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Sources and Methods for the Estimates of Average Earnings per Hour at Work

The NBER series on average earnings per hour at work is composed of a number of segments which will be discussed below in turn. The order of discussion is not strictly chronological, but follows the logic of the construction of the series.

1947-57

For all years in this period except 1948, average earnings per hour at work were computed directly from the Census of Manufactures or the Annual Survey of Manufactures by dividing total wages by total man-hours worked by production workers. The figure for 1948 is interpolated using BLS average earnings per hour paid as an interpolator. The 1947 figures from BLS and the Census are the same, as are the interpolated 1948 figures.

1932-39

The Censuses of Manufactures of 1933, 1935, 1937, and 1939 included special reports of man-hour statistics for selected industries. The industry coverage increased from 32 industries in 1933 to 171 industries in 1939, using a classification of industries more detailed than that of the body of the Census of Manufactures. The coverage of establishments within the selected industries was generally very high. For the selected industries as a whole the proportion of all wage earners covered by the man-hour statistics was 83.2 per cent in 1933, 91.3 per cent in 1935, 91.6 per cent in 1937, and 89.7 per cent in 1939.

The proportion of manufacturing wage earners covered by the BLS

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man-hour data was 28 per cent in 1932, 42 per cent in 1934, and 55 per cent in 1940.¹ The coverage was somewhat higher than this on the average for the detailed industries for which average hourly earnings were published, but it was still substantially below the within-industry coverage of the Census man-hour statistics. The higher coverage of the latter and their inclusion of very small firms are the reasons for placing principal reliance on them.

To obtain our estimates of average earnings per hour of work for all manufacturing, the industries of the Census man-hour statistics were first matched with those of the BLS average hourly earnings series. This matching could be done with accuracy for 1939 because the BLS published the 1939 Census employment corresponding to its industry definitions. For 1933, 1935, and 1937 there may be some errors in matching. For each pair of matched industries the Census average hourly earnings were divided by the BLS average hourly earnings. The resulting ratios for 1939 are shown in Table 2. These ratios were averaged, using employment weights. The average ratio was then used to adjust the BLS all-manufacturing series on the assumption that the percentage difference would be the same for the industries not covered by Census man-hour statistics as for those covered. Line 2 of Table 3 shows the correction ratios for each of the four Census years. The 1933 correction factor was applied to 1932. For 1934, 1936, and 1938 the correction factors for the two adjacent Census years were averaged.

As a check on the procedure just described, the same procedure was followed for average weekly hours. The combined corrections for average hourly earnings and average weekly hours were then applied to the BLS series on average weekly earnings, and the corrected figures were compared with average weekly earnings derived from the full Census of Manufactures (average annual earnings divided by 52). In each case BLS weekly earnings were adjusted downward, and in each case the adjusted figure was still above the Census figure (see Table 3). The small remaining underadjustment cannot be corrected because there is no basis for allocating it between hours and earnings.

The 1939 ratios of Census to BLS average hourly earnings by industries are positively correlated with the coverage of the BLS man-hour sample in 1940. For 41 of the industries in Table 2 for which BLS coverage data have been published, the coefficient of correlation between the earnings ratio and the percentage of coverage was +.48, which is significant at the 1 per cent level. Since the Census man-hour data show that in 1939 the smallest establishments had below average earnings, this

¹ BLS Bulletin 697, p. 35.

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TABLE 2

Comparison of Average Hourly Earnings Data by Industry, 1939

Industry	Average Hourly Earnings (cents)		Ratio (Col. 2 Divided by Col. 1) (3)
	BLS (1)	Census Man-Hour Statistics (2)	
Slaughtering and meat packing	68.6	64.8 ^a	.945
Flour	60.5	55.1	.911
Sugar, beet	58.5	52.6	.899
Sugar refining, cane	63.6	61.6	.969
Malt liquors	91.6	84.7	.925
Tobacco	47.6	44.6 ^a	.937
Cotton smallwares	47.4	44.8	.945
Cotton manufactures except smallwares	38.9	37.8 ^a	.972
Dyeing and finishing textiles	53.5	52.4 ^a	.979
Silk and rayon goods	42.9	41.1 ^a	.958
Woolen and worsted goods	52.8	51.3 ^a	.972
Carpets and rugs, wool	64.4	65.1	1.011
Knit cloth	46.8	47.0	1.004
Knit underwear	41.0	38.6	.941
Knit outerwear	46.1	43.4 ^a	.941
Hosiery	53.6	49.3 ^a	.920
Work shirts	30.9	30.0	.971
Shirts, collars, and nightwear, men's and boys'	39.8	36.1 ^a	.907
Underwear and neckwear, men's and boys'	40.1	39.3 ^a	.980
Men's clothing, n.e.c.	58.1	51.5 ^{a, b}	.886
Lumber and timber	48.9	46.0 ^a	.941
Furniture	53.0	49.1 ^a	.926
Paper and pulp	62.0	61.0 ^a	.984
Rayon and allied products	64.6	65.3	1.011
Soap	70.7	70.1	.992
Drugs, medicines, and insecticides	59.2	52.2	.882
Petroleum refining	97.4	92.0	.945
Rubber products	75.4	73.1 ^a	.969
Leather	63.4	61.4 ^a	.968
Cement	69.9	67.1	.960
Brick, tile, and terra cotta	54.3	50.3 ^a	.926
Pottery and related products	62.5	57.7 ^{a, c}	.923
Glass	72.1	69.1 ^a	.958
Nonferrous alloying, rolling, and drawing	72.9	68.0	.933

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TABLE 2 (Continued)

Comparison of Average Hourly Earnings Data by Industry, 1939

Industry	Average Hourly Earnings (cents)		Ratio (Col. 2 Divided by Col. 1) (3)
	BLS (1)	Census Man-Hour Statistics (2)	
Nonferrous metals, primary smelting and refining	69.9	67.6	.967
Aluminum manufactures Blast furnaces, steel works, and rolling mills	69.9	69.4 ^a	.993
Steel castings	84.5	83.1 ^a	.983
Gray iron castings	75.9	73.1	.963
Malleable iron castings	69.9	64.1	.917
Cast iron pipe	67.1	63.1	.940
Tin cans	58.1	55.3	.952
Wirework	61.1	59.1	.967
Plumbers' supplies	68.3	61.5	.900
Stamped, enameled, and galvanized ware	67.6	64.0	.947
Electrical machinery	62.7	59.2 ^{a, d}	.944
Engines and turbines	70.2	66.9 ^a	.953
Machine tools	76.7	74.0 ^a	.965
Machine tool accessories	75.2	75.8	1.008
Automobiles	77.7	77.5	.997
	92.9	89.9 ^a	.968

SOURCE: Computed from Census of Manufactures, 1939: "Man-hour Statistics for 171 Selected Industries"; and *Monthly Labor Review*, February 1948, pp. 222-230.

^a Employment-weighted average for more than one industry as defined in the Census man-hour data.

^b Earnings for "men's hats and caps" estimated, using 1947 ratio to earnings of other industries in the group.

^c Earnings for "china decorating" estimated, using 1947 ratio.

^d Earnings for "galvanizing" estimated, using 1947 ratio.

correlation reinforces the view that omission of many of these small establishments biases the BLS earnings data upward.

An unexpected feature of Table 3 is that the ratio of Census to BLS average hourly earnings falls from 1933 to 1939. This is not, for the most part, a result of the increase in the number of industries covered by the comparisons. The fall occurs in the ratios for most of the industries individually. The improved coverage of the BLS data over the period would lead one to expect the opposite movement.

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TABLE 3

BLS and Census Data on Hours and Earnings, Manufacturing, Census Years, 1933-39

	1933	1935	1937	1939
1. Average hourly earnings, BLS (¢)	44.2	55.0	62.4	63.3
2. Adjustment ratio	.988	.977	.971	.953
3. Adjusted hourly earnings (¢)	43.7	53.7	60.6	60.3
4. Average weekly hours, BLS	38.1	36.6	38.6	37.7
5. Adjustment ratio	.996	.998	.982	.993
6. Adjusted weekly hours	37.9	36.5	37.9	37.4
7. Average weekly earnings, BLS (\$)	16.73	20.13	24.05	23.86
8. Adjusted weekly earnings ^a (\$)	16.46	19.65	22.94	22.59
9. Average weekly earnings, Census ^b (\$)	16.42	19.53	22.71	22.16

SOURCE: Computed from Censuses of Manufactures, 1933-39, especially "Man-hour Statistics for Selected Industries," and *Monthly Labor Review*, July, 1955, p. 803.

^a The product of lines 2, 5, and 7.

^b 1939 definition of manufacturing used in all years.

Table 4 suggests the explanation for the fall in these ratios. It gives, for nine selected industries, the Census man-hour data on average hourly earnings by size of establishment, expressed as percentages of the industry average. The industries were selected to include those with the sharpest falls in the earnings ratio, plus two industries, basic steel and automobiles, in which there was an especially sharp growth in union organization during the period.

Table 4 shows that in each of the nine industries, wages in the smallest establishments fell relative to the industry average from 1933 to 1939. In several industries, the smallest establishments had earnings higher than the industry average in 1933, and the 1933 earnings ratio was above unity in each of those cases. The fall in the relative earnings of these smallest plants meant that in 1939 their omission or underrepresentation had a greater tendency to pull up the BLS average earnings than in 1933, even though the sample coverage had improved.

Two possible explanations of the shift in the earnings pattern by establishment size suggest themselves. One is that unionization affected the large establishments most. This is supported by the very large change shown in Table 4 for the automobile industry. The shift in the steel industry, however, is about average for the industries shown. The other possible explanation is that very small plants cut wages less than others during the Great Depression, perhaps because workers were more specialized to the plant or there were closer personal relations between em-

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TABLE 4
Average Hourly Earnings by Establishment Size, Selected Industries, 1933 and 1939
(per cent of industry average)

No. of Wage Earners	1933	1939	1933	1939
	<i>Flour</i>		<i>Woolen and Worsted</i>	
1-20	87	76	104	90 ^a
21-100	96	95	102	93 ^a
101-2500	113	120		
101-500			99	98 ^a
Over 500			101	104 ^a
Earnings ratio ^b	.965	.911	1.008	.972
	<i>Hosiery</i>		<i>Knit Underwear</i>	
1-20	87	79	123	96
21-100	91	85	98	94
101-500	96	95	105	101
Over 500	105	109	87	100
Earnings ratio ^b	.969	.920	1.049	.941
	<i>Petroleum Refining</i>		<i>Leather</i>	
1-20	90	76	109	88
21-100	88	85	99	92
101-500	93	96		
101-2500			100	102
Over 500	105	105		
Earnings ratio ^b	.982	.945	1.054	.968
	<i>Machine Tools</i>			
1-20	99	81		
21-100	95	88		
101-2500	101	102		
Earnings ratio ^b	1.030	1.008		
	<i>Blast Furnaces, Steel Works, and Rolling Mills^c</i>		<i>Automobiles</i>	
1-20			91	65
1-100	96	82		
21-100			78	64
101-500	96	89	88	80
500-2500	100	100	98	100
Over 2500	102	103	104	105
Earnings ratio ^b	.976	.983	.980	.968

SOURCE: Computed from Census of Manufactures, 1933 and 1939, "Man-hour Statistics for Selected Industries."

^a Regular factories only.

^b Average hourly earnings, Census man-hour statistics, divided by average hourly earnings, BLS.

^c Includes steel castings in both years.

Sources and Methods for Estimates of Average Earnings per Hour ployers and workers.² This argument might account for the cases in which wages in the smallest plants were above the industry averages in 1933.

1939-47

No Census man-hour data are available for the period 1939-47. The NBER earnings series for these years was obtained by interpolating a factor for the adjustment of the BLS series with the aid of scattered data from several sources.

The procedure was first to estimate average weekly hours at work for the years 1940-46. As shown in Table 3, the ratio of Census to BLS hours was .993 in the paired industries in 1939. By 1947 it was .971 for all manufacturing; the drop is due, of course, to the increase in paid vacations, holidays, and sick leave. Available evidence suggests that this increase was not uniform over the period, but began in earnest after 1943 as a result primarily of policies of the National War Labor Board. By the end of 1943, the Board had a general policy of approving or ordering a one-week paid vacation after one year of service and two weeks after five years, and of approving straight-time pay for six holidays if not worked where this conformed to area or industry practice.³

Rough estimates of vacations and holidays paid for and not worked in 1943 and 1946 were made from data of the National Industrial Conference Board.⁴

The 1943 data cover 150 companies, of which 110 were in manufacturing. Sixty-four per cent of the total number of companies had paid vacation plans; one week after one year and two weeks after five years was typical. I have assumed that the average for all workers in the companies with plans was one week; for all companies, this means 1.19 per cent of hours paid for were vacation hours. No data were available for paid holidays. Accordingly, the ratio of hours worked to hours paid for 1943 was assumed to be .989. The figures for 1940-42 were linear interpolations between this ratio and the one for 1939 of .993, derived from the Census data.

The NICB study of 1946 covered 254 companies, of which 215 were in manufacturing. The typical paid vacation plan was unchanged, but the percentage of all companies with plans rose to 88. In addition, 42 per

² This point was suggested by H. G. Lewis.

³ See *The Termination Report of the National War Labor Board*, Washington, 1917, Vol. I, pp. 338-41, 361-64. Since wages were being held down by wage controls, employers had a strong incentive to give all allowable fringe benefits.

⁴ *Wartime Influences on Vacation Policies*, Studies in Personnel Policy No. 56. New York, 1943, and *Vacation and Holiday Practice*, Studies in Personnel Policy No. 75, New York, 1946.

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cent of all companies gave pay for the most widely observed holiday (Christmas), and the average number of holidays observed by manufacturing companies giving holiday pay was 5.5, or an average of 2.3 paid holidays a year for all manufacturers. The estimate of total vacation and holiday time paid for and not worked derived from this survey was 2.5 per cent of all time paid. This gives a ratio of .975 of hours at work to hours paid, just above the 1947 ratio, .971, of Census to BLS hours. The years 1944 and 1945 were obtained by linear interpolation between the 1943 and 1946 estimates from the NICB surveys. These surveys may not represent conditions in all manufacturing very accurately; however, the series of hours ratios based on them falls slowly from 1939 to 1943 and more rapidly thereafter, a result in keeping with the timing of actions by the War Labor Board.

The series of hours at work obtained by the methods just described then had to be transformed into a series on hourly earnings. This was done by taking the ratios of Census to BLS average weekly earnings in 1939 and 1947 and making a linear interpolation for the intervening years. The BLS average weekly earnings for each year were multiplied by these ratios and the adjusted weekly earnings estimates were divided by the series on hours worked per week. The estimates are shown in Table 5.

TABLE 5
Estimates of Hours and Earnings, Manufacturing, 1939-47

Year	Average Weekly Hours, BLS (1)	Adjustment Ratio (2)	Estimated Hours at Work (3)	Average Weekly Earnings		Average Earnings per Hour at Work ^a (6)
				BLS (4)	Adjusted (5)	
1939	37.7	.993	37.4	\$23.86	\$22.59	\$0.603
1940	38.1	.992	37.8	25.20	23.95	0.634
1941	40.6	.991	40.2	29.58	28.23	0.701
1942	42.9	.990	42.5	36.65	35.11	0.827
1943	44.9	.989	44.4	43.14	41.48	0.934
1944	45.2	.984	44.5	46.08	44.48	1.00
1945	43.4	.980	42.5	44.39	43.01	1.01
1946	40.4	.975	39.4	43.82	42.62	1.08
1947	40.4	.971	39.2	49.97	48.80	1.24

SOURCES: See text.

^a Column 5 divided by column 3.

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For the period 1920-31, two earnings series are available: that of the National Industrial Conference Board (NICB) and the historical estimates of the Bureau of Labor Statistics. The year-to-year movement of the NBER earnings series for this period is based on the NICB data. The level of the NICB series has been adjusted downward to the levels of the adjacent segments of the NBER series. The downward adjustment is 11.4 per cent in 1932; it is based on a one-year overlap between the NICB series and the 1933-39 segment of the NBER series previously described. In 1920, the adjustment amounts to 6.1 per cent; for intervening years the adjustment factors are obtained by linear interpolation. The adjustment factor for 1920 was gotten by extending the estimates for 1914-19, to be described below, into 1920, using as an extrapolator the index of wage rates developed by Daniel Creamer.⁵

The need for the downward adjustment of the level of the NICB series arises from the probable overrepresentation of large firms in the NICB sample, and from the underrepresentation of the South.⁶

The NICB data for 1922 cover only the last six months; the data for 1920 cover only the last seven months. The annual average for 1922 was estimated by using Creamer's wage rate index as an interpolator for the missing months; for 1920 Creamer's index was used to extrapolate the NICB data back to January.⁷

The use of NICB rather than BLS data in estimating hourly earnings for 1920-31 requires explanation. For 1923-31, the basic BLS data are for twelve industries, each of which was studied for a limited number

⁵ Daniel Creamer, with the assistance of Martin Bernstein, *Behavior of Wage Rates during Business Cycles*, Occasional Paper 34, New York, NBER, 1950. Creamer's index of wage rates for all manufacturing is based on reports of changes in wage rates from establishments in the BLS employment and payroll sample in thirteen industries. Within establishments, wage changes are weighted by the number of workers affected; within industries (until 1923), they are weighted by the number of establishments reporting each average wage change. Establishments not reporting any change are considered to have made none.

The use of an index of wage rates to represent average hourly earnings would involve considerable error over long periods. For brief periods, the results should be reasonably satisfactory.

⁶ Of 1,444 plants reporting to the NICB in the fourth quarter of 1930, only 109 were in the South, and of these 37 were in the border states Delaware, Maryland, and West Virginia. See National Industrial Conference Board, *Wages in the United States, 1914-1930*, New York, 1931, pp. 42-43.

⁷ In *Wages, Prices, Profits, and Productivity*, King's data were used for this interpolation (W. I. King, *Employment Hours and Earnings in Prosperity and Depression, United States, 1920-1922*, New York, NBER, 1923). Creamer's index has two advantages for present purposes. It is monthly rather than quarterly, which is important in 1920, and it covers only wages, whereas King's data are for wages and salaries combined.

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of payroll periods every other year. To turn these data into a continuous annual series the BLS had to do a good deal of interpolation. In contrast, the NICB data for 1923-32 are a continuous monthly series covering twenty-five industries.⁸ The BLS data are undoubtedly more representative within industries, especially geographically, than the NICB data. However, much of the effect of the bias in NICB coverage may have been removed by adjusting the level of the series downward.

The level of earnings in the BLS historical series also appears to be too high. To see why requires an understanding of the construction of the BLS series.

The BLS estimates for 1923-29 were made essentially as follows: (1) The BLS average hourly earnings data for twelve industries were combined into an annual series. (2) Average weekly earnings for the same industries were obtained from the continuous BLS payroll and employment series, which uses the biennial Censuses of Manufactures as bench marks. (3) Average weekly hours for these industries were obtained by dividing the weekly earnings data of step 2 by the hourly earnings estimates of step 1. (4) By minor adjustments based on Census prevailing hours data for 1923 and 1929, the hours series of step 4 was converted into an estimate of average weekly hours for all manufacturing. (5) Average hourly earnings for all manufacturing were obtained by dividing average weekly earnings for all manufacturing—taken from the payroll and employment series—by the average weekly hours of step 4.⁹ For 1930 and 1931, the BLS estimates of hourly earnings in all manufacturing are interpolations based on the trend of hourly earnings in the twelve surveyed industries.

It is my contention that error is introduced into the BLS estimates at step 3. The divisor and dividend in this step come from samples with very different characteristics. The weekly earnings data, because they use Census bench marks, have reasonably full coverage of small establishments; the hourly earnings data probably do not. The resulting weekly hours series is too low—considerably lower than the hours reported directly in the studies of the twelve industries.¹⁰ The level of hours is not appreciably affected by step 4. The divisor of step 5 is thus too small and the resulting hourly earnings series is too high.

The accuracy of the contention of the last paragraph can best be judged by comparing the BLS historical series on weekly hours with other

⁸ The BLS counts foundries and machine shops as one industry; NICB counts five branches of this industry as separate industries.

⁹ See "BLS Historical Estimates of Earnings, Wages, and Hours," *Monthly Labor Review*, July 1935, pp. 805-806.

¹⁰ The statement following the dash is based on work in progress by Ethel B. Jones.

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available information on weekly hours during the 1920's, some of which is shown in Table 6. The first column of this table shows the actual weekly hours implicit in the NBER hourly earnings estimates; these are obtained by dividing the BLS-Census weekly earnings series by the NBER hourly earnings series. The second column is the NICB hours series, which lies slightly above the implicit NBER series. The BLS series, in the third column, lies two to four hours below the other two series in each year.

TABLE 6
Average Weekly Hours, All Manufacturing, 1923-29

Year	Average Actual Hours			Census Prevailing Hours (4)
	NBER (Implicit) (1)	NICB (2)	BLS (3)	
1923	47.7	49.2	45.6	51.2
1924	46.4	46.9	43.7	
1925	47.5	48.2	44.5	
1926	47.7	48.1	45.0	
1927	47.4	47.7	45.0	
1928	47.8	47.9	44.4	
1929	47.2	48.3	44.2	50.1

SOURCES

Column 1: BLS average weekly earnings divided by NBER average hourly earnings.

Column 2: M. Ada Beney, *Wages, Hours, and Employment in the United States, 1914-1936*, New York, National Industrial Conference Board, 1936, pp. 44-46.

Column 3: *Monthly Labor Review*, July 1955, p. 805.

Column 4: Computed from frequency distributions in the Census of Manufactures, using the 1939 definition of manufacturing.

The last column of Table 6 shows the average prevailing or full-time hours of work as computed from the Census for 1923 and 1929. (No such data are available for the intervening Census years.) The relation between these and the NBER or NICB data seems more reasonable than their relation to the BLS data. It is hard to understand why in prosperous years firms would report "prevailing hours" 12 or 13 per cent higher than average actual hours.

In constructing its historical series, the BLS did not use its industry earnings data for 1920-22; they were not considered an adequate basis for all manufacturing estimates. Instead, the series is based on W. I. King's study, which gives combined data for wage earners and salaried

Sources and Methods for Estimates of Average Earnings per Hour workers.¹¹ The BLS has adjusted the level of King's earnings data, using annual earnings data for wage earners and for salaried workers from the Censuses of Manufactures of 1919 and 1923, to get estimates for wage earners alone. However, in a period of severe depression, wages undoubtedly differed from salaries in movement as well as in level. Perhaps because of the inclusion of salaries, the BLS hourly earnings series based on King's data drops only 12 per cent from 1920 to 1922, while the NBER series based on NICB and Creamer drops 18 per cent.

The King data have the additional disadvantage that they do not overlap the BLS estimates that begin with 1923, or the BLS estimate for 1919, so that the BLS historical series uses no direct evidence on the movement of wages from 1922 to 1923 or from 1919 to 1920. In the NBER estimates, all segments overlap, though the need for considerable splicing is itself a disadvantage.

The King study gives actual and prevailing hours for 1921 for the same sample of establishments. These data are shown in Table 7 together

TABLE 7
Average Weekly Hours in All Manufacturing, 1921

Actual hours	
NBER, implicit	45.5
NICB	45.6
King	45.9
BLS	43.1
Prevailing hours	
Census	50.9
King	49.6
Ratio, actual to prevailing, King	.924
Census prevailing hours multiplied by King ratio	47.1

SOURCES: See text and notes to Table 6.

with figures from other sources. The BLS apparently did not rely wholly on King in obtaining the level of hours for 1920-22, but relied in part on its estimates for 1923-29. The result is that the BLS estimate is again the lowest available; this again implies a high estimate of hourly earnings. The average actual weekly hours implicit in the NBER earnings estimates are very close to those of the King and NICB data. If the King study is used to get a ratio of actual to prevailing hours and this ratio is

¹¹ *Employment Hours and Earnings*, p. 113.

Sources and Methods for Estimates of Average Earnings per Hour applied to the prevailing hours computed from the Census, an even higher figure is obtained. (See the last two lines of Table 7.)

1914-19

The NBER earnings series for 1914-19 is a direct continuation of the series for 1890-1914 presented in *Real Wages in Manufacturing, 1890-1914*,¹² in the sense that the same general sources and methods are used. Since the methods will be fully described in that study, the discussion here will be brief.

Table 8 shows the NBER hourly earnings series for 1914-19 and the principal series from which it is derived. Column 1 shows average annual earnings per full-time equivalent worker in all manufacturing; the 1914 and 1919 figures are computed from the Censuses of Manufactures; the

TABLE 8
Annual, Daily, and Hourly Earnings, Manufacturing, 1914-19

	Average Annual Earnings ^a (1)	Days in Operation (2)	Average Daily Earnings (3)	Full-Time Daily Hours (4)	Average Hourly Earnings (cents)		
					NBER (5)	Douglas All Mfg. (6)	Douglas Payroll (7)
1914	\$574	281	\$2.04	9.28	22.0	28.7	21.3
1915	592	284	2.08	9.23	22.6	28.7	21.2
1916	702	291	2.41	9.19	26.2	32.0	25.0
1917	837	291	2.88	9.11	31.6	36.4	29.9
1918	1077	291	3.70	8.86	41.7	44.8	37.4
1919	1142	279	4.10	8.59	47.7	52.9	44.8

SOURCES

Column 1: 1914 and 1919 computed from Census of Manufactures; 1915-18 interpolations based on data from Massachusetts, *Annual Report on the Statistics of Manufactures*; New Jersey, Bureau of Statistics of Labor and Industries, *Annual Reports* (1915 and 1916 only); and Pennsylvania, Department of Labor and Industry, *Annual Reports*.

Column 2: Computed from state sources used for column 1.

Column 3: Column 1 divided by column 2.

Column 4: 1914 and 1919 computed from Censuses of Manufactures; 1915-18 interpolations based on Douglas, *Real Wages in the United States*, p. 114.

Column 5: Column 3 divided by column 4.

Column 6: Douglas, *Real Wages in the United States*, p. 101.

Column 7: *Ibid.*, p. 108.

^a Per full-time equivalent worker.

¹² Albert Rees with the assistance of Donald P. Jacobs, Princeton for NBER, in press.

Sources and Methods for Estimates of Average Earnings per Hour

figures for the remaining years are interpolations. Annual earnings data from the state labor statistics of three states are used as interpolators: New Jersey for 1914-16, Massachusetts for 1914-18, and Pennsylvania for 1914-19.¹³ Column 2 is the average number of days per year that establishments were in operation; these are from the same state sources as the interpolator of column 1. Dividing column 1 by column 2 gives average daily earnings (column 3).

Column 4 shows estimates of average hours per day. These are prevailing or full-time hours; in the method of this segment, the allowance for layoffs or short work weeks is in the days in operation. The estimates of daily hours for 1914 and 1919 are computed from the frequency distributions of prevailing weekly hours in the Censuses of Manufactures; it is assumed that there were six days in the full-time work week. The figures for 1915-18 are interpolated, using as an interpolator the Douglas series of full-time weekly hours in "payroll" industries (those for which the data are not union scales). Column 5, average hourly earnings, is column 3 divided by column 4.

The BLS historical series omits the years 1915-18. For 1919, the BLS average hourly earnings figure is an average computed directly from wage surveys of 27 industries, and should be more accurate than the BLS estimates for the 1920's. Our estimate for 1919 happens to be identical with the BLS figure: 47.7 cents per hour. The BLS estimate for 1914, 22.3 cents, is slightly above the NBER estimate of 22.0 cents.¹⁴

For comparison, Table 8 also shows two of the Douglas hourly earnings series: average hourly earnings in all manufacturing and in payroll industries. Because of its heavy reliance on union scales, the all-manufacturing series lies above the NBER series in 1914, but it rises less rapidly. The NBER series rises 117 per cent, compared with 84 per cent for the Douglas all-manufacturing series; the rise in the former is more concentrated in the war years 1917 and 1918.

The series for payroll industries lies slightly below the NBER series, but has much the same movement for the period as a whole; it rises 110 per cent.

¹³ This method of estimating annual earnings is similar to that used by Douglas in *Real Wages in the United States* for the period before 1914. Differences in the estimates for Census years arise because we use a 1939 definition of manufacturing, while Douglas uses a current definition. For the non-census years after 1914 Douglas used a very different method of interpolation, largely because it provided monthly data (*ibid.*, pp. 236-238). The resulting annual earnings series are quite different: Douglas's averages for full years are 1914, \$580; 1915, \$568; 1916, \$651; 1917, \$774; 1918, \$980; 1919, \$1,158.

¹⁴ For discussion of the 1914 estimates, see *Real Wages in Manufacturing, 1890-1914*, and "BLS Historical Estimates of Earnings, Wages, and Hours," pp. 803-804.