48 hour week.<sup>66</sup> Most firms instituted a one-break system (constituting a one hour lunch break), together with a Saturday half day.<sup>67</sup> Meanwhile piece rates were raised so that, assuming constant hourly output, weekly incomes would be reduced by only 1.5 per cent. The rise in piece rates was strongly linked to pressure for a wage increase, war-time inflation having eroded real wages.<sup>68</sup>

Monthly returns of employment and wages for the cotton industry, published in the *Labour Gazette* - covering a large sample of firms in the last pay week of each month – were used to assess the productivity impact of the 48 hour week by A. L. Bowley as early as 1921.<sup>69</sup> His findings, that the 48 hour week had not reduced weekly output, were later challenged by John Jewkes and E. M. Gray.<sup>70</sup> With regard to spinning, they claimed that Bowley had failed to take account of short-time working which, they argued, rose progressively from 1916-18, then fell off from 1919 to early 1920.<sup>71</sup> They also cited a study by Harold Cliff, Secretary of the Oldham Master Cotton Spinners' Association, indicating that a 13.5 per cent reduction in spinning working hours was matched by a 11.86 per cent reduction in the output of mule spinners and a 10.25 per cent reduction for ring spinners.<sup>72</sup> However, Cliff's data was restricted to observations covering June and July 1919 (the period immediately before and after the hours reduction, punctuated by a strike from 23<sup>rd</sup>

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<sup>66</sup> Clegg, *History*, p. 267.

<sup>67</sup> United Textile Factory Workers' Association, *Inquiry*, p. 52.

<sup>68</sup> Fowler, *Lancashire Cotton Operatives*, p. 85.

<sup>69</sup> Bowley, *Prices and Wages*, pp. 177-80.

<sup>70</sup> Jewkes and Gray, *Wages and Labour*; Gray, "Wage Rates".

<sup>71</sup> Jewkes and Gray, *Wages and Labour*, p. 22.

<sup>72</sup> *Ibid.*, pp 22-3.

June to 10<sup>th</sup> July). As noted above, there is a consensus among empirical studies that any productivity offset from reduced hours emerges gradually over several weeks of continuous shorter hours.

Gray also criticised Bowley's cotton weaving results, arguing that weavers' earnings were depressed prior to the introduction of the 48 hour week by restrictions imposed by the Cotton Control Board and, in particular, the alleged imposition of a 40 hour week throughout most of 1918.<sup>73</sup> In fact both this, and his earlier joint study with Jewkes, made erroneous claims regarding the impact of production restrictions imposed by the Cotton Control Board. These had been subject to a detailed 1922 study by Hubert Henderson, which Gray and Jewkes appear to have been unaware of.<sup>74</sup> Rationing had been imposed from the summer of 1917, via restrictions on the proportion of spindles or looms run by each firm, surplus workers being laid off (originally under a rota system, then - from August 10<sup>th</sup> 1918 - via continuous lay-offs). Lay-offs would not affect reported earnings per person, which were based on employees retained in work.

From June 1918 these restrictions were supplemented by short-time working, hours being reduced from 55.5 to 40 in weaving and in mills spinning American cotton, effectively reducing piece-rate earnings by 28 per cent (assuming hourly productivity remained constant).<sup>75</sup> Hours were not similarly restricted for Egyptian cotton spinning, as there was no shortage of shipping space for Egyptian cotton imports. However, contrary to Gray's claim that the 40 hour week was imposed 'throughout most of 1918', it was in effect only during the brief period from June 10<sup>th</sup>

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<sup>73</sup> Gray, "Wage Rates," p. 8.

<sup>74</sup> Henderson, *Cotton Control Board*.

<sup>75</sup> *Ibid.*, pp. 30-44. This was applied by not by reducing daily hours, but by stopping work on Saturdays and Mondays.

– August 4<sup>th</sup>.<sup>76</sup> Hours were then raised to 45.5, and, on October 28<sup>th</sup>, to 46. From 25<sup>th</sup> November 1918 hours restrictions were entirely withdrawn and within three months of the armistice limitations on machinery utilisation were also abolished.<sup>77</sup>

Gray explains the improvement in hourly earnings during the months following the introduction of the 48 hour week in weaving as arising from war-time dislocations among the labour force and a recovery in output.<sup>78</sup> However, the evidence indicates that during the summer and Autumn of 1919 the industry did not experience any major change in working conditions. There was no sudden, rapid, re-introduction of ex-servicemen and despite its prosperity during this period the impact of overtime on the returns was said to be almost negligible, as vigorous union opposition prevented its widespread use.<sup>79</sup> Nor was there any residual short-time working immediately prior to the move to 48 hours, as by June 1919 an ‘unexampled trade boom’ had effectively eliminated unemployment in the industry.<sup>80</sup>

As Bowley and Henderson note, cotton experienced a particularly short post-war boom, the reintroduction of short-time working after May 1920 resulting in a decline in weekly productivity.<sup>81</sup> Short-time working reduced output both due to the reduction in hours worked and a decline in production per hour. A study of cotton weavers, conducted in late 1919 and 1920, found that following the move to short-time working average hourly output fell by 6.1 per cent - as workers deliberately

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<sup>76</sup> Gray, “Wage Rates,” p. 8.

<sup>77</sup> Henderson, *Cotton Control Board*, pp. 65-72.

<sup>78</sup> Gray, “Wage Rates”, p. 66.

<sup>79</sup> Rowe, *Wages in Practice*, p. 253.

<sup>80</sup> Henderson, *Cotton Control Board*, p. 66.

<sup>81</sup> Bowley, *Prices and Wages*, pp. 177-80; Henderson, *Cotton Control Board*, p. 73.

restricted output in the knowledge that higher productivity might lead to even tighter restrictions.<sup>82</sup>

Table 5 shows the results of regression analyses to determine the relationship between working hours and weekly output per person over the period 1917 – May 1920; using Bowley’s method for calculating hourly productivity and Henderson’s hours data. Both productivity and hours are expressed in logs - as empirical studies indicate that the relationship between hours reductions and productivity depends on the proportional, rather than absolute, decrease and the data cover several hours regimes. This also has the advantage that the coefficients can be determined as elasticities, thus allowing us to estimate the productivity offset. For cotton preparation and spinning both hours in those sections of the industry dealing with American and Egyptian cotton are included, given their different incidences of short-time working.

The data indicate that the American sections of the cotton preparation and spinning trades witnessed a large compensating gain in hourly productivity, sufficient to offset more than 75% of the weekly productivity loss from shorter hours. Conversely the Egyptian sections of these processes had a lower productivity offset, of around 57 per cent.<sup>83</sup> The greater offset in the American section of the trade may be related to the impact of substantial hours restrictions imposed as a production

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<sup>82</sup> Wyatt, *Variations in Efficiency*, pp. 33-4.

<sup>83</sup> It had been argued that spinning was strongly dependent on machinery speeds and would, therefore, offer little scope for a substantial productivity offset – see, for example, UK, Parliament, *Annual Report...for the Year 1918*, p. 8. However, recent research by Tim Leunig (based on analysis of ring spinners at a large Massachusetts mill over the period 1903-12) found substantial output variations between operatives even for ring spinning. Output per worker rose over the first two years of employment, eventually reaching a third more than the worker’s typical rate when initially employed (thereafter stagnating, as ‘learning by doing’ effects had been exhausted) - Leunig, “Piece Rates”.

rationing device during the summer and autumn of 1918, discussed above. This may have led to greater efficiency-gains through reorganisation of the working process; whereas the Egyptian section of the trade had no experience of adapting to short hours prior to the introduction of the 48 hour week. Meanwhile weaving firms had a lower productivity offset, estimated at around 53 per cent.

As with coal, the hours reduction in cotton was an international phenomenon. US working hours fell over 1913-20 from 55.6 to 48.9 for male mule-spinners, from 57.8 to 51.8 for female frame spinners, from 57.6 to 51.8 for male weavers, and from 56.7 to 50.3 for female weavers.<sup>84</sup> In Germany, hours declined from 56-58 in 1910 to 46 in January 1919.<sup>85</sup> By 1921 the 48 (or fewer) hour week had also been introduced in Austria, Belgium, Czechoslovakia, Denmark, France, Italy, the Netherlands, Poland, Spain, Sweden, Switzerland and Yugoslavia (generally by statute and during 1919).<sup>86</sup> Thus, given that pre-war British hours were shorter than those of any major European manufacturer, British producers appear to have derived a competitive advantage from the 48 hour week.

During the First World War some British employers had argued for an international agreement on working hours, as France, Belgium, Austria, and Germany worked longer hours than were legal in Britain.<sup>87</sup> Indeed, there is little evidence that the interwar depression in British cotton textiles stemmed from increased British labour costs relative to other advanced industrial nations. For example, Roland Gibson's study of cotton textile wages in Britain and the United States found British

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<sup>84</sup> United Textile Factory Workers' Association, *Inquiry into the Cotton Industry*, p. 53.

<sup>85</sup> *Ibid.*, p. 53.

<sup>86</sup> *Ibid.*, pp. 54-6, using on data from the 1922 *Textile Recorder Year Book*.

<sup>87</sup> UK, Parliament, Annual Report... for the Year 1918, p. 9.

weekly money earnings and total weekly earnings had fallen from 62 and 60 per cent of American levels in 1914 to 46 and 44 per cent respectively in 1920.<sup>88</sup> Meanwhile, British hourly wages had experienced an even greater decline.<sup>89</sup> This was almost entirely due to Britain's exchange rate depreciation; in terms of their domestic currencies the 1914-20 weekly money earnings growth for British cotton workers (168 per cent) lagged only slightly behind that in the USA (174 per cent).<sup>90</sup> Thus, as with coal, the overvaluation of Britain's currency, rather than its working-hours, was the major factor inflating its labour costs.

### **The iron and steel industry**

The Iron and Steel industry is an important case-study both in terms of its contribution to the British economy and as an example of the impact of shorter hours on Britain's largest continuous process industry. The British industry had been in relative decline from the 1870s, partly due to the rise of major new competitors such as the United States and Germany, with markedly higher labour productivity.<sup>91</sup> Despite a respectable output growth performance over 1913-37, the industry continued to suffer from relatively low productivity, owing to a legacy of out-dated plant of sub-optimal size, based in areas that were no longer well-located for minimising production costs.<sup>92</sup>

As a continuous process industry, iron and steel production required a shift system that was divisible into 24 hours. British producers had begun to move from a

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<sup>88</sup> Total weekly earnings also include payments in kind.

<sup>89</sup> Gibson, *Cotton Textile Wages*, p. 2.

<sup>90</sup> *Ibid*, p.8.

<sup>91</sup> Elbaum, "The Steel Industry," pp. 51-81.

<sup>92</sup> Buxton, "Efficiency"; Tolliday, "Steel".

twelve to an eight hour shift regime from around the turn of the century and by 1914 an eight hour day had been introduced at the regional-level for blast furnaces in Durham and Cleveland, Lincolnshire, and the North West Coast, and in the steel and tinsplate industries of South Wales.<sup>93</sup> At the end of the First World War the industry's main union - The Iron and Steel Trades Confederation – pressed for the national introduction of an eight-hour day. It claimed that this constituted both an essential development in its own right and a safeguard against unemployment in the context of anticipated industrial restructuring and the absorption of extra workers during demobilization. A meeting of employers' and workers' representatives on 19<sup>th</sup> February 1919, covering a large part of the iron and steel trades, agreed in principle to the introduction of an eight hour day by 30th March 1919.<sup>94</sup>

A scale of contributions towards the cost of the third shift was introduced for higher-paid workers, graduated according to income - up to a maximum of one third of wages for the very highest-paid, earning £6 per week. Meanwhile workers with basic wages of 50 shillings per week or under were exempted from contributions.<sup>95</sup> This arrangement had the effect of increasing labour costs by around 25 per cent (assuming no change in productivity) – though, given heavy war-time inflation, this rise cannot be isolated from the general pressure for wage increases.<sup>96</sup> The majority of highly-paid workers were on piece rates and as it was subsequently reported by the union that increased productivity had negated any loss of earnings under the

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<sup>93</sup> Committee on Industry and Trade (Balfour Committee), *Survey of Metal Industries*, p. 40; and Bowley, *Prices and Wages*, pp. 145-7.

<sup>94</sup> Pugh, *Men of Steel*, pp. 283-85 and 612.

<sup>95</sup> Bowley, *Prices and Wages*, pp. 145-47.

<sup>96</sup> Burn, *History of Steelmaking*, p. 355.

agreement.<sup>97</sup> However, no detailed study was made of the productivity offset and Duncan Burn (who conducted the most detailed near-contemporary study of the British industry) reported that the data for such a study were no longer in existence.<sup>98</sup>

The most detailed official investigation of the impact of shorter hours in iron and steel was conducted by the Balfour Committee on Industry and Trade. Evidence submitted by the Iron and Steel Trades Confederation argued that new technologies made the introduction of the third shift imperative from a productivity perspective: as technical innovations such as larger furnaces and new machinery and processes required increased throughput and, therefore, worker fatigue. Moreover, they argued that, 'even prior to the war... wherever we introduced an eight hour day productivity of the plant increased even under the same mechanical conditions'.<sup>99</sup>

Conversely, evidence presented the National Federation of Iron and Steel Manufacturers claimed that most producers had found that the eight-hour system had increased costs, particularly in the wrought iron and woven wire trades. Yet an employer engaged in wire manufacturing and another in forging and hammering of steel stated that they were obtaining the same or even higher output with the shorter shift. In both cases employees were paid piece rates, which provided a strong incentive to increase hourly output and maintain a high standard of time-keeping and low absenteeism.<sup>100</sup>

A common feature of evidence presented by the union, the employers, and by Horace M. Vernon of the government's Industrial Fatigue Research Board, was that

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<sup>97</sup> Pugh, The Iron and Steel Trades Confederation, "Hours of Work" Memorandum CM. 7.5.35, moms, 7/5/1935.

<sup>98</sup> Burn, *Economic History of Steelmaking*, p. 355.

<sup>99</sup> Committee on Industry and Trade (Balfour Committee), *Survey of Metal Industries*, p. 41.

<sup>100</sup> *Ibid.*, p. 41.

the impact of lower hours in iron and steel varied substantially according to the particular process under consideration. Vernon, who undertook detailed empirical research on pig iron production, steel production, and steel rolling (albeit with very small samples for each) concluded that the productivity impact of the hours reduction varied not only by process, but by the technology, scale, and organisation of production and, crucially, by the extent of managerial effort to adjust production methods. Where employers and labour cooperated to improve productivity, he argued, it should be possible to both move to eight hours and maintain output per person.<sup>101</sup>

As in most other areas of industrial production, Britain's move to an eight hour day was matched by that of most of its principal competitors. Germany conceded an eight hour day in October 1918, followed within the next two years by France, Belgium, Austria and Italy. By the early 1920s, Canada, India, Japan, South Africa and the USA (in 1923) had also adopted the eight hours system.<sup>102</sup> Burn argued that, while the international introduction of the eight hours regime in steel may not have increased Britain's proportionate labour costs relative to its competitors, British producers would still have been disadvantaged to some extent – as Britain was a high-wage country. However, he failed to take into account that, since several regions had already introduced the eight hour day by 1914, the *aggregate* reduction in working hours for British iron and steel plants in 1919 was significantly lower than for those countries which had a national 12 hour shift system in 1914.

## **Conclusions**

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<sup>101</sup> Vernon, "Fatigue and Efficiency," pp.94-6.

<sup>102</sup> Burn, *Economic History*, p. 354; International Labour Office (ILO), *Application*; and Shiells, "Collective Choice".

The eight hour day constituted the major international humanitarian reform of the interwar period. As the evidence reviewed above demonstrates, this was achieved without any substantial relative impact on national industrial competitiveness, especially for Britain (which had a relatively low hours in 1914). Furthermore, the absolute loss in output was largely offset by increased hourly productivity. Meanwhile there were important demand-side gains from shorter hours which, while difficult to quantify, were probably of greater magnitude than the net loss in weekly productivity imposed by the hours reduction. For example, in Britain the shorter working day both led to the rapid growth of industries associated with working-class leisure and stimulated migration of working-class households from cramped inner-urban housing to new suburban estates, boosting demand for both housing and associated consumer durables.<sup>103</sup>

Given that the 1920s were characterised by over-production and falling prices, rather than shortages and cost-push inflation, the argument that the economic problems of this era can be attributed, even in part, to a restriction in output owing to the 48 hour week appears implausible. Indeed the 48 hour week constituted a rare successful interwar example of a new international standard that avoided competitive rises in working hours - at a time when beggar-thy-neighbour strategies produced destabilising competitive tariff hikes and currency devaluations. Despite frequent calls in many countries to raise hours, usually without considering the likelihood of other nations following suit, the international 48 hour week both survived the economic crises of the interwar years and formed an important landmark in the development of the modern work-leisure balance for industrialised societies.

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<sup>103</sup> Scott, "Marketing Mass"; Burnett, *Social History*.

## References

- Altman, Row Morris. "New estimates of hours of work and real income in Canada from the 1880s to 1930: long-run trends and workers' preferences." *Review of Income and Wealth* 45, no. 3 (1999): 353-72.
- Bentick, Henry. *Industrial Fatigue and the Relations Between Hours of Work and Output, with a Memorandum on Sickness*. London: King, 1918.
- Bowley, Arthur L. *Prices and Wages in the United Kingdom, 1914-1920*. Oxford: Clarendon, 1921.
- Broadberry, Stephen N. "Aggregate Supply in Interwar Britain." *Economic Journal* 96, no. 382 (1986): 467-81.
- \_\_\_\_\_. "The Emergence of Mass Unemployment: Explaining Macroeconomic Trends in Britain during the Trans-World War I Period." *Economic History Review* 43, no. 2 (1990): 271-82.
- Brown, David G. "Hours and Output." In *Hours of Work* edited by Clyde E. Dankert, Floyd C. Mann, and Herbert R. Horthrup, 149-51. New York: Harper Row, 1965.
- Burn, Duncan L. *The Economic History of Steelmaking 1867-1939. A Study in Competition*. Cambridge: CUP, 1940.
- Burnett, John. *A Social History of Housing 1815-1985*. 2<sup>nd</sup> ed. London: Methuen, 1986.
- Butlin, Matthew V. "A Preliminary Annual Database 1900/01 to 1973/74." Reserve Bank of Australia Research Discussion Paper No. 7701, Sidney, May 1977.
- Buxton, Neil K. "Efficiency and Organization in Scotland's Iron and Steel Industry during the Interwar Period." *Economic History Review* 29, no. 1 (1976), 107-24.

- Church, Roy A. *The History of The British Coal Industry. Vol. 3: 1830-1913*. Oxford: Clarendon, 1986.
- Clarke, Colin. *The Conditions of Economic Progress*. London: Macmillan, 1951.
- Clegg, Hugh A. *A History of British Trade Unions Since 1889. Vol. 2. 1911-1933*. Oxford: Clarendon, 1985.
- Committee on Industry and Trade (Balfour Committee). *Survey of Metal Industries. Part IV Iron and Steel Engineering Electrical Manufacturing Shipbuilding*. London: HMSO, 1928.
- Cross, Gary. *A Quest for Time. The Reduction of Work in Britain and France, 1840-1940*. Berkeley: University of California Press, 1989.
- Decoufle, Andre-Clement, and Nicholas Svendsen. "Contribution a une histoire des durees du travail dans l'industrie Francaise du milieu du XIXe siecle a la seconde guerre mondaile." *Travail et Emploi*, No. 20 (1984): 57-71.
- Denison, Edward F. *Why Growth Rates Differ. Postwar Experience in Nine Western Countries*. Washington D.C.: Brookings Institution, 1967.
- Department of Employment and Productivity. *British Labour Statistics: Historical Abstract 1886-1968*. London: HMSO, 1971.
- Dowie, Jack A. "1919-20 is in Need of Attention." *Economic History Review* 28, no. 3 (1975): 429-50.
- Eichengreen, Barry. "The British Economy between the Wars.' In *The Cambridge Economic History of Modern Britain. Vol. 2. Economic Maturity 1860-1939*, edited by Roderick Floud and Paul Johnson, 314-43. Cambridge: CUP, 2004.
- Elbaum, Bernard. "The Steel Industry before World War I." In *The Decline of the British Economy*, edited by Bernard Elbaum and William. Lazonick, 51-81. Oxford: OUP, 1986.

- Engineering and National Employers Federation, Shipbuilding Employers' Federation, and the Union's Negotiating Committee, *Working Hours. Report of Joint Investigation*. London: Whitefriars, 1922.
- Evans, Archibald A. "Work and Leisure, 1919-69." *International Labour Review* 99, no. 9 (1969): 35-60.
- \_\_\_\_\_. *Hours of Work in Industrialised Countries*. Geneva: ILO, 1975.
- Fowler, Alan. *Lancashire Cotton Operatives and Work, 1900-1950. A Social History of Lancashire Cotton Operatives in the Twentieth Century*. Aldershot: Ashgate, 2002.
- Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. *Bayesian Data Analysis* 2<sup>nd</sup> ed. London: Chapman & Hall/CRC, 2004.
- Gibson, Roland O. *Cotton Textile Wages in the United States and Great Britain. A Comparison of Trends, 1860-1945*. New York: Kings Crown Press, 1948.
- Glynn, Sean, and Alan Booth. "The Emergence of Mass Unemployment: Some Questions of Precision." *Economic History Review* 45, no. 4 (1992): 731-38.
- Gray, Edward M. "Wage Rates and Earnings in Cotton Weaving." *Manchester Historical Society, Transactions*, XVI (1938-39): 1-22.
- Greasley, David, and Les Oxley, "Discontinuities in Competitiveness: the Impact of the First World War on British Industry", *Economic History Review* 49, no. 1 (1996): 82-100.
- Hatton, Timothy J. "Unemployment and the Labour Market in Inter-war Britain." In *The Economic History of Britain since 1700*, 2<sup>nd</sup> ed., Vol. 2, edited by Roderick. Floud and Donald McCloskey, 359-85. Cambridge: CUP, 1994.
- Henderson, Hubert D. *The Cotton Control Board*. Oxford: Clarendon, 1922.
- Hicks, John R. *The Theory of Wages*. London: Macmillan, 1932.

- Hoffman, Walter G. *Das Wachstum der Deutschen Wirtschaft Seit Der Mitte Des 19. Jahrhunderts*. Berlin: Springer Verlag, 1965.
- Huberman, Michael. "Working Hours of the World Unite? New International Evidence of Worktime, 1870-1913." *This Journal*, 64, no. 4 (2004): 964-1001.
- Huberman, Michael, and Chris Minns. "Hours of Work in Old and New Worlds: the Long View, 1870-2000." The Institute of International Integration Studies Discussion Paper No. 95, Dublin, August 2005.
- Industrial Fatigue Research Board, *Report No. 6: The Speed and Adaption of Output to Altered Hours of Work* (London: HMSO, 1920).
- International Labour Office (ILO). *Application of the Three-Shift System to the Iron and Steel Industry*. Geneva: ILO, 1922.
- \_\_\_\_\_. *Wages and Hours of Work in the Coal-Mining Industry*. Geneva: ILO, 1928.
- Jewkes, John, and Edward M. Gray, *Wages and Labour in the Lancashire Cotton Spinning Industry*. Manchester: MUP, 1935.
- Leunig, Timothy. "Piece Rates and Learning: Understanding Work and Production in the New England Textile Industry a Century Ago." Working Paper, The London School of Economics and Political Science, London, UK, 2003.
- Lipmann, Otto. *Das Arbeitszeitproblem*. Berlin: 1926.
- Maddison, Angus. *Economic Growth in the West*. New York: Twentieth Century Fund, 1964.
- \_\_\_\_\_. *Dynamic Forces in Capitalist Development. A Long-run Comparative View*. Oxford: OUP, 1991.
- \_\_\_\_\_. *The World Economy: Historical Statistics*. Paris: OECD, 2003.
- Mattesini, Fabrizio, and Beniamino Quintieri. "Does a Reduction in the Length of the Working Week Reduce Unemployment? Some Evidence from the Italian

- Economy during the Great Depression.” *Explorations in Economic History* 43, no. 3 (2006): 413-37.
- Middleton, Roger. *Government Versus the Market. The Growth of the Public Sector, Economic Management and British Economic Performance, c. 1890-1979*. Cheltenham: Edward Elgar, 1996.
- Milhaud, Edgar. “The Results of the Adoption of the Eight-hour Day: the Eight Hour Day and Technical Progress.” *International Labour Review* 12, no. 5 (1925): 820-53.
- Pugh, Arthur. “Hours of Work.” The Iron and Steel Trades Confederation Memorandum CM. 7.5.35, moms, 7/5/1935.
- Pugh, Arthur. *Men of Steel by One of Them*. London: The Iron and Steel Trades Confederation, 1951.
- Rowe, John W. F. *Wages in Practice and Theory*. London: Routledge, 1928.
- Scott, Peter. “Marketing Mass Home Ownership and the Creation of the Modern Working Class Consumer in Interwar Britain.” *Business History*, 50, No.1 (2005), 4-25.
- Shiells, Martha E. “Collective Choice of Working Conditions: Hours in British and U.S. Iron and Steel, 1890-1923.” *This Journal* 50, no. 2 (1990): 379-92.
- Supple, Barry. *The History of the British Coal Industry. Vol. 4. 1913-1946: The Political Economy of Decline*. Oxford: Clarendon, 1987.
- Tolliday, Stephen. “Steel and Rationalization Policies, 1918-1950.” In *The Decline of the British Economy*, edited by Bernard Elbaum and William Lazonick, 82-108. Oxford: OUP, 1986.
- United Kingdom, “Coal Output for 1919-1920. Official Estimates.” *Board of Trade Journal*, 102 (12 June 1919): 743-5.

\_\_\_\_\_ "Coal: The Weekly Output." *Board of Trade Journal*, 105 (1 July 1920): 2.

\_\_\_\_\_ *Ministry of Labour Gazette*, various issues.

United Kingdom, National Archives, LAB2/1586/B236/1930.

\_\_\_\_\_ RECO 1/801.

United Kingdom. Parliament. *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1918*, British Parliamentary Papers, 1919, Vol. 22.

\_\_\_\_\_ *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1920*. British Parliamentary Papers, 1921, Vol. 12.

\_\_\_\_\_ *Royal Commission on the Coal Industry (Samuel), Report*. British Parliamentary Papers, 1926, Vol. 14.

United States, Bureau of Labour Statistics. *Hours of Work and Output*, Bulletin No. 917. Washington, DC: GPO, 1948.

United Textile Factory Workers' Association. *Inquiry into the Cotton Industry*. Blackburn: Dickinson, 1923.

Vernon, Horace M. *Fatigue and Efficiency in the Iron and Steel Industry*, Industrial Fatigue Research Board Report no. 5. London: HMSO, 1919.

Viteles, Morris S. *Industrial Psychology*. London: Jonathan Cape, 1933.

Whaples, Robert. "Winning the Eight-hour Day, 1909-1919." *This Journal* 50, no. 2 (1990): 393-406.

Wyatt, Stanley. *Variations in Efficiency in Cotton Weaving*, Industrial Fatigue Research Board Report no. 23. London: HMSO, 1923.

Table 1: ESTIMATES OF WORKING HOURS FOR MAJOR INDUSTRIALISED COUNTRIES, 1870-1938

Year	Australia	Belgium	Canada	Denmark	France	Germany	Gt. Britain	Italy	Netherlands	Spain	Sweden	Switzerland	USA
1870	56.2	72.2	57.2	69.9	66.1	67.6	56.9	63.3	65.0	64.7	69.6	65.4	62.0
1880	53.3	69.3	59.0	64.6	66.0	66.3	56.6	63.4	63.4	62.7	64.6	63.1	61.0
1890	50.5	66.5	60.9	59.9	65.9	65.1	56.3	63.6	61.9	60.8	59.9	60.9	60.0
1900	48.1	64.2	62.6	56.0	65.9	64.0	56.0	63.8	60.5	59.1	56.0	59.0	59.1
1913	49.0 <sup>a</sup>	59.5	53.6	55.8	55.5	57.0	53.8 <sup>b</sup>	62.5	58.6	56.7	56.0	56.3	53.5 <sup>a</sup>
1920	47.4		49.9		49.0	48.0	46.7					48.0 <sup>c</sup>	50.4
1929	45.2	48.2	49.0	48.5	48.0	46.0	47.2	48.8	48.1	48.5	48.0	48.5	49.6
1938	44.9	48.0	47.2	47.6	39.0	48.0	47.1	48.5	48.5	47.0	46.3	46.3	42.4 <sup>d</sup>

Sources: Australia 1913-1938: Butlin, "Preliminary Annual Database," Table IV.4; based on separate series for men and women, on the assumption that men comprise 75 per cent of the labour force; Canada, 1913 and 1920: Altman, "New Estimates of Hours of Work," pp. 359-63; France, 1913-1920: Decoufle and Svendsen, "Contribution a une Histoire"; Germany, 1913-1938: Hoffman, "Das Wachstum der Deutschen Wirtschaft", pp. 213-14; Great Britain 1913-38: Department of Employment and Productivity, *British Labour Statistics*, Tables 20 and 86; Switzerland, 1920: Clarke, *Conditions of Economic Progress*, p. 86; USA, 1920-1938: *Ibid.*, pp. 46-47; other data, Huberman, "Working Hours," p. 977; Huberman and Minns, "Hours of Work".

Notes: <sup>a</sup> Estimate for 1914. <sup>b</sup> Estimate for 1906. <sup>c</sup> Estimate for 1919. <sup>d</sup> Estimate for 1937.

Table 2: STANDARDISED COEFFICIENTS FOR A TIME TREND AND FOR DUMMY VARIABLES FOR THE FIRST WORLD WAR AND THE POST-WAR HOURS REDUCTION, ON REAL GDP PER CAPITA, 1900-1939

	Trend	War	Hours reduction
Australia	1.741**	-0.492**	-1.035**
Belgium	1.173**	-0.694**	-0.583
Canada	1.899**	-0.294*	-1.367**
Denmark	1.254**	-0.300**	-0.369*
France	1.261**	-0.496**	-0.535
Germany	1.922**	-1.023**	-1.664**
Great Britain	1.211**	0.256	-0.681**
Italy	1.195**	0.251**	-0.452**
Netherlands	0.962**	-0.350**	-0.071
Spain	1.055**	-0.201*	-0.126
Sweden	1.651**	-0.635**	-1.064**
Switzerland	1.300**	-0.520**	-0.544*
USA	1.203**	-0.274**	-0.291

Where:

First World War = Dummy taking the value of 1 for years 1914-1918 and 0 for remaining years

Hours reduction = Dummy taking the value of 1 for 1919 and after and 0 for earlier years

Source: See text.

Notes: \* = significant at the 5 per cent level.

\*\* = Significant at the 1 per cent level.

Table 3: ESTIMATES FOR THE RECOVERY FROM THE JULY 1919 MINING HOURS REDUCTION, USING A BAYESIAN APPROACH (LINEAR MODEL WITH A CHANGE-POINT)

Parameter	2.5% lower credibility bound	Median	97.5% upper credibility bound
$\alpha$	4.248	4.407	4.564
$\alpha_2$	-0.4717	-0.2817	-0.07982
$\beta_1$	-0.6385	-0.4415	-0.2424
$\beta_2$	-1.336	-1.165	-0.9919
$\gamma_1$	-0.03466	-0.02395	-0.01319
$\gamma_2$	0.1442	0.234	0.3505
R	29.46	30.93	33.19

Source: See text. Based on weekly output per person data for the weeks ending 8<sup>th</sup> February 1919 – 27<sup>th</sup> March 1920, as shown in Figure 3.

Notes: Dependent variable= weekly output per person. Analysis based on 100,000 iterations, 40,000 burn in, thinning every 10 for autocorrelation, using vague priors on all variables.

Table 4: AVERAGE EARNINGS PER WORKER IN 1925 FOR MAJOR EUROPEAN COALFIELDS, EXPRESSED IN TERMS OF EXCHANGE RATES AND PURCHASING POWER PARITY

	Per manshift		Per hour		Per manshift (PPP)	
	Underground	Surface	Underground	Surface	Underground	Surface
Great Britain	100	100	100	100	100	100
Netherlands*	80	83	78	86	89	88
Ruhr	69	75	64	57	66	68
France*	50	50	52	52	66	65
Belgium*	50	49	51	50	73	70
Poland	43	46	41	45	54	54
Average (excl. UK)	58	61	57	58	70	69

Source: International Labour Office, *Wages and Hours*, pp. 107-23.

Table 5: PRODUCTIVITY IMPACTS OF HOURS VARIATIONS IN COTTON PREPARATION, SPINNING, AND WEAVING: JANUARY 1917 - MAY 1920

	Preparation		Spinning		Weaving	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
<b>Hours:</b>						
American section	0.262	4.704	0.229	4.595		
Egyptian section	0.432	5.417	0.433	6.052		
Weaving (all sections)					0.471	7.375
Constant	1.493	4.619	1.629	5.624	2.476	8.564
R <sup>2</sup>	0.740		0.760		0.595	
Adjusted R <sup>2</sup>	0.726		0.746		0.584	
F:	51.233		56.951		54.388	

Sources: Productivity data, UK, *Ministry of Labour Gazette*, various issues; Hours data, Henderson, *Cotton Control Board*, pp. 30-44

Notes: Variables are in log form. All t- and F- values are significant at the 1% confidence interval. Productivity data calculated from numbers of workers, their output, and piece rates, using the procedure employed by Bowley, *Prices and Wages*, pp. 177-80.

Figure 1: THE PREDICTED IMPACT ON LABOUR PRODUCTIVITY OF A 'SUPPLY SHOCK' FROM REDUCED WORKING HOURS

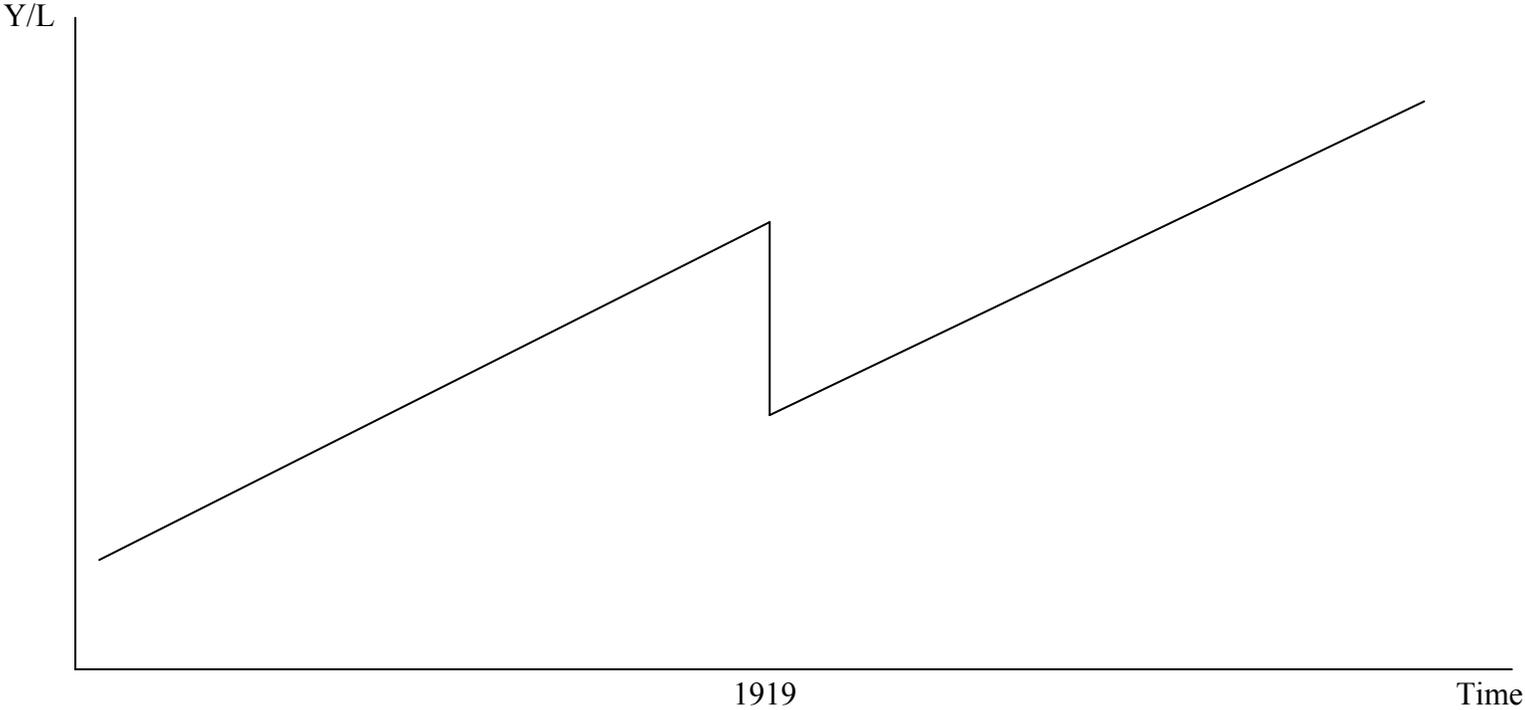
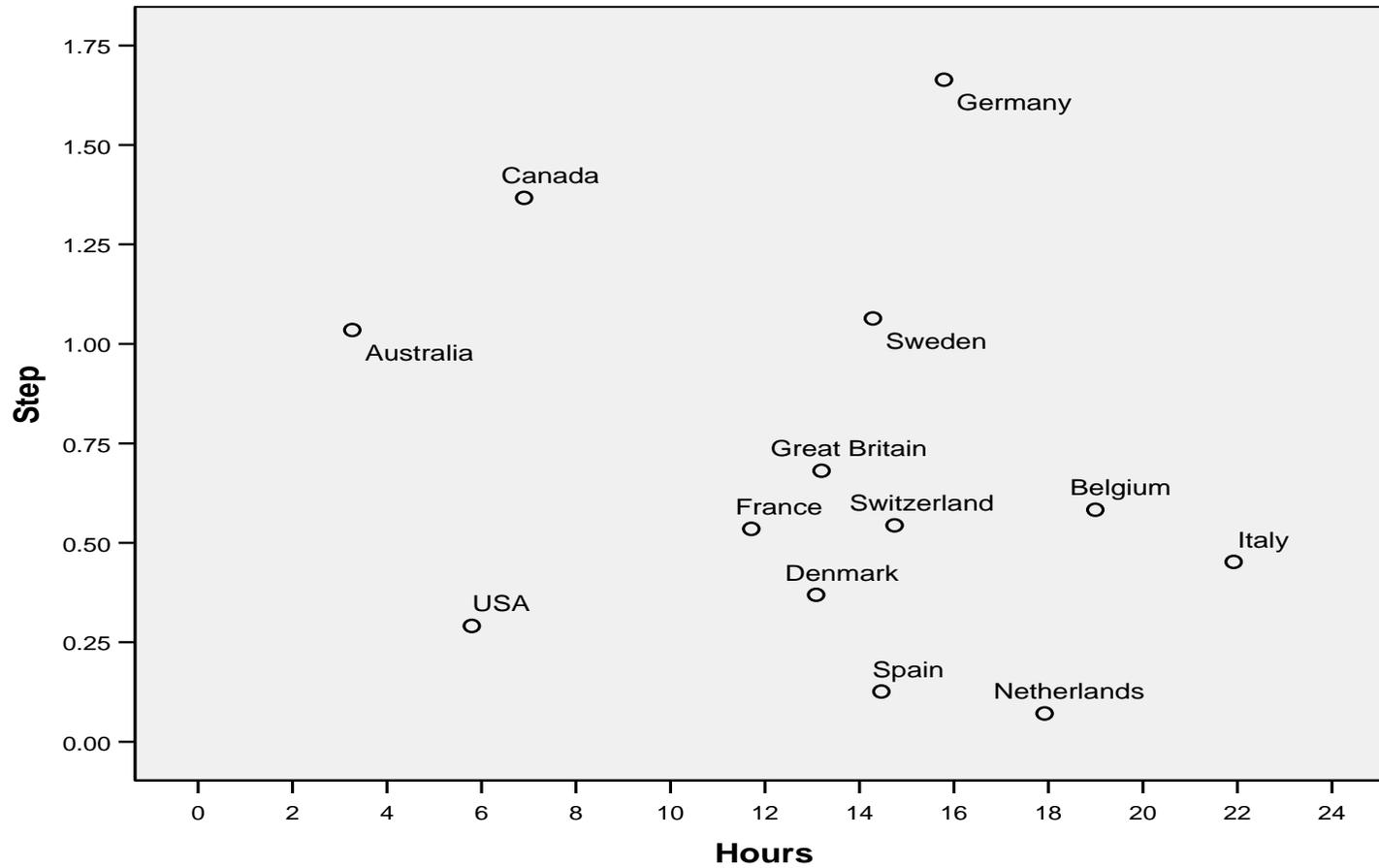
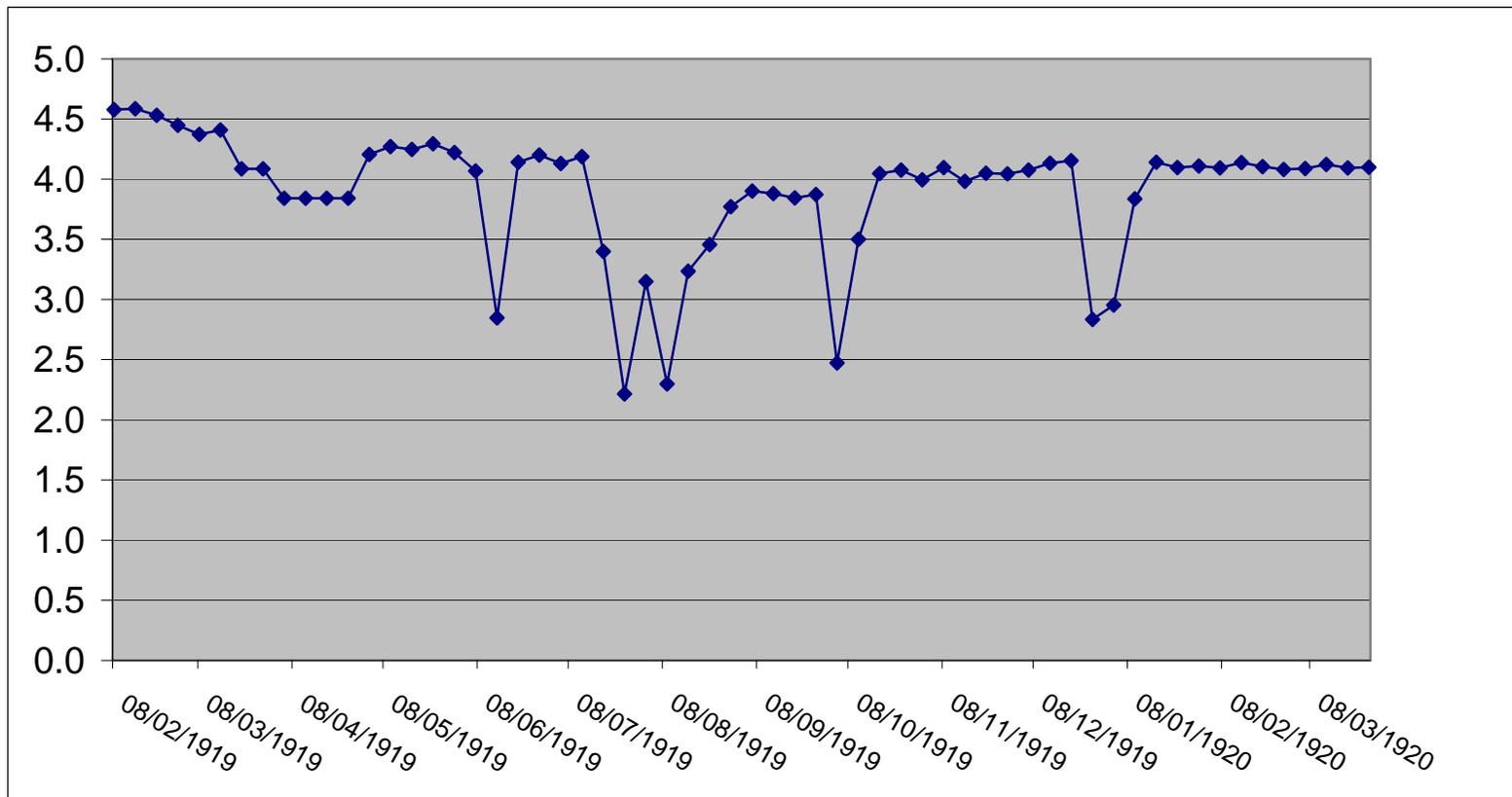


Figure 2: THE RELATIONSHIP BETWEEN THE STEP REDUCTION IN GDP GROWTH FROM 1919 AND THE PERCENTAGE REDUCTION IN WORKING HOURS FROM 1913-1920



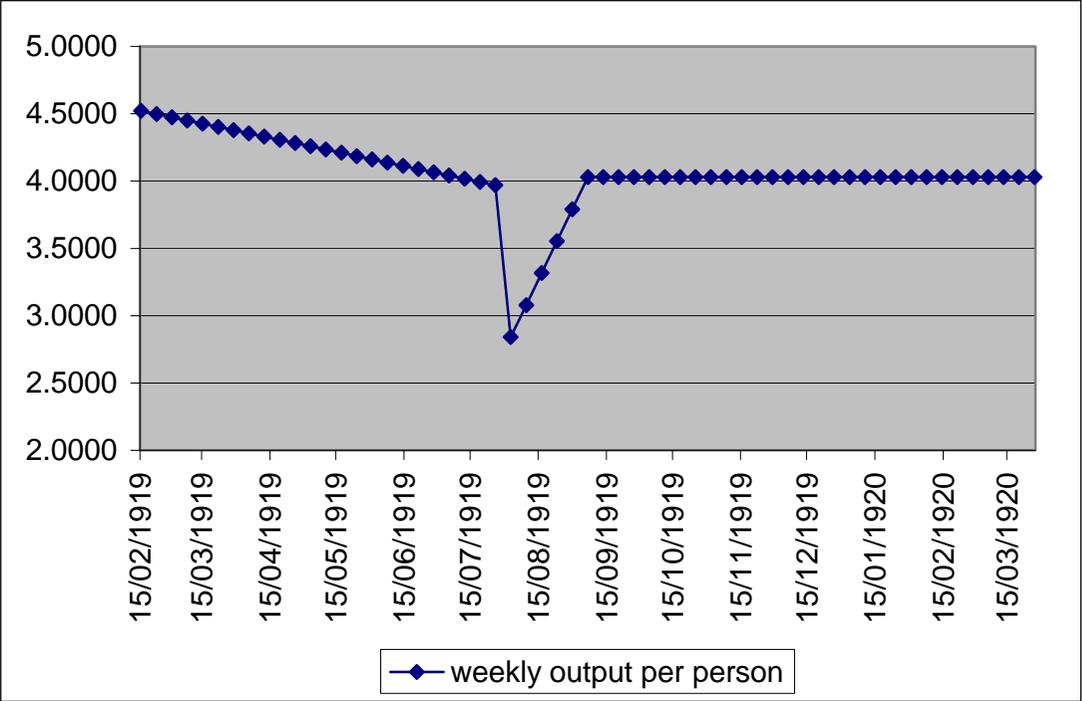
Source: Tables 1 and 2

Figure 3: WEEKLY OUTPUT PER PERSON FOR THE BRITISH COAL INDUSTRY, FOR THE WEEKS ENDING 8<sup>TH</sup> FEBRUARY 1919 – 27<sup>TH</sup> MARCH 1920 (TONS)



Sources: Employment data, UK, *Ministry of Labour Gazette* (various issues); UK, "Coal: The Weekly Output", p. 2.

Figure 4: THE MODELLED CRASH AND RECOVERY FOR COAL OUTPUT



Sources: See text.

Notes: the value of the intercept point in the figure above is given by the value of  $\alpha$  inflated by  $\beta_1$  and  $\beta_2$  (as  $X_1$  and  $X_2$  are centred); the value of the recovery point is given by “inflated  $\alpha$ ” +  $\alpha_2 - \gamma_2$ .