THE WAGE AND THE LENGTH OF THE WORK DAY: FROM THE 1890s TO 1991

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ABSTRACT

I investigate how the relationship between the wage and the length of the work day has changed since the 1890s among prime-aged men and women. I find that across wage deciles, within wage deciles, and within industry and occupation groups the most highly paid worked fewer hours than the lowest paid in the 1890s, but that by 1973 differences in hours worked were small and by 1991 the highest paid worked the longest day. Changing labor supply elasticities explain the compression in the distribution of the length of the work day. In the 1890s the labor supply curve was strongly backwards bending, perhaps because men preferred to smooth hours over their work lives rather than bunch them as they do today. In fact, the intertemporal elasticity of substitution was slightly negative in the 1890s, but by 1973 was positive. I show that the unequal distribution of work hours in the past equalized income, but that between 1973 and 1991 it magnified weekly earnings inequality, accounting for 26 percent of earnings inequality between the top and bottom declines among men, more than all of the earnings inequality among women, and 17 percent of the increase in total household earnings inequality among husband and wife households.

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The length of the work day fell sharply between the 1880s when the typical worker labored ten hours a day six days a week and 1920 when his counterpart worked an eight hour day six days a week. By 1940 the typical work schedule was eight hours a day five days a week. Although further reductions in work time largely took the form of increases in vacations, holidays, sick days, personal leave, and earlier retirement, time diary studies suggest that the work day has continued to trend downwards to less than eight hours a day.[1] This decline in work hours, unmeasured by such common indicators of well-being as income per capita, surely represents one of the larger increases in the standard of living during this century.

Since mid-century the primary beneficiaries of the relatively small declines in the length of the work day and work week have been lower paid workers. Robinson and Godbey (1997: 217) note that Americans with a college education work longer hours than Americans with less formal education and, to a lesser extent, those with larger incomes or in professional occupations work the longest hours. Coleman and Pencavel (1993a,b) find that increases in weekly hours of work for the college educated and declines for those with a high school education or less have been ongoing since 1940.

Although the work day declined sharply before 1940, less is known about the distribution of hours worked prior to this year, the first in which a census contained a question on weekly hours worked. Indirect evidence that the distribution of work hours narrowed is available from national consumer expenditure surveys dating back as far as 1888. These show that differences in recreational expenditures, and hence probably leisure hours, by social class narrowed sharply before 1940 (Costa 1997), implying that inequality of living standards fell. In contrast, the existing data on trends in wage inequality prior to 1940 (although sometimes contradictory) suggests that wage inequality declined only slightly from the end of the nineteenth century to 1940 and never

[1] Estimated from Robinson (1993).

fell below today's levels (Goldin and Margo 1992). If the lowest paid workers worked the longest hours in the past whereas today it is the most highly paid who work the longest hours, then wage or wealth data may underestimate long-run improvements in the welfare of the lowest income workers and may present a skewed picture of recent trends in the inequality of living standards.

This paper uses micro-level data to examine the distribution of daily hours of work in the 1890s and uses comparable data from 1973 and 1991 to examine how inequality in the length of the work day by the hourly wage has changed. Although only data on the hours of men are strictly comparable over time (because of increases women's labor force participation throughout this period), results are presented for women and married couples as well. The paper first describes the data, then presents tabulations of the length of the work day by the hourly wage in the 1890s, 1973, and 1991, and discusses the factors that might have affected the distribution of hours, such as hours legislation and decreases in the number of daily hours that workers are willing to supply and that firms demand from each worker. The paper will show that in the past the labor supply curve was much more backwards bending and will examine why. The paper concludes with an analysis of the implications of the findings for earnings inequality.

1 Data

In the last quarter of the nineteenth century state Bureaus of Labor Statistics published numerous surveys of the personal, occupational, and economic circumstances of non-farm wage earners. The published state reports reproduced the micro data and many of these surveys are now available in machine readable form.[2] The dataset used in this paper pools the available cross-sectional surveys that provide information on men's and women's daily hours of work, their wages, and their age.

[2]See Carter *et al.*

The surveys that are used are from California in 1892, Kansas in 1895, 1896, 1897, and 1899, Maine in 1890, Michigan stone workers in 1888, Michigan railway workers in 1893, Wisconsin in 1895, and women in Indianapolis in 1893.[3]

The final dataset contains over 11,000 men aged 25 to 64 and over 1,100 women aged 18 to 64. Although the men in the survey are predominately upper working class non-farm wage earners and the women manufacturing operatives, there is enough variation in the data to reweight by broad occupation or industry category. As expected, less than 10 percent of women were married. Although unionized workers are oversampled, unionization lowered hours of work by only 2 percent, suggesting that this will not bias my results.[4]

The questions that were asked about hours of work varied slightly by state, but all referred to usual hours of work per day.[5] I assume throughout that the usual work day excludes lunch time, breaks, and overtime, but includes time spent on the job not working.[6] None of the states had hours legislation at the dates of the surveys.

The mean length of the work day in the pooled dataset was 10.2 hours for men and 9.5 for women, estimates similar to those obtained from other sources (see Table 13 in the Appendix). Mean hours of work remain virtually unchanged when the pooled dataset is reweighted to be

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[3]These surveys differed in the types of questions asked respondents, in the types of individuals surveyed, and in data collections methods. Some states gathered data through personal interviews. Others sent out mail surveys, with failure to comply a misdemeanor, punishable by law. Some states surveyed workers in specific industries, whereas others polled workers from many different industries.

[4]Eichengreen (1987) finds that unionization lowered daily hours by 1 percent in summer and 3 percent in winter.

[5]In California workers were asked when they started work, when they ended work, and how much time they took off for lunch. In Kansas the questions were "number of hours per day's work" or "average number of hours worked per day," depending on the year. In Maine and in the 1883 Michigan survey the questions were "number of hours employed daily" and "hours employed per day," respectively. The 1893 Michigan survey and the Wisconsin survey asked about summer and winter hours. I averaged summer and winter hours to derive an estimate of usual hours of work.

[6]Atack and Bateman (1992) note that it was customary in the United States to exclude lunch time and work breaks from hours of work. They cite a study of the 1911 Iron and Steel Commission which found that whereas the working day at a blast furnace of a large steel mill was 12 hours, workers were active for fewer hours, depending on the job.

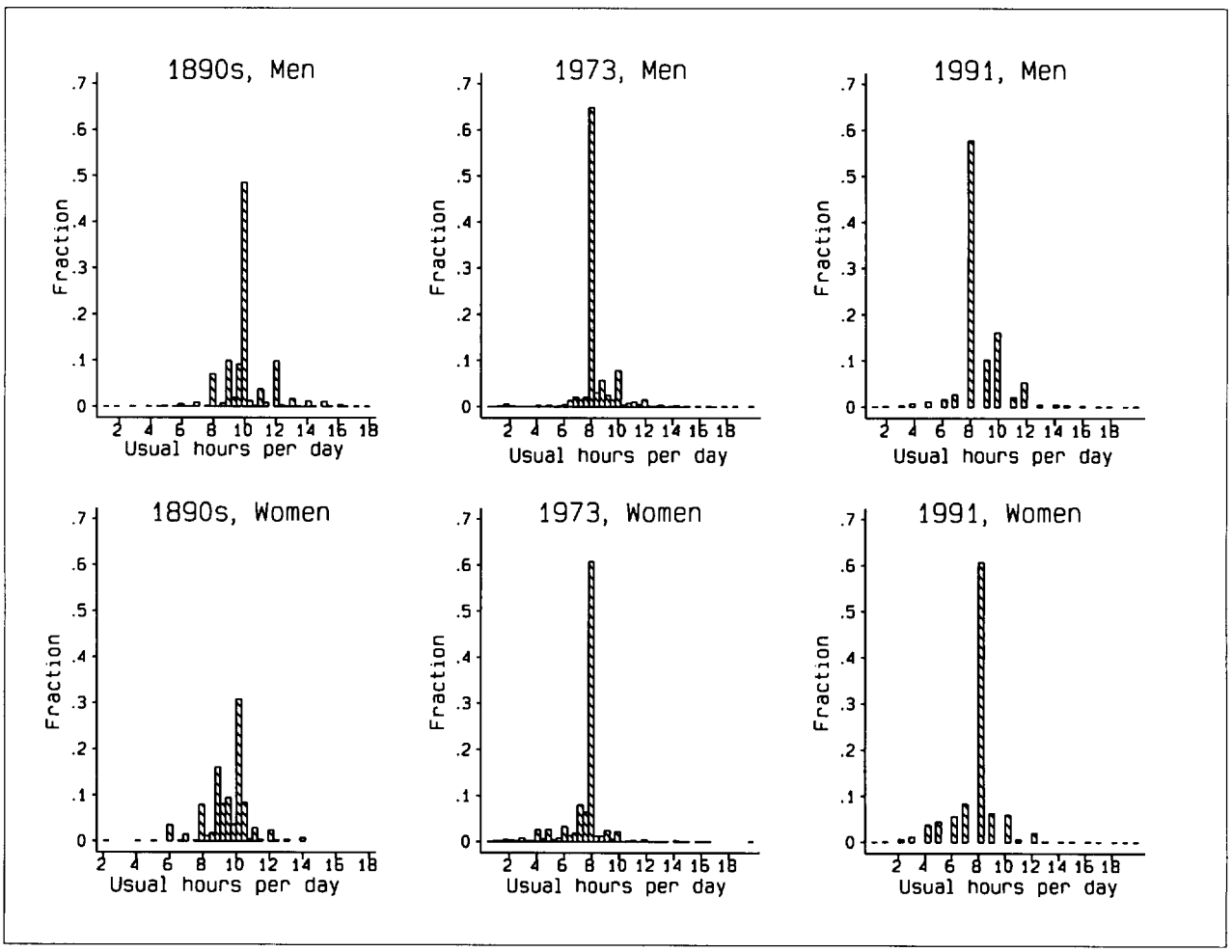
representative of the 1900 occupational distribution and the 1910 industrial distribution.[7] Forty-seven percent of the men in the sample stated that they worked ten hours a day (see Figure 1). The California data indicate that the most common pattern was for work to begin at 7:00 am and end at 5:30 pm with a 30 minute break for lunch.

The men and women in the pooled dataset, like most workers at the end of the nineteenth century, probably labored six days a week. Although information on days worked per week is unavailable, women in the Indianapolis survey reported hours worked on Saturday and the 1897 Kansas survey included a question on whether hours of work were reduced or increased on Saturday. Only 9 percent of workers reported that hours of work were reduced. Fourteen percent reported that hours of work were increased and 76 percent that they remained the same. In the same survey almost 40 percent of the men, generally railroad workers, reported that some Sunday work was required. None of the women in the Indianapolis survey reported that they did not work on Saturday. Mean hours on Saturday were 9.7 (as opposed to 9.5 on a weekday) and 72 percent reported that hours increased.

Questions on hours of work comparable to those in the pooled datasets were asked in a supplement to the 1991 Current Population Survey. Mean hours of work per day (5 days a week) were 8.6 for men and 7.7 for women. Fifty-seven percent of the men in the sample stated that they worked eight hours a day (see Figure 1). The most common pattern was for work to begin at 8 am and end at 5 pm. A comparison of work start and end times and the reported length of the work day suggests that the majority of workers excluded lunch breaks from reported daily hours of work. The questions asked in the 1973 Current Population Survey were somewhat different and usual hours per day were estimated from usual hours per week divided by usual days per week. When similar information is used to estimate hours per day in the 1991 data, the average length of

[7]Although industry was generally not asked in the surveys, I could infer it from occupational information for 76 percent of the sample.

Figure 1: Distribution of Hours Worked, Men Aged 25 to 64 and Women Aged 18 to 64, 1890s, 1973, and 1991



Note. The 1890s data are reweighted to have the same distribution of occupational categories as the population in 1900.

Table 1: Distribution of Length Workday, 1890s, 1973, and 1991

	Men Aged 25-64			Women Aged 18-64		
	1890s	1973	1991	1890s	1973	1991
$\sigma/\bar{X}$	0.15	0.17	0.18	0.13	0.19	0.21
90th-10th percentile	4.00	2.00	2.00	2.50	2.00	3.00
90th-50th percentile	2.00	2.00	2.00	0.80	0.00	1.00
50th-10th percentile	2.00	0.00	0.00	1.70	2.00	2.00

Note. The 1890s data are weighted to have the same distribution of occupational categories as the population in 1900.

the usual working day falls slightly to 8.4 hours for men and 7.6 for women. The reported work day may include overtime if overtime was "usual" but because the proportion of low wage to high wage decile workers receiving overtime pay did not change between 1973 and 1991, changes in overtime coverage are unlikely to bias my results. Although time diary studies suggest that the length of the work day is overestimated both in 1991 and in 1973, but particularly in 1991, this will not bias my estimates of changes in relative hours of work.[8]

Despite a slight increase in the coefficient of variation of daily hours worked from the 1890s to the present (see Table 1), for men the distribution between the 90th and 10th percentiles has become more compressed because the majority now work an eight hour day (see Figure 1). However, for women the distribution first narrowed between the 1890s and 1973 and then widened between 1973 and 1991, largely because the widening of the distribution for full-time workers outweighted the narrowing of the distribution for part-time workers.

Wages in the 1890s were reported according to how the worker was paid, by the hour,

[8]In contrast to survey data, time diary studies suggest that between 1965 and 1985 the length of the work day has fallen by ten percent (Robinson and Godbey 1997: 321). The extent of the overstatement bias varies by educational group, but the bias did not change between 1965 and 1985. When the sample is restricted to employed men age 25 to 64 the results suggest that the college educated over-state their hours of work by 14 percent whereas those with a high school education or less overstate their hours worked by 6 to 8 percent. (Estimated from Robinson (1993) and Converse and Robinson (1980).)

day, week, month, year, ton, or piece. Sometimes total yearly wages are given as well. For men I construct two wage variables. One is strictly for the set of workers paid by the hour and is the hourly wage as given by workers. The second wage variable, which is my only wage variable for women, is an hourly wage estimated from any available information. Thus for workers who were paid by the day the measure consists of the daily wage divided by usual hours worked per day. For workers who were paid by the week or the month I estimated an hourly wage assuming a six day week. For workers for whom I have only a yearly wage, I estimated the length of the work year assuming a work year of 307 days (6 holidays and Sundays off) minus the number of days lost due to ill health, unemployment, or other factors. The last two imputation procedures introduce systematic bias, but, by examining workers paid by the hour, I am able to assess the likely effect of this bias on estimates of the wage elasticity of daily hours worked. Workers for whom the only wage information is the amount paid by the ton, mile, or piece were deleted from the sample. All wages were adjusted to be in real 1895 dollars. Using my second wage variable the mean wage in the sample was 19 cents per hour and for workers paid by the hour it was 23 cents per hour. The sample mean is therefore close to the national mean hourly wage for manufacturing workers of 20 cents per hour in 1895 (Series D 765-778 in U.S. Bureau of the Census 1975: 168).

For the 1973 and 1991 data I also construct two wage variables. One is the hourly wage for workers paid by the hour. For workers who were not paid by the hour, the hourly wage is estimated from information on weekly earnings. None of the sample was topcoded in 1973 and in 1991 only 0.03 percent of workers paid by the hour were topcoded and only 0.29 percent of workers stating their weekly earnings. The top-coded value was therefore used in estimating the hourly wage. The 1890s, 1973, and 1991 data are restricted to non-farm, single job holder wage and salary workers.[9]

[9]I do not observe multiple job holders in the 1890s data. The proportion of male multiple job holders increased from 4 percent in 1973 to 7 percent in 1991, but the proportion of multiple job holders was always greater among

Table 2: Distribution of Usual Length Work Day by Hourly Wage Deciles, Men Aged 25 to 64, 1890s, 1973, and 1991

Wage	All Workers			Paid by Hour		
Decile	1890s	1973	1991	1890s	1973	1991
$<$ 10 (Bottom)	10.99	8.83	8.05	11.14	8.17	7.64
10-20	10.46	8.47	8.47	10.08	8.23	8.14
20-30	10.50	8.54	8.53	9.62	8.23	8.24
30-40	10.62	8.38	8.61	9.62	8.16	8.30
40-50	10.31	8.34	8.59	9.62	8.12	8.38
50-60	9.99	8.33	8.61	9.33	8.15	8.48
60-70	10.29	8.33	8.47	9.42	8.16	8.26
70-80	10.07	8.32	8.66	8.67	8.20	8.47
80-90	9.64	8.26	8.64	8.50	8.15	8.40
$\geq$ 90 (Top)	8.95	8.22	8.72	8.88	8.01	8.51
90th/10th	0.81	0.93	1.08	0.80	0.98	1.11
90th/50th	0.90	0.99	1.01	0.95	0.98	1.00
50th/10th	0.94	0.94	1.07	0.86	0.99	1.10

Note. The 1890s data are weighted to have the same distribution of occupation categories as the population in 1900.

2 Who Worked the Longest Day?

Table 2 gives average hours worked per day by deciles of the average hourly wage both for men paid by the hour and for all men aged 25 to 64 in the 1890s, 1973, and 1991. In the 1890s hours worked were 11 for men in the bottom decile but decreased sharply to 9 for men in the top decile. The California sample shows that men in the top decile began work an hour later than men in the bottom decile (8:00 rather than 7:00 am) and took an hour for lunch rather than a half hour. By 1973 the decrease in daily hours with the wage was no longer as pronounced. Men in the bottom

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the college educated than the non-college educated and increased increased disproportionately among the college educated. The proportion of female job holders increased from 2 to 7 percent and, although the fraction of multiple job holders was always greater among the college educated, the increase was more pronounced among the non-college educated.

Table 3: Distribution of Usual Length Work Day by Hourly Wage Deciles, Women Aged 18 to 64, 1890s, 1973, and 1991

Wage	All Workers			Nonmarried	
Decile	1890s	1973	1991	1973	1991
$<$ 10 (Bottom)	10.06	7.36	6.67	7.17	6.23
10-20	9.93	7.19	6.96	7.18	6.61
20-30	9.98	7.25	7.55	7.22	7.22
30-40	9.85	7.58	7.59	7.52	7.77
40-50	9.67	7.56	7.66	7.50	7.90
50-60	9.66	7.70	7.87	7.66	7.86
60-70	9.55	7.70	8.00	7.62	7.90
70-80	9.37	7.81	8.05	7.76	8.14
80-90	8.90	7.78	8.23	7.76	8.35
$\geq$ 90 (Top)	7.97	7.50	8.14	7.39	8.27
90th/10th	0.79	1.02	1.22	1.03	1.33
90th/50th	0.83	0.98	1.05	0.97	1.05
50th/10th	0.96	1.04	1.16	1.06	1.26

Note. The 1890s data are weighted to have the same distribution of occupation categories as the population in 1900.

decile worked close to 9 hours and those in the top 8 hours. By 1991 daily hours worked increase with the wage decile, from 8 for those in the bottom to almost 9 for those in the top. Although working 8 am to 5 pm was the most common pattern for both low and high wage decile workers, three times as many top wage decile workers as low wage decile workers were working from 8 am to 6 pm.[10] The same trend towards longer hours for top wage decile workers and shorter hours for low decile workers is observed for women as well (Table 3).

The trends observed in Table 2 (the disproportionate decline in the work hours of low wage workers between the 1890s and 1973 and the increase in the work hours of high paid workers and the decrease in hours of low paid workers between 1973 and 1991) persist even

[10]The 1985 time use survey shows that lunch breaks averaged 19 minutes for the college educated and 18 minutes for those with a high school education or less.

Table 4: Ratio of Daily Hours Worked of 90th to 10th Wage Percentile, Within Occupation Category, Men Aged 25-64, All Workers and Workers Paid by the Hour

	All Workers			Paid by Hour		
Occupation	1890s	1973	1991	1890s	1973	1991
Professional	0.62	0.86	1.00		1.04	1.06
Managerial	0.60	0.84	0.98		0.98	1.01
Clerical	0.67	0.93	1.09		1.01	1.20
Sales	0.73	0.88	1.09		1.31	0.97
Crafts	0.86	0.96	1.02	0.86	0.98	1.03
Operative	0.84	0.97	1.07	0.79	0.99	1.04
Service	0.75	0.90	1.24		1.00	1.30
Laborer	0.91	0.97	1.08		1.03	1.13
All	0.81	0.93	1.08	0.80	0.98	1.11

within groups of male workers.[11] Within wage deciles the lower paid workers worked the longest day in the 1890s whereas the higher paid workers worked the shortest day in 1991. Furthermore, the relationship between daily hours and the wage rate observed in Table 2 is seen within all occupation and industry categories (see Tables 4 and 5), implying that the pattern is not solely due to changes on the factory floor. The pattern persists within age groups and within occupation and industry groups controlling for age, marital status, number of dependents, and state and year fixed effects as well. Between 1973 and 1991 the dispersion in hours by wage decile among men working less than 40 hours a week (and hence not subject to legal overtime provisions) widened, suggesting that disproportionate increases in overtime rates of pay cannot explain the changing hours pattern.

Although micro data do not exist to ascertain exactly when between the 1890s and 1973 the distribution of the length of the work day became more compressed, the trend in the mean length of the work day suggests that most of the compression occurred by 1920. The length of the

[11] There are too few women to examine within group patterns among female workers.

Table 5: Ratio of Daily Hours Worked of 90th to 10th Wage Percentile, Within Industry Category, Men Aged 25-64, All Workers and Workers Paid by the Hour

	All Workers			Paid by Hour		
Industry	1890s	1973	1991	1890s	1973	1991
Mining	0.75	0.85	1.12	0.79	0.85	1.15
Construction	0.79	0.94	1.05	0.83	0.96	1.05
Manufacturing	0.89	0.97	1.03	0.77	0.98	1.03
Transportation, Communication, Utilities	0.83	0.93	0.94		1.01	1.07
Trade	0.76	0.90	1.17		1.05	1.12
Finance, Insurance, Real Estate		0.93	1.08		0.97	1.37
Repair		0.94	1.17		1.11	1.12
Personal Service	0.84	0.88	1.40		1.04	1.20
Entertainment		0.90	1.20			
Professional		0.91	1.12		1.10	1.16
Public Administration	0.58	0.88	1.02		1.06	1.14
All	0.81	0.93	1.08	0.80	0.98	1.11

work day for manufacturing workers was 10.0 hours in 1895 and 9.3 in 1914 (Series D 845-876 in U.S Bureau of the Census 1975: 172) and by 1919 eight hour work days were the norm (U.S. Department of Labor 1920: 37). Recall that Table 2 showed that the decline in hours worked between the 1890s and 1973 was largest among men earning the lowest wages. Therefore most changes in the mean length of the work day probably came from disproportionate changes in the hours of men in the lowest deciles of the wage distribution.

3 Explanations

Various factors might account for the change in the distribution of daily hours worked by different wage deciles. The distribution of daily hours may be a poor indicator of total or yearly hours, particularly in the 1890s when workers who experienced large amounts of seasonal unemployment may have traded off a longer day for a shorter year. The length of the work day may be a poor

indicator of the intensity of work, especially if some jobs require large amounts of time spent on the job but not working. Hours legislation may have lowered the hours worked by men and women in the lowest wage deciles. The number of daily hours supplied by workers in the lowest wage decile may have fallen relative to the number of hours supplied by workers in the top decile. Technological change such as electrification that allows firms to use different shifts of workers may have decreased firms' demand for daily hours from each individual worker, but disportionately so for hours of work of lower skilled and hence lower paid workers.

3.1 Weekly and Yearly Hours

The highly inegalitarian distribution of daily work hours in the past translated into an unequal distribution of weekly and yearly hours. In the 1890s workers who reported that Sunday work was required were more likely to work a longer day, as were those who reported either no reduction or an increase in Saturday hours. Similarly in 1991 men who worked a longer usual day reported working longer usual weekly hours and more days per week.

I am also able to rule out the possibility that the longer hours of the lower paid in the 1890s were making up for their greater seasonal employment. Workers in the lowest deciles of the wage distribution did not report a disproportionate number of days lost due to sickness or unemployment. When I re-estimate the wage as yearly earnings divided by the yearly number of hours worked (the product of 307 days and days lost times daily hours worked), the results remain virtually unchanged. Furthermore, the number of days lost by the individual worker in the past year has a negligible, but negative, effect on his usual hours of work. The mean number of days lost by workers in the same 3 digit census occupation is also negatively related to the length of the working day.[12] Controlling for observable characteristics such as the wage and demographic

[12]The mean number of days lost by workers in the same 3 digit census occupation was estimated from the 1900

characteristics, workers in occupations where mean unemployment was three months in the year labored almost 2 hours less per day than workers in occupations with mean unemployment of 0. Given their choice of occupation, workers probably had little control over their daily hours.

3.2 Work Intensity

Changes in work intensity will affect the relationship between the hourly wage and the number of hours, particularly in a comparison of the 1890s with recent data. When 12 hour days were the norm in the steel industry, the idle time of an open hearth crew might be 54 percent for second helpers and 70 percent for steel pourers. Workers might even spend some of their idle time sleeping. Workers may have wanted idle time on the job and could take it if they enjoyed broad autonomy over the pace of their work, working as semi-independent businessmen within the firm, as was true of skilled workers in iron, glass, pottery, foundry, mining, and precision industries (Montgomery 1979: 11, 37-38, 41).

Although I cannot ascertain exactly whether the workers working the longest day were also those working less intensely, an examination of the 1890s data suggests that the observed relationship between the hourly wage and the number of hours is not determined by the intensity of work. Craftsmen had the greatest control over the pace of their work and therefore might be more likely to work in a less intensive, pre-industrial fashion, but their average hours were lower than those of operatives and they constituted only 9 percent of the bottom 20th wage percentile and 63 percent of the top 20th. Furthermore, craftsmen's ratio of daily hour worked in the 90th to the 10th wage percentile was similar to that observed among operatives and laborers (see Table 4). Firms worried about the pre-industrial work habits of their employees sought to pay by the piece or by the hour (Montgomery 1979: 38), but among hourly workers the difference in daily hours

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census which provided information on months lost in the past year.

between the lowest and highest paid workers was greater than among non-hourly workers (see Table 2).

3.3 Hours Legislation

Recall that I argued that because the decline in hours worked between the 1890s and 1973 was largest among men earning the lowest wages, most of the decrease in the mean length of the work day in this time period probably came from disproportionate declines in the hours of men in the lowest deciles of the wage distribution. Therefore the mean length of the work day provides a good indicator of inequality in hours worked and testing whether hours legislation affected the distribution of hours worked becomes a test of whether hours legislation affected the average length of the work day. I will therefore examine whether the decline in the length of the work day coincides with the adoption of maximum hours legislation.

As previously noted, most of the decline in the length of the work day probably occurred by 1920. But, prior to the 1930s state legislation restricting maximum hours of work applied only to women and to relatively few men in dangerous industries. Federal legislation applied only to railroad workers. Although hours of work in 1920 were lower in states with hours legislation, hours of work were lower for men as well, even in industries where there were virtually no female employees, suggesting that hours fell where workers favored decreased hours and that the states where workers favored decreased hours passed hours legislation (Goldin 1988). There is some evidence from the Kansas surveys of 1897 and 1899 that hours were low where workers favored hours legislation. Although 73 percent of workers favored hours legislation, 44 percent favored an 8 hour day and 38 percent a ten hour day. Those who worked a longer day were more likely to favor a 10 hour day or longer and those who worked a shorter day an 8 hour day or less.

There may be some role for federal action during World War I in hastening the decline in the length of the work day. But, although the War Labor Policies Board and the War Labor

Board required the adoption of the 8 hour day for contract work, the work day did not return to its previously high levels after the war.[13]

3.4 Demand and Supply

The highest hours occupations and industries in the 1890s were no longer necessarily the highest hours occupations and industries in recent times. For example, in the 1890s professionals, crafts workers, and laborers worked a much shorter day compared to managers, service, and sales workers. By industry the longest hours worked were in trade and personal service and the shortest in mining and construction. In 1991 managers and sales workers still worked the longest day but service and clerical the shortest. By industry the longest hours were in mining, transportation, communications, utilities, and trade and the shortest in entertainment and personal service. If some of the occupations or industries that experienced large hours declines (perhaps because these were the industries that experienced the greatest degree of technical change) were the occupations or industries that employed many low decile workers, then hours of workers in the lowest deciles may have fallen simply because they were over-represented in the occupations or industries that experienced declines in hours. This point can be quantified as follows. Suppose that the daily hours of a worker in wage decile i, h_i, can be written as

$$h_i = \sum_j \alpha_{ij} a_{ij} H_j \ ,$$

where H_j is the average number of daily hours worked in occupation or industry j, a_{ij} is the ratio of daily hours worked in wage decile i to average occupation or industry hours (H_{ij}/H_j), and α_{ij} is the fraction of workers in wage decile i in occupation or industry j. Then, the horizontal

[13]Labor markets may have remained tight because of the slowdown of immigration, thereby inducing firms to offer a short work day.

Table 6: Average Annual Percentage Change in the Demand for Daily Hours of Work of Men and Women by Wage Decile

	(1) $<$ 10th Percentile	(2) $\geq$ 90th Percentile	Relative Demand Shift (2)-(1)
Due to Occupational Shifts			
Men			
1973-1890	-0.24	-0.20	0.04
1991-1973	0.11	0.19	0.08
Women			
1973-1890	0.30	0.02	-0.28
1991-1973	-0.08	-0.11	-0.03
Due to Industry Shifts			
Men			
1973-1890	-0.24	-0.25	-0.01
1991-1973	0.11	0.16	0.05
Women			
1973-1890	-0.27	-0.21	0.06
1991-1973	0.04	0.16	0.12

Note. Demand shifts were estimated as $\Delta h_i = \sum \alpha_{ij} a_{ij} \Delta H_j$, where 1991 was the base year. See the text for details. The numbers given are average annualized percentage changes in the number of daily hours demanded from worker in each wage decile. Using 1890 as a base year yielded virtually identical results.

shift in demand for daily hours of work from an individual in wage decile i due to changes in the interoccupational or interindustrial mix of daily hours at fixed wages is

$$\Delta h_i = \sum_j \alpha_{ij} a_{ij} \Delta H_j \ ,$$

where α_{ij} and a_{ij} are evaluated at the base year.[14]

Table 6 shows that demand for daily hours worked from workers in the 90th wage decile barely increased relative to demand for daily hours from workers in the 10th wage decile. Of

[14]The computed index is similiar to that used by Freeman (1980) for employment.

course, the computed relative demand shift is only a partial measure of the total demand shift. Relative changes in productivity may have changed the ratio of daily hours of workers in the lowest to the highest wage decile even within a broad occupation or industry category. Fixed costs per worker (arising from health insurance, social security payroll taxes, or capital deepening) may have disproportionately increased for either higher or lower paid workers. The Fair Labor Standards Act of 1938 and subsequent extensions, none of which may affect the highly paid, raised the price of overtime.

I determine changes in the supply of daily hours worked of men and women in a given wage decile by explicitly estimating labor supply equations for each period and then using the estimated regressions to predict daily hours of work within each wage decile. The equations that I estimate are

$$h_i = \beta_0 + \beta_w w_i + x_i'\beta \tag{1}$$

for the 1890s and

$$h_i = \beta_0 + \beta_w \ln(w_i) + x_i'\beta \tag{2}$$

for 1991 and 1973, where h is hours worked, w is the hourly wage, and x is a vector of demographic characteristics, such as age and number of dependents. Endogeneity between the wage and hours presents potential problems. Because individuals may influence their own wage through investment in human capital the wage is likely to be correlated with the stochastic error term due to unobserved tastes and abilities that help determine the wage and that determine current labor supply. I therefore use industry dummies as instruments.[15]

[15]Industry dummies will be valid instruments if hours demanded from each worker depend upon the industry

Table 7: Elasticity (IV Estimates Using Industry Dummmies) of Daily Hours Worked with Respect to the Hourly Wage, Men Aged 25 to 64 and Women Aged 18 to 64, 1890s, 1973, and 1991

	1890s	1973	1991
Men			
All Workers	-0.304	-0.087	-0.017
	(0.023)	(0.013)	(0.016)
Paid by Hour	-0.536	-0.023	0.104
	(0.126)	(0.011)	(0.019)
Women			
All Workers	-0.328	0.107	0.130
	(0.028)	(0.010)	(0.017)
Nonmarried Women	-0.326	0.044	0.128
	(0.028)	(0.015)	(0.030)

Note. Standard errors are in parentheses. Control variables for the 1890s data are age, age squared, dummies for foreign birth, homeownership, whether the worker has any dependents, and fixed effects indicating which State Bureau of Labor Statistics Report the data came from. Control variables for 1973 and 1991 are age, age squared, dummies for nonwhite and married, state fixed effects, and for 1991 the number of children under age 18. All elasticities are estimated at the variable means.

Table 7 presents estimates of wage elasticities for the 1890s, 1973, and 1991. Note that the supply curve of daily hours in the 1890s was very backwards bending, with an elasticity for all male workers of -0.304 (a much larger estimate than when ordinary least squares is used). I obtain negative labor supply elasticities within broad occupation and industry groups as well when I use ordinary least squares. Labor supply elasticities for women were even slightly more negative than those of men. That the labor supply curve in the 1890s was backwards bending is consistent with other estimates for the period (e.g. Whaples 1990; Rosenbloom 1992) and with contemporary observations. For example, the French statistician and economist Simiand examined the wages of French coal miners from 1847 and 1902 and noted that in years when

(perhaps because of technological factors) and if hours supplied by each worker do not. That is, I assume that workers will not demand different hours because an industry may be more exhausting and that workers do not differ across industries in unobservable characteristics that may affect their supply of hours.

tonnage rates were decreased daily output increased whereas in years when rates were greater, output per day either diminished or did not increase (cited in Douglas 1937: 295).

In contrast to the estimates for the 1890s, elasticities for men estimated for 1973 and 1991, although negative, are fairly small. For workers paid by the hour they are positive in 1991. For women elasticities are positive and around 0.11. Of course, the negative labor supply elasticities estimated for 1973 and 1991 may well be spurious. Estimates derived from modern panel data sets suggest that changes in hours worked are positively related to increases in wages upon instrumenting, even when ordinary least squares indicates that the relationship is negative (e.g. Lundberg 1985). If so, then increasing earnings inequality in recent times may have led to increasing hours inequality.[16] Regardless of whether recent labor supply elasticities are positive or small and slightly negative, the comparison with past labor supply elasticities suggests that at least between the 1890s and 1973 the labor supply curve has become less backwards bending. The next section examines potential explanations.

Table 8 summarizes changes in the supply of daily hours by wage percentile. Between the 1890s and 1973 hours supplied by men in the bottom wage decile fell much more than hours supplied by men in the top wage decile. But, between 1973 and 1991 hours supplied by men in the top wage decile rose while those supplied by men in the bottom decile fell.[17] For women hours supplied by those in the top decile rose between 1890 and 1973 and those supplied by women in the bottom decile fell. Between 1973 and 1991 hours supplied by women in the top decile continued to rise while those of women in the bottom decile remained unchanged. A comparison

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[16]However, although earnings inequality today is as high as it was in 1940 (Goldin and Margo 1992), Coleman and Pencavel (1993) find that in 1940 those with at least a college education worked fewer hours than those with a high school education or less, the reverse of the current pattern.

[17]The supply shifts overpredict the actual change between the 1890s and 1973 for workers in the bottom decile and the 1973-1991 change for workers in the top decile. The supply shifts underpredict the actual change between 1973-1991 and 1890-1973 for men in the top and bottom deciles, respectively.

Table 8: Average Annual Percentage Change in the Supply of Daily Hours of Work of Men and Women by Wage Decile

	(1) $<$ 10th Percentile	(2) $\geq$ 90th Percentile	Relative Supply Shift (2)-(1)
Men			
All Workers			
1973-1890	-0.30	-0.00	0.30
1991-1973	-0.22	1.06	1.26
Paid by Hour			
1973-1890	-0.60	-0.21	0.39
1991-1973	-0.11	1.22	1.33
Women			
All Workers			
1973-1890	-0.50	0.55	1.00
1991-1973	0.00	0.30	0.30
Nonmarried			
1973-1890	-0.46	0.50	0.96
1991-1973	-0.25	0.39	0.64

Note. Average daily hours worked were predicted from the specifications described in the text assuming that workers earned a wage equal to the median of the bottom 10th percentile and top 90th percentile and using industry dummies as instruments for the wage rate.

of the size of the relative demand and supply shifts suggests that for both men and women changes in labor supply dominated changes in labor demand.

4 The Labor Supply Curve

Why is the labor supply curve of daily hours worked now less backwards bending? Within a static labor supply model, the most common explanation is a falling income effect, but when I include measures of home value, the income of other family members, and savings in the 1890s regression, I obtain income elasticities that are close to zero.[18] Another explanation is that of Barzel and McDonald (1973) whose model predicts that when assets are below subsistence the labor supply curve is backwards bending and that when assets are above subsistence the labor supply curve is forwards bending. But, inconsistent with the predictions of their model, the elasticity of labor supply in the 1890s is not positive for men with large asset holdings (as measured by home value).

Within a life cycle labor supply model, my estimated elasticity of daily hours supplied will be determined by wage changes arising from shifts in the wage profile, changes in the profile slope, and movements along a given lifetime wage profile. Thus not only could the wage profile have changed, but whereas in the 1890s workers may have preferred to take their recreation through reductions in the length of the work day (perhaps because the work day was so long), later generations of workers may have preferred reductions in the length of the work week, work year, and work life. Increased bunching in annual hours worked over the life cycle, among men both in and out of the labor force, is striking. Circa 1900 men's annual hours were 2641 at ages 45 to 54, 2465 at ages 55 to 64, and 2118 at ages 65 to 74. Between 1940 and 1990, annual hours

[18]Of course, this may merely be an indication that I do not have exogenous measures of income. In previous work (Costa 1995) I showed that the income elasticity of retirement was much larger at the turn of the century than it is today.

of men aged 45 to 54 increased from 1732 in 1940 to 1874 in 1960 and then to 1896 in 1990, largely because of the decline in part-year work; among men aged 55 to 64 annual hours fell 1732 in 1940 to 1577 in 1960 and 1291 in 1990. Among men aged 65 to 74 the decline has been particularly pronounced – from 940 hours in 1940 to 590 hours in 1960 and then to 313 hours in 1990.[19]

I can use my three datasets to determine whether men in the labor force are now more likely to bunch work time during prime ages than they were in the 1890s and whether this is attributable to changes in the wage profile.[20] Although the wage profile was flatter in the 1890s than in either 1973 or 1991, the hourly wage peaked at around age 40 to 45 in all three years. However, in the 1890s daily hours worked peaked around age 27 and then declined slightly, bearing very little relation to the wage, whereas in 1973 and in 1991 hours worked have the familiar hump shape. The intertemporal substitution of daily hours worked with respect to the wage rose from -0.072 in the 1890s to 0.125 in 1973 and 0.147 in 1991 (see Table 9). If the retired had been included in the samples, the increase in the intertemporal elasticity of substitution would probably have been even greater. The changing slope of the labor supply curve may therefore reflect individuals' increasing willingness to bunch their hours of work over the life cycle.[21]

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[19]Estimated from Ruggles and Sobek (1995). Yearly hours in 1900 were estimated as the difference of 307 days and the number of months lost due to unemployment multiplied by daily hours, where daily hours were predicted for every occupation group from a regression based on the 1890s data.

[20]I need to assume no cohort effects. I do not examine women because so few women in the 1890s were in the labor force, particularly over age 30.

[21]Although women did bunch hours of paid work prior to marriage, combined hours of paid work and unpaid housework were most likely fairly evenly distributed over the life cycle.

Table 9: Intertemporal Elasticity of Substitution of Daily Hours Worked With Respect to the Wage, Men, 1890s, 1973, and 1991

	Elasticity	
	All	Paid by Hour
1890s	-0.072	0.012
	(0.029)	(0.012)
1973	0.125	0.152
	(0.027)	(0.038)
1991	0.147	0.142
	(0.012)	(0.017)

Note. Standard errors are in parentheses. Elasticities were estimated from a regression of the logarithm of mean hours worked on the logarithm of the mean wage among men of the same age.

5 Implications

I have shown that the distribution of hours worked was much less egalitarian in the past than it is today and that much of the change in the inequality of the length of the work day could be explained by declines in the number of hours workers were willing to supply. In the past, in contrast to recent times, the labor supply curve was strongly backwards bending.

The backwards bending labor supply curve of the 1890s implies that circa 1890 increases in wages should have led to a decrease in the length of the work day. In fact, between 1890 and 1919 when real wages increased by 43 percent, the work day fell from 10 to 8 hours.[22] The elasticities estimated for 1973 and 1991 are small and between 1973 and 1991 the length of the work day barely changed. If the elasticity of labor supply in 1920 was small as well then that might explain why the length of the work day has remained unchanged since 1920. Recent estimates of the elasticity of daily hours supplied suggest that the average work day is likely to remain constant or even increase.

[22]The estimated labor supply elasticities over-predict the decline in the length of the work day suggesting that either elasticities were falling during this period or that labor demand was increasing.

Table 10: Weekly Earnings Inequality, Men and Women, 1890s, 1973, and 1991

Difference Deciles Log Weekly Earnings	Actual			At 1991 Hours	
	1890s	1973	1991	1890s	1973
Men					
90th-10th	1.13	1.16	1.39	1.36	1.22
90th-50th	0.57	0.56	0.65	0.68	0.59
50th-10th	0.56	0.60	0.73	0.67	0.63
Women					
90th-10th	1.22	1.55	1.59	1.53	1.69
90th-50th	0.62	0.63	0.71	0.80	0.65
50th-10th	0.61	0.92	0.89	0.73	1.00

Note. The 1890s data are weighted by the distribution of occupation groups in the 1900 population; nonetheless, because the 1890s data are not a random sample of the population, wage inequality in the 1890s may be underestimated. Weekly earnings in the 1890s were estimated assuming a regular work year of 307 days minus days lost due to unemployment, sickness, or other causes.

The changing labor supply curve has implications for earnings inequality. Table 10 shows that between 1973 and 1991 26 percent of the earnings inequality of men between the 90th and the 10th wage deciles could be attributed to differences in hours worked. For women more than all of the earnings inequality could be attributed to differences in hours worked. Table 10 also shows that had the 1991 pattern of hours worked prevailed in the past (but the number of days worked per week had remained unchanged) weekly earnings inequality would have been much greater in the past than it actually was. Because this calculation does not account for the fact that higher paid workers may have worked fewer hours on Saturday, the extent to which the inegalitarian distribution of daily work hours at the end of the last century equalized income is probably underestimated.[23] Nonetheless, the results suggest that an examination of income alone would underestimate the extent of inequality in the past.

In the 1890s when few wives worked in the labor force earnings inequality among

[23]The data sets with information on Saturday work had too narrow an occupational distribution to be permit generalizations to the population as a whole.

Table 11: Distribution of Total Weekly Hours Worked by Husbands and Wives by Weekly Household Earnings Deciles, 1973 and 1991

	1973					1991				
Earnings Decile	Husbands	Wives in LF	% Wives in LF	All Wives	Total	Husbands	Wives in LF	% Wives in LF	All Wives	Total
< 10 (Bottom)	41.39	28.00	9.38	2.63	44.01	38.24	37.03	38.36	14.20	52.45
10-20	42.28	29.46	17.42	5.13	47.61	42.07	36.44	52.18	19.02	61.08
20-30	42.36	31.01	29.91	9.28	51.63	42.92	37.33	62.86	23.47	66.39
30-40	50.89	31.71	24.83	7.87	50.89	43.26	36.43	58.25	21.22	64.48
40-50	42.80	32.67	46.09	15.06	57.86	42.50	36.33	62.17	22.58	65.09
50-60	43.33	33.91	47.98	16.27	59.60	42.51	35.78	65.50	23.44	65.94
60-70	43.93	35.09	51.18	17.96	61.89	43.30	36.66	70.72	25.93	69.23
70-80	43.05	35.41	69.42	24.58	67.63	43.55	36.83	71.09	26.18	69.73
80-90	44.24	36.55	63.01	23.03	67.27	44.24	36.78	72.40	26.83	71.07
≥ 90 (Top)	45.66	36.95	60.87	22.48	68.14	47.95	36.78	62.20	22.88	70.83

Note. The sample was restricted to married couples in which the husband was in the labor force and was age 25 to 64. Hours are the sum of husbands' and wives' hours. Hourly earnings are the sum of husbands' and wives' weekly earnings divided by the sum of weekly hours worked.

married couples was determined by the distribution of husbands' hourly wages and hours worked. But, this was not true in 1973 and in 1991. In 1973 and in 1991 the trend in combined hours of work of husbands and wives by the sum of their weekly earnings was very different from that of own hours by own wage decile (see Table 11).[24] Although between 1973 and 1991 the hours of husbands in the top household earnings decile increased relative to the hours of husbands in the bottom of the household earnings decile, labor force participation rates of wives in the bottom of the household earnings decile rose relative to the labor force participation rates of wives in the top of the household earnings decile. Among wives in the labor force, the hours of wives in the bottom decile rose relative to the hours of wives in the top decile.[25]

[24]Weekly hours are shown rather than daily hours because in 1991 daily hours were asked of only a supplement of workers.

[25]These findings do not contradict those of Juhn and Murphy (1997). The stratification here is by total household earnings, not by husband's earnings.

Table 12: Weekly Household Earnings Inequality, Married Couples, 1973 and 1991

Difference Deciles Log Weekly Earnings	Actual 1973	Actual 1991	1973 at 1991 Total Hours 1973 LFP women	1973 at 1991 Total Hours 1991 LFP women
90th-10th	1.16	1.34	1.21	1.19
90th-50th	0.55	0.61	0.59	0.58
50th-10th	0.61	0.73	0.63	0.61

Note. LFP=labor force participation rate. Weekly earnings of married couples are the sum of weekly earnings of wives and of husbands.

Table 12 shows that between 1973 and 1991 inequality in the sum of husbands' and wives' weekly earnings widened. Because the dispersion in husbands' hours of work widened as husbands in the highest combined household earnings deciles increased their hours while those in the lowest income deciles decreased their hours, 28 percent of the increase in earnings inequality could be accounted for by increases in the hours of husbands and wives holding wives' labor force participation constant. Counteracting the increasing dispersion of husbands' hours worked was the narrowing of dispersion in hours of wives in the labor force and the increase in wives' labor force participation in low earnings decile households. Once increases in wives labor force participation rates are accounted for then only 17 percent of the increase in earnings inequality among married couples could be accounted for by changes in hours worked.[26]

6 Conclusion

The distribution of work hours was very inegalitarian in the 1890s when the most highly paid worked 2 hours less per day than the lowest paid. By 1973 differences in hours worked between

[26]Even if the time women spend in housework were taken into account, differences in the daily work days of couples would remain about the same across earnings deciles. The time use surveys show that married women aged 18 to 64 spend about one and third hours in housework per day. The amount of time is slightly lower for college educated women, but the difference is not large.

the top and bottom deciles were small and by 1991 workers in the top wage decile worked the longest day. In the 1890s inequality of daily work hours equalized income, but between 1973 and 1991 it magnified weekly earnings inequality, accounting for 26 percent of earnings inequality between the top and bottom deciles among men, more than all of the earnings inequality among women, and 17 percent of the increase in total household earnings inequality among husband and wife households.

I argued that much of the change in the inequality of the length of the work day could be explained by declines in the relative number of daily hours workers were willing to supply. I showed that in the past, in contrast to recent times, the labor supply curve was strongly backwards bending. It was so backwards bending that wage increases more than explain the two hour decline in the length of the work day from 1890 to 1919.

I also showed that a rising intertemporal elasticity of substitution may account for the change in the elasticity of supply of daily hours of work estimated from a regression of daily hours of work on the hourly wage. In the 1890s men were more likely to smooth hours over their work lives than they were in 1973 and in 1973 they were more likely to smooth hours over the life cycle than they were in 1991. Several factors could explain the increased bunching of hours over the life cycle. The work day is no longer so long that it leaves individuals with little free time in the day. Better savings and borrowing vehicles may have weakened the link between current consumption and current income. Returns to experience that are not reflected in the aggregate wage profile may have increased. Private pensions and Social Security provide strong financial incentives to take leisure at older ages. The rise of mass tourism and increases in fixed costs of work such as those incurred in commuting are additional explanations. Explaining the increased bunching of work hours over the life cycle remains a topic for future research. Regardless of what the explanation is, the results of this paper imply that although the rich and the poor will always differ in terms of income, income differences no longer mean that the poor have less time for fun.

Appendix

Table 13: Length of the Working Day (Mean), 1890s and Today

	Daily Hours at Work
This data set, 1890s, (men only)	10.2
Weighted by 1900 occupational distribution	10.3
Weighted by 1910 industrial distribution	10.3
This data set, 1890s, (women only)	9.5
Weighted by 1900 occupational distribution	9.5
Manufacturing workers, 1880 Census (Atack and Bateman 1992)	10.0
Commissioner of Labor, 1890	10.0
Commissioner of Labor, 1900 (Whaples 1990: 33)	9.9
Manufacturing workers, 1890	10.0
Manufacturing workers, 1895	10.0
Manufacturing workers, 1900 (Series D 845-876 in US Bureau of the Census (1975: 172)	9.9
1973, usual hours, men, (May CPS)	8.4
1991, usual hours, men, (May CPS)	8.6
1973, usual hours, women, (May CPS)	7.6
1991, usual hours, women, (May CPS)	7.7
1985, actual hours, men, (time diary)	8.1
1985, actual hours, women, (time diary)	6.9

Note. The length of the average working day from the Commissioner of Labor was estimated assuming a work week of six days. Hours of work in 1973, 1991, and 1985 were weighted using the age distribution in the pooled data Labor was estimated assuming a work week of six days. Hours of work in 1973, 1991, and 1985 were weighted using the age distribution in the pooled data set and are for single job holders only. Hours of work from the May 1973 and 1991 CPS and the 1985 time diary were estimated from U.S. Department of Commerce (1981, 1992) and Robinson (1993). In 1973 usual hours per day were estimated from usual hours per week and usual days per week.

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