Weak Bodies, Strong Wills: The Empirical Evidence for Marx's Theory of Worktime

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The industrialised capitalist nations are characterised by a tendency to reduce the time workers spend at their place of paid employment. Since 1870, worktimes in these societies have been reduced by approximately 40 per cent. Why working times should change has been a matter of debate for as long as capitalism has existed. The contemporary literature, however, appears to contain a basic consensus. It is accepted that standard times are determined primarily by worker preferences for income and leisure. It is true that differences of opinion exist as to precisely how the workers' presumed leisure preference is transformed into reality. Mar-
ginalists tend to stress individual/family choice and radicals emphasise political/class power. There is either explicit or implicit agreement, though, that the contraction of standard times is essentially a function of rising income. This is despite the fact that there is no substantive theoretical or empirical support for the claim that the supply of labour-time is inversely related to income.²

Included within the worktime consensus are the majority of Western Marxists. Most of these scholars appear to believe that Marx saw the introduction of the shorter working day merely as one more element in the changing class division of the spoils of the production process. Cleaver, for example, argues that worktime reductions are solely a consequence of the political struggle between capital and labour. As the working class grew in size and power, he argues, it was able to challenge capital and compel the introduction of the modern working day and the weekend.³ Likewise, Weekes argues that the length of the normal working day is merely a function of the political struggle between the classes.⁴ That Marx believed that worktimes were greatly affected by the balance of class power, and that worktime is very much a political as well as an economic issue, is not to be denied. He stressed that the establishment of a rational working day—one that minimised the waste of labour-power and considered the whole life needs of the individual—was a product of a more or less concealed “civil war” between capitalists and workers. However, while he insisted that the employers’ ability to determine time schedules was limited by the “strong wills” of employees (as these scholars correctly suggest), Marx stressed that employees were also limited and shaped by their “weak bodies.” He insisted that if working times are continually extended or intensified with one or the other element being held constant, then a point must inevitably be reached where the limitations of “man, that obstinate yet elastic barrier” will be reached. It is the combination of these two factors—human capacities and human will—that makes up the core of Marx’s theory of worktime.

In Capital, Marx argued that unless there were unlimited supplies of labour-power freely available, it would be necessary for the state to impose limits on the length of time employees laboured. Limited availability of labour-power and human needs, he observed, played a crucial role in the struggle over
the factory acts between 1819 and 1867. As the expansion of the British economy began to eliminate the abundant surplus of labour-power that had been available in the market-place in the first years of the century, workers found that they could more effectively resist the demands of capital. At the same time, employers found that the decreased availability of labour-power made replacement cost a significant factor determining the efficient utilisation of this commodity. Faced with growing pressure from the working class, and the increasing need for economy in the utilisation of labour-time, a number of employers began experimenting with time schedules during the 1830s and 1840s. In many cases these individuals found, often much to their surprise, that there was great validity in the arguments of those, such as Robert Owen, who claimed that compelling employees to labour 70-plus hours per week was inefficient because of the level of fatigue this induced. Publication of the results of these experiments by the leaders of the 10 Hours Movement and the factory inspectors had a dramatic influence on the various participants in the worktime debate. It strengthened the resolve and militancy of the workers' campaign for a legal limit to the workday; it undermined the strength and unity of employer resistance to such laws; and it greatly influenced those within the state who were attempting to find some acceptable means of limiting the high social and economic cost of the damage being done to the working class through excessively long time schedules.

The subsequent introduction of a legal, temporal barrier to the length of the working day, Marx argued, did not lessen the "civil war" between the buyers and sellers of labour-power. Nor did it lessen the significance of the worktime issue. For once capitalists were confronted with this temporal barrier, they shifted their primary attention away from the extension of worktime and concentrated on the task of increasing the intensity of the time that continued to be laboured. In the long term, Marx argued, this new employer concentration would tend to raise the average level of work intensity considered normal within industry. The rising intensity, in turn, would invariably recreate the conditions that had made it necessary to introduce the factory acts in the first place. In other words, the tendency for the time normally laboured to increase its density, while its temporal duration remained fixed,
would periodically recreate a situation in which the level of intensity demanded within the established time schedule came into conflict with the innate and social needs of the workers. As a result of this development, the workers would again be compelled to struggle for a reduction in the time schedule normally laboured. Eventually, Marx was convinced, the workers would be successful in their struggle because their political and organisational strength would gain increasing sustenance (as it had in the fight for the 10-hour day) from the growing imbalance between the intensive and temporal aspects of the given schedule:

Capital's tendency, as soon as a prolongation of the hours of labour is once and for all forbidden, is to compensate for this by systematically raising the intensity of labour, and converting every improvement in machinery into a more perfect means for soaking up labour-power. There can not be the slightest doubt that this process must soon lead once again to a critical point at which a further reduction in the hours of labour will be inevitable.5

In this paper, the empirical evidence as to the relationship between standard times, work intensity and productivity that underpins Marx's theory of worktime is examined. This kind of limited approach is adopted not because Marx's argument was purely technical. It has been undertaken, first, because I have dealt elsewhere (at book length) with the broader theoretical and empirical questions associated with precisely how political class struggle over normal worktimes influences and is influenced by both the "weak bodies" and the "strong wills" of the workers.6 More importantly, this approach has been chosen because it is precisely the aspect of Marx's argument which stresses the recurring conflict between the demands of the capitalist production process and human needs that has been so glaringly absent from contemporary Marxist literature relevant to this topic. This omission has removed much of the materialist essence from Marx's argument. The one-sided political element that is left is unacceptably voluntarist in that it locates the primary causal determinants of worktime change solely in human will or consciousness. The crucial factor inducing worktime change is supposedly the workers' conscious decision to engage in political struggle. Recognition that the balance of class power is a crucial factor determining when
and where worktime changes are introduced appears to ground the argument in the material world. This is not the case, however, for such arguments recognise that humans make circumstances what they are, but ignore the fact that circumstances limit what humans are capable of achieving. As Hyman has observed, such arguments treat the scope for working-class creativity as if it were unlimited by the material world. He rightly suggests that this position is as inadequate as that which would deny the potential of human practice to influence history:

Marx's theoretical stature derives essentially from the creative tension between his dual emphasis on the structural determinancy of capitalist production and the historical agency of the working class in struggle.7

Lack of knowledge of the human capacities aspect of Marx's argument and of the material evidence supporting his basic hypotheses in this area (which has accumulated over the last century) has severely limited the value of post-war Marxist contributions to the worktime debate. What contributions have been made have been relatively easy for non-Marxists to refute. Neo-classical analysis, consequently, has been able to dominate this issue. If this situation is to be challenged, it is necessary for Marxists to at least be aware of the evidence underpinning Marx's argument.

Worktime and Intensity Marx based his concept of worktime change on the "law that the efficiency of labour-power is in inverse ratio to the duration of its expenditure."8 As a consequence of this inverse relationship, he argued, what is lost by a curtailment in working time can often be made up by an increase in the intensity of effort during the period that continues to be worked. Over the last century, a vast mass of research into how the relationship between effort and time manifests itself within the production process has been undertaken. In many of these studies, the researchers have examined situations in which production methods and conditions could be held constant with the only variable being the length of time worked. A fixed group of workers was then studied, and their physical output recorded, both before and after the
worktime change. The first systematic study of this nature following the publication of *Capital* was undertaken in England in the late nineteenth century. In 1873, Brassy widely publicised the fact that many employers had found output did not necessarily fall when working times were reduced. In 1893, Mather reduced the weekly hours in his works from fifty-three to forty-eight and maintained output records both before and after the change. The result was a slight increase in total output. In the following year, the British government reduced working times at Woolwich Arsenal by five and three-quarter hours per week and by two and a half hours at the Admiralty Dockyards with similar results. Knowledge of these experiments spread through Europe and the United States. In 1900, the workday at the Zeiss Optical Works at Jena was reduced from nine hours to eight, and records were maintained of the change in output. All other factors remained constant, yet hourly output rose by 16.2 per cent, and power consumption by 12 per cent. By 1912, Goldmark was able to publish her volume, *Fatigue and Efficiency*, which detailed research in Britain, France, Belgium and the United States—all of which had produced similar results. The British Association for the Advancement of Science reacted to these findings in 1913 by appointing P. Sargant Florence organising secretary and investigator of a committee charged with the task of studying "the question of Fatigue from the Economic Standpoint." A massive impetus was given to worktime research by World War I. In Britain, the government established the Health of Munitions Workers Committee in 1915. This body was asked to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munitions factories and workshops. In 1921, a summation of the committee's results was published by Vernon. From 1915 to 1918, this scholar had attempted to determine the "maximum achievement" of which the worker is capable in times of prolonged stress, as may occur during a period of war or in times of industrial pressure. He was particularly interested in determining the time schedule that would maximise production. The war provided Vernon with an unrivalled opportunity to obtain the type of
information he needed. Under normal industrial conditions, it is difficult to undertake extended observations of a wide range of work situations in which nothing else changes but the length of time laboured. In the first eighteen months of the conflict, however, the British War Office imposed extremely long schedules on the workers in the munitions industry. The government refused to heed warnings that intensity levels within industry had risen to such an extent that time schedules considered normal during the nineteenth century were no longer efficient. The evidence that an extension of working time did not necessarily produce more output, accumulated over the previous century, was in effect ignored. The dramatic increase in worktimes, however, established excellent conditions for testing this hypothesis. The workers in the munitions industry were highly motivated by patriotism. Yet despite this high level of motivation, when working times were extended to 12 hours a day, six days a week, total output fell from what it had been during the shorter time period. The government, as a result, acknowledged that there did appear to be an inverse relationship between effort and time and consequently reduced standard schedules in order to increase the level of output. To discover the schedule that would maximise productivity, gradual curtailments in standard times were introduced through the period of the war. These staggered reductions made it possible for Vernon to study the output of groups of workers under varying schedules. As it was found that workers often took several months to respond fully to a reduction in the length of time worked, each new schedule had to be maintained for an extended period. A representative example of the results Vernon obtained is provided in table 1.

Within the United States the war also made worktimes and productivity a problem of "national scope and concern." In order to determine standard times that would maximise output, the Federal Public Health Service, in 1917, authorised Florence to begin a study of the output, accident, labour-turnover and lost-time records of two plants working different schedules. The two factories were both large establishments. One operated 22 hours a day under a two-shift system of 10 hours by day and 12 by night. The other operated using three
Table 1
Comparative Output from Longer to Shorter Hours of Work
1915-1917

<table>
<thead>
<tr>
<th></th>
<th>Average Weekly Hours</th>
<th>Relative Output</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Nominal Actual</td>
<td>Hourly Weekly</td>
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<tr>
<td>80-95 Women Turning Fuse Bodies on Capstan Lathes</td>
<td></td>
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<tr>
<td>First Period:</td>
<td></td>
<td></td>
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<tr>
<td>Aug. 15-Jan. 16</td>
<td>74.5 66.0</td>
<td>100 100</td>
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<tr>
<td>Second Period:</td>
<td></td>
<td></td>
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<tr>
<td>Jan. 16-Jul.30</td>
<td>63.5 54.4</td>
<td>121 100</td>
</tr>
<tr>
<td>Third Period:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jul. 30-May 5</td>
<td>55.3 47.5</td>
<td>156 113</td>
</tr>
<tr>
<td>56 Men Sizing Fuse Bodies</td>
<td></td>
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<tr>
<td>First Period:</td>
<td></td>
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</tr>
<tr>
<td>Nov. 14-Dec. 19</td>
<td>66.7 58.2</td>
<td>100 100</td>
</tr>
<tr>
<td>Second Period:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb. 27-Apr. 16</td>
<td>62.8 50.5</td>
<td>122 106</td>
</tr>
<tr>
<td>Third Period:</td>
<td></td>
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</tr>
<tr>
<td>Nov. 11-Dec. 23</td>
<td>56.5 51.2</td>
<td>139 122</td>
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shifts of 8 hours each. The factories used similar technology and both were metal manufacturers, though their products were not identical. The 10-hour plant produced munitions; the 8-hour plant, motor vehicles. Management was considered equal in quality.14

In both the British and American studies, it was found that as production proceeded through the day, hourly output at first rose but eventually began to fall. The outstanding feature distinguishing the two schedules was the level of output maintenance. This was markedly higher in the 8-hour plant. It was also found that there was an increase in spoilt work with the longer schedule and a very considerable increase in accidents. The last hour of the day, in general, had the lowest output and the highest accident ratio. A correlation between nominal worktimes and actual times was also found by the fatigue researchers. As nominal schedules were reduced, absenteeism
and poor time-keeping decreased at an even more rapid rate. In table 1, for example, the men sizing lost only 5.3 hours a week when on a 56.5-hour schedule, as against 12.3 hours when nominally working 62.8 hours.

A summation of the primary reasons that there is not a proportional reduction in output when worktimes are reduced has been provided by Evans:

1. The majority of people are capable of working more intensely during a relatively short period than they are over a relatively prolonged period;
2. Where working times are particularly long their reduction often has a favourable impact on absenteeism and sick leave;
3. The "shock effect" of an enforced worktime change often stimulates management to re-examine methods of production thus generating increased productivity;
4. Higher hourly labour costs stimulate increased capital intensive production methods;
5. The reduction may eliminate a relatively unproductive time period and thus reduce fixed costs per unit of production;
6. It may be possible, as a result of the time cut, to introduce shiftwork thus facilitating greater use of capital equipment;
7. The reduction may elicit a more congenial climate of industrial relations. This may in turn facilitate the introduction of productivity increasing modifications to the production process.15

The Pattern of Worktime The general conclusion as regards the working day made by the worktime researchers has been summarised by Friedmann:

1. A reduction in the working day from 12 hours to 10 increases both hourly and daily output;
2. A reduction from ten to eight hours has a similar effect except for certain tasks that are machine paced;
3. Below 8 hours hourly output continues to rise but not sufficiently to outweigh the decrease in time worked.16

It was realised that this pattern is a generalisation. While having wide applicability, it is influenced by numerous factors including age, sex, climate, etc. This point was stressed by Florence, who observed that the nature of the specific task could radically influence the length of worktime that would maximise output. In order to determine the significance of this factor, Florence sub-divided work tasks into five basic categories:

1. Semi-automatic machine work;
2. Muscular body work;
3. Fully automatic machine work;
4. Dextrous hand work;
5. Sense and brain work.
By studying these five groups, he was able to compare their performance during common work periods. He found that fully automatic machine work was most inelastic in relation to output, followed by semi-automatic work. In general, it was found the greater the degree of independence from the machine enjoyed by the worker, the greater the potential capacity to vary work intensity. Florence went on to point out that within the firm the existence of a range of optimal time schedules needs to be balanced with the need for a common denominator. It is often extremely difficult to differentiate within any one workplace or even industry the worktimes of different employees. This is particularly the case where unions insist on some “common rule.” In such cases, a standard generally needs to be implemented that best suits the average type of operation and the capacities of the average individual. From his experiments, Florence concluded that an 8-hour day was the optimum schedule that was generally most appropriate within industry.

The diminishing capacity of workers to increase their hourly intensity as the working day is reduced limits the degree to which this particular work period can be shortened if output is to be maintained. It does not follow from this, though, that the curtailment of standard times, induced by rising intensity, ceases when an 8-hour day is established. Besides attempting to determine the optimum length of the working day, the fatigue researchers also examined numerous other work periods. They found that varying amounts of rest are necessary to offset the diverse influences that cause fatigue. A night's rest is sufficient to offset most of the deterioration in work capacity normally accumulated over a day. A residue of chronic fatigue, however, tends to accumulate within the individual as the work period is extended. This form of fatigue requires longer periods of rest to dissipate. The weekly and annual rests necessary to restore long-term work capacity also have a positive effect on the intensity level that can be sustained during an 8-hour day. Daily worktimes, in other words, can be maintained at 8 hours, even though the work becomes greatly intensified, if longer periods of rest are provided in place of reductions in the daily schedule. It is the existence of this phenomenon that largely explains why, in every industrialised capitalist nation, once an 8-hour day has been estab-
lished, the downward movement in the length of the working day invariably ceases. When it becomes necessary to further reduce standard times, after this daily standard is reached, it is generally more efficient to maintain 8 hours as the daily norm and make alternative temporal adjustments. At this stage, short breaks during the day and reductions in the length of the working week have generally proven more effective modifications for attaining a high degree of offset. It was primarily for this reason that the 7-hour day, six-day week was replaced by the 8-hour day, five-day week in the U.S.S.R. in the 1960s.\textsuperscript{17}

The advantage to be gained from the shorter week lies in the tendency for worker efficiency to fall as the workweek progresses. As early as 1915, the Health of Munitions Workers Committee advised that if maximum output was to be attained, a weekly rest of a day was imperative. The committee concluded that Sunday work gave "six days output for seven days work on eight days pay."

\textbf{Figure 2}

\textit{The Productivity of the Workweek}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2}
\caption{The Productivity of the Workweek}
\end{figure}


Florence argued that the introduction of a 5-day week could be particularly beneficial when the Saturday was normally
worked as a half-day. This is because of the lower output per hour and the high levels of absenteeism generally experienced on half-days. The abolition of half-days also has a number of other advantages. It reduces some overhead costs such as heating and provides more time for maintenance.\textsuperscript{18}

A similar relationship to that existing between the working day and working week would appear to exist in relation to the working year. Once the five-day week is established, greater degrees of offset can usually be obtained by increasing holiday entitlements rather than by introducing a four-day week. The fatigue researchers found that annual output records were characterised by features similar to daily and weekly records. Over a period of several months, an accumulation of residual fatigue manifests itself in the need for prolonged periods of rest—in other words, in a need for vacations. Vernon found that when the worker returned from holiday there tended at first to be a diminution of weekly output. This is soon overcome, however, as the individual settles to the work. Average weekly output then tends to rise above the pre-holiday period so that total output rises overall.\textsuperscript{19}

The need for human beings to take periodic vacations has been discussed by Grinstein. During holidays, he suggests, even if arduous physical effort is undergone, energy normally consumed by the ego in meeting the daily demands of reality is freed and can be utilised in what is a healing or recuperative process for the mind and body.\textsuperscript{20}

In those countries where a five-day week, 8-hour day is now the standard, employers tend to regard the extension of annual holidays as one of the least objectionable forms of reducing worktime. For example, at a 1982 meeting of management experts on the adjustment of working time, held under the auspices of the Organization for Economic Co-operation and Development (OECD), participants emphasised that long vacations had the least disruptive effects on production:

Indeed, the interesting point was made that where shorter time work reductions were effected, such as reductions in the length of the work week by an hour or so, then it was preferable to aggregate the extra leisure hours and grant them as extensions to holidays rather than as minimal, though potentially disruptive, changes to the working day.\textsuperscript{21}
At the close of World War I, studies into the relationship between worktime and output were continued in both Europe and the U.S. Most of this research, however, was limited in scope and it was not until World War II again made maximisation of national output a matter of urgency that large-scale worktime studies were undertaken. During the crisis that followed the fall of France in 1940, the workweek in most British munitions factories was extended from 56 to 69.5 hours. An initial outburst of energy and patriotism enabled the workers to maintain this schedule for a number of weeks without a corresponding decrease in the average level of intensity. Output was increased by ten per cent. Within six weeks, however, there was a sharp increase in injuries and lost time. Average times actually laboured fell to 51 hours per week where they had been 53 when the nominal workweek had been 56 hours. The corresponding fall in output was twelve per cent below output at the 56-hour level. Workers throughout the country were fatigued and strained as a result of the excessive length of the time they were compelled to work. The government was consequently forced to recognise its mistake and shorten the workweek, a month later introducing a system of authorised holidays. To justify these reductions, the experiments conducted during World War I were repeated in 1941. The Industrial Health Research Board concluded from this study that even in wartime the workweek should not exceed 60-65 hours for men and 55-60 hours for women. Thus, a 10-hour day, which during the nineteenth century had been the norm within British industry, was, by 1941, an absolute maximum even in time of war, when economic cost was of greatly reduced significance.

The war also stimulated the United States government to again undertake a large-scale worktime study. This was conducted between 1944 and 1947 by the Department of Labor. The purpose of this research was "to measure objectively the effects of working hours on the performance of workers and to determine how the schedules compared in obtaining the goal of increased output." In this examination, seventy-one case studies were undertaken covering 2,445 men and 1,060 women workers in thirty-four plants, across a wide range of industries. The conclusion drawn by the researchers was that there was no such thing as a single optimum workweek for all
individuals. Workers performed differently when working the same time schedule because of a variety of factors: incentive to work, demands of the task, control over pace, nature of shift, working conditions and relations with management. In other words, optimum times were influenced by social, technological and historical factors. Recognition of these influences, however, did not lead the researchers to conclude that there were no absolute human limits relevant to the determination of optimum worktimes. Rather, they argued that while variability existed, there were norms shaped by workers' social and physical needs, around which variation fluctuated, and which had wide applicability within industry. With few exceptions, they reported, a marginal extension of the time worked increased total output. As a rule, however, above a minimal level, the increase in output fell considerably short of the temporal increase. For hours above 8 per day and 48 per week, it usually took 3 hours to produce 2 additional hours of output if the work was light. When work was heavy, it took 2 hours to produce 1 hour of additional output. Working seven days of the week, moreover, produced no greater output than working six days.

The objective of extended time schedules during the war was maximisation of output. The criteria of effectiveness, accordingly, was the highest combination of working time and intensity that would produce the most goods. Cost minimisation was not considered a major criterion. If the cost factor is taken into consideration, as is necessary under normal peace-time conditions, then all other things being equal, the researchers concluded, "the eight hour day and the forty hour week are best in terms of efficiency and absenteeism and the higher levels of hours are less satisfactory."25

The conclusion that an 8-hour day, five-day week is a general optimum for industry in terms of profitability has gradually become accepted within the industrialised capitalist nations over the last forty years. During this period, numerous worktime-output studies have been undertaken as worktime has progressively contracted. A study undertaken by the Norwegian government in 1959, for example, found that hourly output rose sufficiently to offset most of a reduction from 48 to 45 hours per week.26 Similar results were obtained from a study commissioned by the West German Ministry for Eco-
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nomic Affairs in 1962. This study was one of the most thorough empirical examinations of the relationship between worktime and productivity undertaken to that point. The researchers concluded that a reduction in worktime below forty-five hours per week would have "no significant adverse effect upon output per man—that is, that the productivity offset would be complete." It was further concluded in this study that the effect on unemployment was minimal and that reductions in worktime boosted productivity and gave impetus to structural adjustments within the economy. Finally, Tsuji-mura has reported that reductions in worktime in Japan, during the 1960s, produced no adverse effects upon output. Rather, he reports, even after allowing for changes in the nature and use of capital equipment, for every one per cent reduction in time worked, there was a corresponding two per cent increase in labour productivity.

The Level of Intensity As a result of their studies, the fatigue researchers endorsed Marx's argument that capitalism was characterised by a tendency to increase the intensity of labour-time. In the late 1960s, Poper undertook an empirical examination of the validity of this belief. In his study, he examined the results of 1,677 separate worktime studies that had been conducted over the previous eighty years. His specific purpose was to assess the validity of the fatigue researcher's claim that fewer hours imply better rested and more energetic workers who, as a consequence, will increase the intensity and speed of their work. Reduced hours will thus lead to increased labor productivity and part or all of the decline in hours will be offset.

The mass of evidence compiled by the fatigue researchers, Poper concluded, gives overwhelming support to their claims. Workers can and have offset the fall in the length of time they normally labour by raising the average level of intensity they apply to their work. Denison likewise examined the evidence of the fatigue researchers and came to a similar conclusion:

The quantity and quality of work done in an hour is affected by the length of the workweek or work year. As hours are shortened... the product turned out in an hour typically increases as a
direct consequence of the change in hours, so that the loss of output is less than proportional to the reduction in hours.⁰¹

That average intensity levels within industry have risen significantly over the last century has been generally accepted by scholars familiar with the work of the fatigue researchers. Even such an ardent advocate of unqualified marginalism as Becker has not denied the validity of this evidence when compelled to consider the intensity issue.⁰² Individuals less conversant with fatigue research, on the other hand, often find it difficult to accept that there has been any general increase in the level of work intensity. It is asserted or implied by these critics that the production process no longer demands any significant degree of effort from the working class. Such a conclusion necessarily follows if it is insisted that work intensity has not risen during a period when worktime has been reduced by forty per cent. Indeed some go so far as to argue that through the twentieth century “it has become less and less necessary to do a great deal of work of any sort in order to maintain a high level of economic productivity.”³³ This claim, however, is merely an unsubstantiated assertion which can be sustained only if one ignores the evidence of heightened physiological and psychological work intensity accumulated by the fatigue researchers. Indeed the evidence of these scholars suggests that even the claim that the physical demands of the labour process have declined needs to be treated with a great deal of suspicion.

In his 1970 presidential lecture to the Ergonomics Research Society, for example, Edholm confronted this claim. Concentrating on changes to the physical demands of the production process, he attempted to determine whether “the average energy expenditure of the present population [is] higher or lower, or the same, as it was 20, 40, 60, etc., years ago . . .”³⁴ To answer this question he examined the available British data on (1) food intake; (2) numbers engaged in different occupations and how these have changed over time; (3) demographic changes; and (4) direct studies of energy expenditure of workers in different occupations. He conceded that it was true that mechanisation had reduced radically the number of workers it took to undertake many tasks. It did not follow from this, however, that the workers who continue working at the task
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necessarily have a lower energy expenditure than those replaced by machines. The evidence on the food intake and effort demands of the coal industry, for example, showed that British coal miners of 1924 could not have undertaken as much physical work as miners in 1952. This was, in short, because the quantity of food consumed by miners in 1924 was so low it could not possibly have provided the energy requirements demanded of the miner in 1952. In terms of the society as a whole, Edholm concluded there was insufficient evidence to provide a conclusive answer as to whether overall physical activity had declined. The most important data upon which such a decision could be based is food intake, which has increased significantly since 1939. Prior to this period, he estimates, approximately one-third of the British population had a calorie intake less than that necessary to undertake the physical demands of the present day. It follows from this that if, as he shows, the physical demands of non-work activities have not increased, then the average level of intensity within industry must have risen:

Since energy expenditure cannot, over a long period of time, exceed energy intake I would argue that in spite of long hours of work and the early age at which a working career began, the average energy expenditure of the population in, e.g., 1910, would be less than it is today.35

Their awareness of the long-term trend for work intensity levels to rise led the fatigue researchers to support periodic reductions in standard worktimes. Florence, for example, while supporting a standard 48-hour week in 1924, insisted that this schedule was not an abstracted optimum that existed independently of the specific time and location. Fatigue, he argued, is clearly related to duration and intensity of activity. The reduction in the length of time workers need to labour to earn their wages, he argued, leads capitalists to concentrate their attention on increasing the intensity of the labour process. Their success in attaining this objective, over time, tends to gradually increase the pace of work considered normal for the society. He concluded, in 1924, that the decrease in standard worktimes that had been introduced in Britain through the
nineteenth and twentieth centuries had been largely offset by this process:

There is little doubt that what was gained by decrease in hours was largely offset by an increase in the intensity of work, and the worker is more and more becoming concerned with questions of speeding up as hours are gradually reduced.36

Writing twenty-four years later, Florence again considered the question of industry's general worktime optimum. He argued in 1948 that the case for a reduced working week had been greatly enhanced since 1924 by the increase in the average level of intensity experienced within industry. If a 48-hour week had been the optimum for Britain in 1924, he concluded, a 44-hour week was the more likely optimum in 1948.37

**Factors External to the Workplace** In arguing that periodic reductions to time schedules are necessary to ensure that workers received a sufficiently long period to recuperate from the demands of the production process, the fatigue researchers tended to emphasise the increasing demands being placed upon the worker within the paid workplace. They did not totally ignore changes outside this sphere, however, being very much aware that the amount of labour employees can undertake during a normal work period may be influenced significantly by the demands normally placed upon them while away from paid work. In other words, they realised that the great mass of work that individuals must undertake outside the workplace, because it acts as a tax on human capacities, lessens the potential reserves of mental and physical resources workers have available to sell on the market. Changes in the level of social needs considered minimal by the society, and indeed changes in the general pace of life, it was also realised, can alter radically the efficiency of a given schedule. If, for example, changes in the nature of a particular occupation or increased competition for jobs made it necessary for workers to increase significantly the amount of study they undertook after they finished their paid work, the fatigue researchers would generally have expected the length of time that maximised the paid output of these particular workers to contract.

One source of non-paid work the fatigue researchers came to believe could exert a particularly significant influence on
the efficiency of time schedules was housework. The "double
day of labour" that women invariably had to endure, given
that they were generally expected to undertake most of the
work of the home, even when they laboured full-time in
industry, came to be considered a major issue in the determi-
nation of optimum time schedules. This issue gained increas-
ing significance as it became common for women to remain in
employment after they were married. Ironically, it was found
that the fact that women were expected to undertake this
double shift did not always tend to induce females to have a
greater desire for reduced time schedules. Rather, with single
females the exact opposite often occurred. These particular
workers, in many instances, preferred to labour longer hours
at their place of paid employment. Florence explained the
preference by single women for longer paid worktimes as a
consequence of the demands placed upon them within the
home. These women often stated that, if they were not at
their place of paid employment, they would not be allowed to
relax anyway, as could males, because their families would
expect them to help their mothers with the work of the home.38
Married females who undertook paid employment, on the
other hand, were found to have a decidedly marked prefer-
ence for shorter time schedules. Vernon reports that the do-
mestic demands placed upon married women, particularly the
need to shop for their families, had a major effect on the
capacity of these workers to labour the time schedules normally
worked by males and single females. This problem was espe-
cially significant where there were young children in the fam-
ily.39

In the period since Florence and Vernon published their
work, the extent to which women have continued to engage
in paid labour outside the home after marriage has increased
dramatically. The fact that until recently this development did
not tend to change the nature of the sexual division of labour
within the home has led many scholars to point out that
women are significantly disadvantaged within the paid sector
of the economy. The domestic labour demanded of these
workers acts as a significant tax on their mental and physical
resources. Consequently, they often have great difficulty un-
dertaking the degree of paid work that single females and
men are capable of sustaining. The significance of this factor
is made glaringly obvious by the disproportionate number of women who undertake part-time jobs in order to allow themselves sufficient time and effort to fulfill their domestic roles. Were men to undertake an equal share of domestic labour, it is certainly the case that their capacity to undertake paid work would likewise be seriously taxed. In other words, the level of intensity they are able to maintain in a given schedule would be significantly undermined were men expected to fulfill an equal share of the work of the home. Were this to happen and they were not able to reduce their paid-work intensity, there would be a significant increase in their need for further reductions to their standard worktimes.

The Lessons of the Past It has been argued by Clegg and Narasimhan that though increased production resulting from decreased absenteeism might have been an important element in the first agreements on paid vacations, this factor has little relevance beyond the second week. This is, however, a mere assertion and there would appear to be strong evidence to suggest that it is wrong.

Table 2
Comparison of the Annual Working Time in Germany, France, the U.K. and the Netherlands in 1978

<table>
<thead>
<tr>
<th>Country</th>
<th>Hours Per Year Excl. Weekend</th>
<th>Annual Leave and Public Holidays (days/hours)</th>
<th>Nominal Annual Working (hours)</th>
<th>Absence Through Illness (hours)</th>
<th>Effective Annual Working Time (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>2,088 (26 + 10) 288</td>
<td>1,800</td>
<td>100</td>
<td>1,700</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>2,088 (24 + 10) 272</td>
<td>1,816</td>
<td>108.8</td>
<td>1,707.2</td>
<td></td>
</tr>
<tr>
<td>U.K.</td>
<td>2,088 (20 + 8) 224</td>
<td>1,864</td>
<td>149.6</td>
<td>1,714.4</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>2,088 (21 + 7) 224</td>
<td>1,864</td>
<td>200</td>
<td>1,664</td>
<td></td>
</tr>
</tbody>
</table>


Table 2 presents estimates of annual effective working time for four European countries. It can be seen that Germany and, to a lesser extent, France have significantly longer vacations than the United Kingdom or the Netherlands. Despite
this disparity, the annual time actually worked in the two former nations is not any less, because they have significantly less absence due to illness. Commenting on this table, Hart has observed:

The thesis that the U.K. and the Netherlands are significantly less healthy places than Germany and France might be hard to sustain, which may mean that absenteeism occurred for other reasons and that changes in these effects may have significant implications for working time.11

The stance adopted by Clegg and Narasimhan of conceding that output may not have been adversely affected by the earlier growth of holidays, while at the same time asserting that similar results would not occur in the future, is characteristic of contemporary marginalism. In this regard, these scholars continue the tradition of their nineteenth century counterparts, who supported the factory acts once they had become law and had proven to be no danger to capital, but who argued strongly against any further legislation of a similar nature on the grounds that it would be ruinous to the economy.

A similar resistance to the idea that historical experience may provide some suggestion of what may occur in the future has characterised the work of those scholars who have attempted to estimate when reductions in working time would cease being offset by increased levels of work intensity. There have been various answers put forward by those who have taken up this quest. Verdorn, for example, estimated that maximum output was obtained when workers laboured 60 hours per week. Below this point, he suggested, a falling level of offset would be experienced with the point of zero offset being reached at approximately 40 hours per week. Denison, on the other hand, suggested that zero offset would not be reached until the work year fell to 1,762 hours, while Reynolds put his point of maximum output somewhere between 40 and 50 hours per week and assumed a twenty per cent offset in moving from a 40- to a 30-hour week.42 All of these predictions have been invalidated by actual developments. This recurring error is primarily explained by the fact that these attempts at establishing absolute limits to the offset process are seriously
flawed by their implicit assumption that levels of intensity remain constant while the length of worktime remains unchanged. This assumption is not valid, for intensity levels can clearly vary during a fixed working time. This means it is possible for over-intensification to occur at almost any level, and where this is the case, an offset will invariably be achieved if the time worked is reduced. Consequently, it is pointless to attempt to determine abstract minima for the offset phenomenon. For even if worktimes are lowered to 30 or even 20 hours per week, it is still possible that a degree of offset will be obtained, even at levels of 100 per cent.

That the condensation and intensification of work is still a major factor offsetting reductions in working time when the standard falls below 40 hours per week has been shown by White's research. He found that while employers attempted to offset the introduction of shorter times by improving the technology and management methods utilised initially, their primary means of obtaining this objective was, on the whole, relatively straightforward and simple, with reductions in the length of tea-breaks and speeding up the pace of work being most common. The methods used by some of the firms he examined are summarised in table 3.

**Human Limits and the Production Process** The reasons that contemporary marginalists are prone to underestimating the significance of work intensification in relation to working time are many. One of the most important of these would appear to be their general assumption that human capacities no longer conflict with the needs of the production process. Twentieth-century reductions in working time have occurred concomitantly with improvements in workers' food intake, housing and general living standards. Given these changes, many scholars have assumed that the capitalist production process, rather than being characterised by a tendency to come constantly into conflict with human limits, tends increasingly to impinge less on the workers' capacities, while at the same time raising these capacities by improving the workers' health and general well-being.

If this assumption were valid, then the aspect of Marx's argument which suggests that the "weak bodies" of human beings are a major factor tending to lower standard times
### Table 3
**Offsets to Shorter Working Time**

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Methods of Offsetting Reduced Working Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco—dayworkers</td>
<td>(a) Increased pace of work among incentive-paid workers;</td>
</tr>
<tr>
<td></td>
<td>(b) Analysis of work organisation and identification of improvements.</td>
</tr>
<tr>
<td>Tobacco—shift workers</td>
<td>Continuous operation of machines during meal breaks.</td>
</tr>
<tr>
<td>Mechanical Engineering—holidays</td>
<td>(a) Increased pace of work before holidays;</td>
</tr>
<tr>
<td></td>
<td>(b) Earlier anticipation of holidays to smooth effects on output.</td>
</tr>
<tr>
<td>Clothing</td>
<td>(a) Reduction or abolition of meal-breaks;</td>
</tr>
<tr>
<td></td>
<td>(b) Increased pace of work by piece workers.*</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>(a) Abolition of tea-break;</td>
</tr>
<tr>
<td></td>
<td>(b) Faster pace of work on production lines;</td>
</tr>
<tr>
<td></td>
<td>(c) Change in stockholding policy and in production planning.</td>
</tr>
<tr>
<td>Electronic Engineering</td>
<td>(a) Use of flexible-hours system;</td>
</tr>
<tr>
<td></td>
<td>(b) Increased pace of work before holidays (possible).*</td>
</tr>
<tr>
<td>Publishing</td>
<td>Use of flexible-hours system.</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Abolition of tea-breaks.</td>
</tr>
</tbody>
</table>

* These increases in the pace of production were put forward as explanations by management, but without factual corroboration.


would no longer have much relevance. Its validity, however, is open to serious challenge. As Doyal has noted:

> While the development of capitalism may have facilitated an improvement in the general health of the population (as measured, for example, in life expectancy rates), the health needs of the mass of the population continue to come into frequent conflict with the requirements of continued capital accumulation. This produces contradictions which are ultimately reflected in historical changes in patterns of morbidity and mortality.«

An examination of the data relating health and work would certainly appear to endorse Doyal's proposition. In the United States, for example, official figures indicate that about 14,000
workers are killed each year and 2.2 million suffer disabling injuries as a result of their employment. American research, moreover, indicates that there is an “iceberg” character to work-related afflictions in terms of their incidence. The ratio of official to real figures has been estimated at 1:10 in the case of non-fatal on-the-job accidents, and as high as 1:100 for occupational diseases.\textsuperscript{45} Other studies have indicated that as many as forty per cent of medically diagnosed health problems are work-related.

In considering the conflict between the demands of the capitalist production process and human limitations, it also needs to be remembered that the adverse effects of work are not necessarily directly physical. Effort involves energy, but it also involves many other things, and the two terms should not be equated or confused. Many tasks may require a low energy output and yet necessitate a high level of effort.\textsuperscript{46} If the energy content of a task is diminished so that it is well within an individual’s muscular capacities, while at the same time the wearying or boring aspects of the job are increased, it is not valid to claim that the level of effort required has necessarily fallen. Different human capacities are now being placed under strain. Marx made a similar observation when discussing factory workers:

Factory work exhausts the nervous system to the uttermost; at the same time, it does away with the many-sided play of the muscles, and confiscates every atom of freedom, both in bodily and intellectual activity. Even the lightening of the labour becomes an instrument of torture, since the machine does not free the worker from the work, but rather deprives the work itself of all content.\textsuperscript{17}

Margolis and Kroes have argued that there are basically three sets of needs that are common to human beings, even though their specific manifestations may vary between cultures:

*Maintenance needs:* The need for food, shelter, and activity is derived from man’s physiology. Work provides the means to obtain physical objects which permit satisfaction of these needs...

*Social needs:* The need for companionship, recognition, and a feeling of belonging is derived from society. Work can often be a major source of satisfaction of these needs...
Growth needs: The need for self-actualization and the development of competence and mastery over one's environment is derived from man's psychology. Satisfaction of this need is often characterized as attainment of positive mental health.

Most marginalists, on the other hand, appear to conceive of human capacities as a relevant factor in their theories of labour supply solely in terms of maintenance needs. They consequently fail to recognise that conflict between human limits and the demands of the production process can still occur even where workers are well fed and do not have to undertake hard physical labour. Certainly the prevalence of forms of effort more closely associated with the social and psychological capacities of workers have increased. While such society-wide change across time is not easily measured, the consequences are becoming increasingly clear. Through the twentieth century, there has been a significant decrease in infectious diseases within the industrialised nations. However, the benefits of this change, in terms of longevity, have been increasingly offset by the growth of coronary and rheumatic disorders and by the incidence of carcinomas. Such stress-related illnesses have been on a steady upward trend throughout the post-war years. In England and Wales, for example, the death-rate in men between 35 and 44 nearly doubled between 1950 and 1973 and has increased much more rapidly than that of other ranges. Of these young deaths, forty-one per cent were due to cardio-vascular disease formerly considered an affliction of the aged. The rate of growth of such chronic and degenerative diseases is such, Naschold argues, that it can no longer be believed that they are primarily symptoms of the aging process. He suggests that it is the nature of work within contemporary capitalist society that is a major factor bringing about this change. His conclusion that work is so central to this problem is supported by a fifteen-year study of aging. This research found that the strongest predictor of longevity was work satisfaction, the second predictor being overall "happiness":

These two socio-psychological measures predicted longevity better than a rating by an examining physician of physical functioning, or a measure of the use of tobacco, or genetic inheritance. Con-
trolling these other variables statistically did not alter the dominant role of work satisfaction.32

The Forty-Hour Week as an Optimum For two decades after the late 1940s, the fatigue and health aspects of work failed to attract the attention of industrial psychologists in the way that it had in the first half of the century. Baladmus has argued that the abandonment of fatigue research, of which the worktime studies were a significant part, occurred because it was eventually realised that fatigue was such a complex phenomenon it could not be adequately quantified and systematically controlled.33 What this meant for worktime research was that one realised that the determination of abstract working times and patterns that would maximise the extraction of labour from the worker was unattainable. It was only when stress-related afflictions clearly connected with work began to reach epidemic proportions during the late 1960s that interest in studying the effects of work on the worker was restimulated. This new-found interest has, thus far, produced little new data on the temporal aspects of work and human deprivation. McGrath reports that the temporal factors in stress research have largely been ignored. This is, he suggests, despite the fact that time may be one of the most important parameters of the stress problem.34 What research has been undertaken in this area has been of a peripheral nature and has concentrated on "abnormal" work patterns, with particular emphasis on shift-work, overtime, and more recently, flexi-time.

A rare exception to this dearth of data is a report on worktime-induced stress and strain prepared by Naschold for the International Institute for Comparative Social Research. Naschold and his colleagues have attempted to determine whether the time element, in all its dimensions, is so important in overall strain and stress that a strategy to curtail the length of time worked constitutes a meaningful attack on the real source of the problem. Their conclusions, based on research primarily undertaken in West Germany, are that changes in the production process have led to changed requirements as regards skill and work capacity; that these in turn reflect changes in the form of physical and mental strain and stress emanating from work; and that these changes are increasingly undermining the health of the working population. These
researchers have castigated those scholars who presumed, without any evidence, that working times and human capacities are no longer in conflict:

The abstract and moralistic argument often heard during the fifties and again today, that a forty hour week (five times eight hours) is an optimal duration overlooks and underestimates a historical change in the risk structure.55

Human Limits and the Pattern of Change There is, then, strong empirical support for Marx's argument that there would be a recurring conflict between human capacities and the demands of the capitalist production process. His claim that changes in intensity levels would be both a cause and a consequence of the movement to reduce working times can also be substantiated. What is more, the significance of human capacities in this changing situation is evidenced by the form the downward movement has taken. Such change has not been totally random, for there would appear to be a distinct pattern to the way in which change tends to occur. In virtually every society, when working times first begin to contract, it is the hours of the day that are initially curtailed. This daily movement tends to flatten out as it approaches 8 hours. The few countries that have shortened the working day below 8 hours, such as the Soviet Union, have invariably reverted to the longer daily schedule, choosing instead to reduce the number of days in the week. Within the capitalist nations, as the five-day week has become established, this flattening out and stabilisation can also be seen. As this schedule is established, the length of the workweek tends to cease contracting and the growth of holidays becomes the main means of introducing further cuts in time schedules.56 The similarity between this all but universal pattern and the nature of human capacities in relation to worktime and the maximisation of output is not difficult to observe. What appears to have happened is that as worktimes have shortened, the least efficient marginal times were invariably disposed of first. Because the "weak bodies" of human beings are such an important factor in the determination of efficient worktimes, there is a distinct similarity between the nature of this weakness and the general pattern of worktime contraction.57
In arguing that human biology appears to play a central role in both the direction and shape of worktime change, it must be stressed that it is not being suggested that this whole movement can be explained merely in biological terms. To argue that nature is often an important factor influencing human social activity is not biological determinism. As has already been argued, it is clear that political struggle, culture and the specific form of historical development experienced by individual societies also play important roles in determining when and where worktime change will occur. Likewise, the pattern of worktime and work intensity that is most efficient within any given society at a specific time is influenced by such factors. This must be so even if for no other reason than that human capacities are so clearly elastic, even if they do have limits, and that social action by the various actors in the worktime struggle can so radically change the length of time a worker can labour. These factors have not been highlighted in this paper because contemporary Marxists generally do not need to be convinced that issues of this nature are central to the issue of worktime. Rather, it is the primary role played by biology in Marx's understanding of this issue that Marxist scholars generally do not appreciate. If such individuals wish to make any significant contribution to our understanding of the political economy of worktime, this omission needs to be resolved.

Notes
8. Marx, *Capital*, 1:535. (See n. 5 above.)
12. Ibid., p. 730.
19. Vernon, *Industrial Fatigue and Efficiency*, p. 57. (See n. 13 above.)
35. Ibid., p. 641.
37. Florence, *Labour*, p. 59. (See n. 18 above.)
38. Ibid., p. 60.
41. Hart, *Working Time*, p. 28. (See n. 21 above.)
55. Naschold et al., *Worktime and Stress and Strain*, p. 36. (See n. 51 above.)