# CHAPTER 3

## Money Wages

THIS chapter is concerned with the movement of money wages in manufacturing and the discussion is restricted to wage earners or production workers. Data are available on the annual earnings of salaried workers, but we have not made use of them. Figures on hourly earnings are not available.

Although we have spoken of "wages" above and will do so throughout the chapter, this expression is used for brevity and is not strictly accurate. We are measuring changes in average hourly earnings, defined as total wage-earner payrolls divided by the number of man-hours worked. These differ from wage rates, which are the basic hourly rates for specific tasks established by employers or by unions. Our measures of average hourly earnings are affected throughout by shifts in the occupational and industrial composition of the work force, as well as by changes in wage rates for particular occupations. An index of wage rates with constant weights would not reflect such shifts in composition. At the end of this chapter we report one test in which we hold industry weights constant and find that this makes no difference in the movement of our series.

Other sources of difference between wage rates and average hourly earnings, such as overtime and shift premiums, are important today but were probably not so during the period of our study. Payment by piece rates, however, was important. For workers paid on piece rates rather than time rates, average hourly earnings will rise as output per man-hour rises even if the piece rates are constant.

A study of wage movements for a more recent period would also have to take account of wage supplements or fringe benefits. We have no data on wage supplements during the period but believe them to be negligible. Toward the end of the period, employers' premiums for workmen's compensation would have been present in some states.[1]

[1] Our data may also fail to catch some wages paid in kind. The instructions for the Census of 1905 state that room and board furnished as part payment of wages are to be included in wages, but this instruction may not always have been followed (see *Census of Manufactures, 1905*, Part I, p. 578).

The next section of this chapter deals with the sources and methods used by Douglas in his estimates of money wages. The following sections discuss our own sources and methods, and present our estimates of money wages for all manufacturing and for a number of individual manufacturing industries. Wherever possible, we make comparisons between our estimates and data from independent sources and seek to explain the differences that are found.

We find that Douglas's estimates of money wages for all manufacturing and for a number of industries are at too high a level because of his reliance on union rates. However, the differences in trend are minor.

## *Douglas's Data*

Those of the studies discussed in Chapter 2 that run beyond 1907 use two kinds of money-wage data: union rates and occupational earnings taken from payrolls. A discussion of the limitations of these data will make clearer our reasons for turning to alternative sources.

Union rates have two kinds of defects. First, they tend to be more stable through time than the earnings actually received by union members. Second, when used to represent industries only partially unionized, their absolute level is too high. Both of these defects were recognized by Leo Wolman as early as 1932,[2] but no alternative series is available that remedies them.

On the first point Wolman wrote: "Union wage rates, moreover, have defects peculiar to themselves. They rarely reflect actual changes in the rate of wages and, particularly during periods of depression they can be regarded as no more than nominal rates which conceal the true movement of wages. This is indubitably the case with the reported union rates of wages during the present depression in the building and other unionized industries, with the possible exception of the printing industry. That the same policy of reporting nominal data has been observed in earlier depressions is, I think, beyond question."[3]

To show the effects of the use of union rates to describe the level of wages for the whole of partially unionized industries, Wolman

[2] "American Wages," *Quarterly Journal of Economics*, February 1932, pp. 398–406. This is a review note of Douglas's *Real Wages in the United States, 1890–1926*. For a more recent criticism along the same lines, see "Nongovernmental Historical Series on Earnings, Wages, and Hours," *Monthly Labor Review*, August 1955, pp. 918–919, a technical note based on a memorandum by Witt Bowden.

[3] "American Wages," pp. 401–402.

compared Douglas's union rate data with payroll data from the National Industrial Conference Board (NICB). These comparisons for 1914 are shown in Table 4; we have added "foundries and machine shops" to the industries shown by Wolman.

TABLE 4

Union Rates and Payroll Data, Three Industries, 1914
(cents per hour)

| | Union Rates (Douglas)[a] | Hourly Earnings (NICB)[b] |
|---|---|---|
| Book and job printing | 45.1 | 30.2 |
| Newspaper printing | 61.0 | 37.8 |
| Planing mills[c] | 40.4 | 22.4 |
| Foundries and machine shops[d] | 41.3 | 27.8 |

[a] Paul H. Douglas, *Real Wages in the Unites States, 1890–1926*, Boston, 1930, p. 96.

[b] National Industrial Conference Board, *Wages and Hours in American Industry*, New York, 1925, pp. 176, 180, 188, and 124; data are for July. See also Leo Wolman, *The Growth of American Trade Unions, 1880–1923*, New York, NBER, 1924, p. 402.

[c] Called "lumber manufacturing and mill work" by NICB, but excludes sawmills.

[d] The union rate data are for "metal trades." They include quotations from industries other than foundries and machine shops, but Douglas gives them the census weight of that industry. For further details see pp. 59–60.

Although none of Douglas's series is based on union rates before 1907, errors of level affect the entire period from 1890, since the earlier data are linked to the later to provide continuity. (The high level of the union-rate data does not constitute evidence that unions raised wages—see p. 59–60 below.)

The problems involved in Douglas's use of union rates can also be seen by comparing the percentage of manufacturing workers organized with the portion of the total weight of Douglas's all-manufacturing series given to union rates. The union rates are clearly overweighted as a result of Douglas's decision in combining industries to weight union rates by the total number of skilled and semi-skilled workers in the industry rather than by union membership. Wolman has estimated the extent of union organization by industry in 1910. For the industries including the groups covered by the union-rate series, Wolman gives the following estimates of the percentage of union membership: metal trades, except iron and steel, 6.5 per cent; marble and stone yards, 45.4; bakeries, 17.4; printing

and publishing, 34.3; and lumber and furniture, 10.3.[4] For all manufacturing Wolman estimates the percentage organized in 1910 as 11.6, while Douglas gives to union rates 31.5 per cent of the total weight of all manufacturing in 1910.[5]

The data for the payroll industries are far superior to those for union industries. Nevertheless, they too present problems. The most important of these is that prior to 1914, data were collected only for "selected occupations," generally those peculiar to the industry. Thus, most of the unskilled workers, and perhaps some of the semiskilled, were excluded. Douglas deals with this difficulty by linking the data for specified occupations to those for all occupations at 1914, thus accepting the level of the 1914 data throughout the earlier part of his series. This is clearly the best method available, and the results seem to be satisfactory in most cases. The absence of data for the unskilled may, nevertheless, be a source of error at some points.

A second difficulty is that in two of the payroll industries, Douglas interpolated hourly earnings for part of the period by assuming that they moved with annual earnings. The interpolations are for 1908–10 in clothing and for 1908–17 in meat packing. We have been unable to make better estimates for either of these industries from alternative data. However, to the extent that Douglas's all-manufacturing series rests on these interpolated data, it is subject to errors that can, in part, be avoided.

The payroll data for basic iron and steel have a special defect; they cover only certain departments of the industry. We will show later that the omissions result in errors both of level and of movement.

The final reason for seeking alternatives to the payroll data is the size and nature of the payroll sample. This sample is very small in the early years of the period and clearly not a random one. The most important discernable way in which it is nonrandom is in the size of establishments included, which tend to be substantially larger than the average of all establishments. Table 5 shows the changes in sample size for three of the payroll industries, in absolute numbers and as a percentage of census employment. The average number of workers per establishment in the BLS sample in 1914 was 623 for boots and shoes, 893 for cotton goods, and 835 for woolens and

[4] Leo Wolman, *The Growth of American Trade Unions, 1880–1923*, New York, 1924, Appendix Table VII.

[5] Interpolated from the figures for 1904 and 1914 given in Douglas, *Real Wages*, p. 94. Wolman, in "American Wages," makes a comparison for 1920 similar to that made here for 1910.

TABLE 5

Coverage of BLS Payroll Samples, Three Industries, Census Years, 1890–1914

| | Boots and Shoes | | | | Cotton Goods | | | | Woolen and Worsted | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Establishments* | | | | *Establishments* | | | | *Establishments* | | | |
| | Number in Sample[a] | % of Census | Number of Workers[b] | % of Census Employment | Number in Sample[a] | % of Census | Number of Workers[b] | % of Census Employment | Number in Sample[a] | % of Census | Number of Workers[b] | % of Census Employment |
| 1890[c,d] | 26 | 1.2 | 938 | 0.7 | 22 | 2.4[e] | 6,498 | 3.0[e] | 15 | 1.0 | 3,078 | 2.6 |
| 1899[d] | 37 | 2.3 | 1,416 | 1.0 | 24 | 2.5 | 7,506 | 2.5 | 15 | 1.2 | 3,041 | 2.4 |
| 1904[f] | 45 | 3.4 | 4,865 | 3.2 | 29 | 2.7 | 15,115 | 4.9 | 27 | 2.7 | 6,592 | 4.6 |
| 1909 | 26 | 1.9 | 4,090 | 2.2 | 36 | 3.0 | 12,698 | 3.4 | 19 | 2.1 | 6,798 | 4.2 |
| 1914[f] | 84 | 6.2 | 51,054 | 26.6 | 90 | 7.6 | 78,582 | 20.7 | 48 | 6.0 | 40,061 | 25.2 |

SOURCE: *Nineteenth Annual Report of the Commissioner of Labor* (1905) and BLS Bulletins Nos. 232, 238, and 239.

[a] Number of establishments is shown in the sources for 1890, 1899, and 1904 by occupation only. The number shown here is the largest for any one occupation in the given year. The total for all occupations may exceed this number if some establishments did not report for the occupation shown here.

[b] The employment totals were computed under the direction of Leo Wolman and are taken from his workbooks in the files of the National Bureau of Economic Research.

[c] Census data shown for 1890 refer primarily to 1889.

[d] Census data exclude custom work and repairing.

[e] Census data include cotton smallwares.

[f] Two samples for the same year were taken in 1904 and in 1914, one comparable with the preceding year and one with the following year. The figures shown here refer to the larger of the two samples for each statistic separately.

worsteds. The corresponding averages from the Census of 1914 were 141, 323, and 199. Such comparisons are not possible for earlier years, when the BLS data do not include all the workers in each establishment. Presumably the disparities were larger when the BLS sample was much smaller.

These defects of the payroll data led us to make alternative estimates, wherever possible, for the payroll industries as well as for the union industries. However, as we will show, these alternative estimates for the payroll industries differ very little from Douglas's in most cases. In other words, the defects of the payroll data, though they seemed to be serious a priori, turned out to be surprisingly unimportant in practice.

## *Our Data and Methods*

The purpose of this section is to give a very brief overview of our methods and sources, which we will explain in more detail as we proceed, and to relate our general methods to those of other investigators.[6]

Our basic method is to compute average annual earnings per full-time equivalent worker from the *Census of Manufactures* for census years. We then interpolate for intercensal years, using data from the reports of state labor bureaus to get a continuous series on annual earnings. These are then converted into daily earnings by use of the state data on the average number of days per year that establishments were in operation.[7] Finally the daily earnings are converted into hourly earnings by means of data on full-time hours from the *Census of Manufactures* for 1914 and 1909 and from the BLS bulletins previously discussed. This method was used to get an all-manufacturing series and separate series for fourteen manufacturing industries.

The method whose rough outlines we have just sketched is essentially identical with the method used by Douglas to derive hourly earnings for coal mining; he got the average number of days mines were in operation from the U.S. Geological Survey.[8] (The method used by Brissenden is like ours in that his estimates of hourly earnings

[6] In our first attempt to find new data on wages before 1914, we wrote to a large number of trade associations that have been in continuous existence since before 1914, asking them for any wage data preserved in their files. This effort was a complete failure; what little information we received was too scattered to be useful.

[7] In practice, we usually perform our interpolations with daily rather than annual earnings, but in a way that is equivalent to that described in the text.

[8] Douglas, *Real Wages*, pp. 142–165.

are ultimately based on census annual earnings, but the two methods are dissimilar in many other ways.[9]) So far as we know, no one has previously used the state establishment data on the average number of days in operation per year to reduce annual earnings in manufacturing to daily earnings.

The annual earnings estimates from which we start are very similar to those made by Douglas in Part III of *Real Wages*. But Douglas made no attempt to reconcile his annual earnings estimates in Part III with his estimates of full-time weekly earnings and hourly earnings in Part II. The discrepancies between Douglas's two sets of estimates were one of the things that led us to our own method.

The differences between Douglas's annual earnings series and his full-time weekly earnings series multiplied by 52 seem, in many cases, too large to be explained by the conceptual differences between the two measures. The two sets of data are shown in Table 6 for 1914 for all the industries where the comparison is possible. In every industry except slaughtering and meat packing, full-time weekly earnings times 52 exceed average annual earnings. In most industries the difference s large, and in the union industries, as we would expect, it is extremely large.

The state establishment data on days in operation permit us to get consistent annual and hourly earnings estimates. This means, in effect, that we accept the annual earnings estimates, and reject the kinds of hourly earnings estimates that have been built up from occupational data. One reason for doing this is that the coverage of the annual earnings data and the data on days in operation is very much broader. A second reason is that the method permits us to estimate hourly earnings for some industries for which no estimates have previously been available.

The breadth of coverage of the state data we used is illustrated in Table 7, which shows the same three industries (somewhat more broadly defined) for which payroll data coverage is shown in Table 5. These industries are among those for which both sets of data are the best, in the case of the state data because employment in these

[9] Paul F. Brissenden, *Earnings of Factory Workers, 1899–1927*, Census Monograph X, Washington, 1929. Brissenden's method is extremely and needlessly complicated and no attempt will be made to summarize it here. Those interested in understanding it should see Brissenden's own description of it and Douglas's criticism in *Real Wages*, Appendix A. Brissenden's estimates rest heavily on some data of dubious reliability or representativeness, including, for example, the percentage of trade unionists in New York State unemployed in 1904.

industries was highly concentrated in states that published earnings statistics. A detailed discussion of the nature and quality of the state statistics we used may be found in Appendix A. A complete table of the coverage of the state data used is given in Appendix C.

TABLE 6

Comparisons Between Average Annual Earnings and Full-Time Weekly Earnings Times 52 (Douglas), 1914
(dollars)

| Industry[a] | Average Annual Earnings | Full-Time Weekly Earnings × 52 |
|---|---|---|
| Union Industries | | |
| Foundries and machine shops[b] | 674 | 1,065 |
| Marble and stone | 692 | 1,243 |
| Book and job printing | 693 | 1,123 |
| Newspaper and periodical printing | 774 | 1,424 |
| Lumber planing mills | 644 | 1,021 |
| Bread and other bakery products | 620 | 934 |
| Payroll Industries | | |
| Cotton goods | 387 | 452 |
| Boots and shoes | 552 | 691 |
| Men's clothing | 500 | 683 |
| Hosiery and knit goods | 397 | 490 |
| Woolen and worsted goods | 479 | 521 |
| Lumber and timber | 500 | 622 |
| Iron and steel works and rolling mills | 758 | 1,015 |
| Slaughtering and meat packing | 629 | 627 |
| All Manufacturing | 580 | 824 |

SOURCE: Paul H. Douglas, *Real Wages in the United States, 1890–1926*, Boston, 1930.

[a] The industry names given are those of the annual earnings data; the order is that of the full-time weekly earnings data. The names of the corresponding full-time weekly earnings series (in order) are: metal trades, granite and stone, book and job printing, newspaper printing, planing mills, and bakers (for the union industries); cotton, boots and shoes, clothing, hosiery and knit goods, woolens, lumber (sawmills), iron and steel, and slaughtering and meat packing (for the payroll industries).

[b] See note d to Table 4.

Although Table 7 indicates a very large gain in over-all coverage compared with Table 5, in one respect the coverage of the state data is inferior. In almost all cases fewer states are represented. Except for our cotton series, which includes South Carolina beginning in 1910, all of our data are from states east of the Mississippi River and north of the Ohio River and the Mason–Dixon line. Altogether, our interpolating series use data from nine states: Connecticut, Maine, Massachusetts, New Jersey, Ohio, Pennsylvania, Rhode Island,

TABLE 7

Coverage of State Data on Average Annual Earnings and Days Worked per Year, Three Industries, Census Years, 1889–1914

| | Boots and Shoes[a] | | | | Cotton Manufactures[b] | | | | Wool Manufactures except Carpets[c] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Establishments* Number in Sample | % of Census | Number of Workers | % of Census Employment | *Establishments* Number in Sample | % of Census | Number of Workers | % of Census Employment | *Establishments* Number in Sample | % of Census | Number of Workers | % of Census Employment |
| 1889[d] | 474 | 16.5 | 40,773 | 28.7 | 157 | 17.3 | 68,991 | 31.5 | 141 | 9.3 | 20,888 | 16.6 |
| 1899[d] | 803 | 35.6 | 78,861 | 52.1 | 336 | 31.8 | 143,369 | 47.3 | 367 | 28.6 | 76,565 | 58.6 |
| 1904 | 766 | 40.4 | 87,933 | 54.9 | 244 | 21.1 | 107,479 | 34.0 | 311 | 29.0 | 73,213 | 49.9 |
| 1909 | 1,003 | 52.3 | 111,495 | 56.2 | 312 | 23.6 | 170,391 | 45.0 | 463 | 47.0 | 97,597 | 57.8 |
| 1914 | 1,042 | 53.2 | 101,490 | 49.2 | 450 | 33.9 | 172,871 | 43.9 | 200 | 22.7 | 70,542 | 43.0 |

SOURCE: See Appendix A.

[a] Includes cut stock and findings.

[b] Includes cotton smallwares and cotton lace.

[c] Includes felt goods and wool hats.

[d] Census data exclude custom work and repairing.

South Carolina, and Wisconsin. However, the great bulk of the data comes from four of these: Massachusetts, New Jersey, Ohio, and Pennsylvania.

The differences (Table 7) between the percentages of census employment and establishments covered show that our state data come in most cases from establishments that are on the average larger than all census establishments. However, for 1914, the only year in which direct comparison is possible, this size bias is smaller in the state data than in the BLS payroll data. The average number of employees per establishment in the state samples in 1914 was 97 in boots and shoes, 384 in cotton manufactures, and 353 in wool manufactures except carpets. The corresponding census averages are 105, 296, and 186 respectively. A similar comparison for the BLS payroll data was given previously (pp. 21–23).

In moving from daily to hourly earnings, we use daily hours data, obtained by dividing average full-time weekly hours by six. Full-time hours, also called standard or prevailing hours, refer to the normal workweek of the establishment or occupation. They thus differ from actual hours, which often lie below standard hours because of slack work or for other reasons. When actual hours lie above full-time hours the difference is "overtime." We know of no accurate way to measure actual hours before 1914.

For 1909 and 1914, average weekly hours are estimated from frequency distributions of employees given in the censuses of 1914 and 1909. These distributions classify workers by the prevailing number of hours worked per week in the establishments where they are employed. The census data are much superior in coverage to the BLS hours data, but they fail to allow for differences in hours of work within establishments. The differences within industries in full-time hours by occupation as shown by the BLS data are usually small, which suggests that the census data do not err badly in treating establishments as units. The second weakness of the census data is the broadness of some of the class intervals, which, at times, makes it hard to estimate means accurately.

For years other than 1914 and 1909, we use the BLS payroll data on full-time hours, adjusting the series to the levels shown by the census data in these two census years. State data on full-time hours were available for some of our states, but it would have been very difficult to combine them with BLS data in a way that would improve the national estimates derived from BLS data alone.

Because we use BLS full-time hours in our estimates of hourly earnings, our estimates are not entirely independent of Douglas. We feel, however, that it is the estimates of daily earnings that are crucial, and these are independent. Since there is relatively little dispersion in full-time hours in a given industry and state in a given year, estimates of hours derived from different bodies of data are usually extremely close. This is shown by Table 8, which gives estimates of

TABLE 8

Estimates of Average Full-Time Daily Hours by Industry, from Census Data and BLS Payroll Data, 1909 and 1914

| | *1909* | | *1914* | |
|---|---|---|---|---|
| | Census[a] | BLS[b] | Census[a] | BLS[b] |
| Cotton goods | 9.90 | 10.02 | 9.50 | 9.47 |
| Woolens and worsteds | 9.63 | 9.65 | 9.23 | 9.17 |
| Silk | 9.53 | 9.43 | 9.18 | 9.10 |
| Hosiery and knit goods | 9.70 | 9.78 | 9.18 | 9.13 |
| Boots and shoes | 9.42 | 9.43 | 9.13 | 9.12 |
| Iron and steel | 10.64 | 11.20 | 10.12 | 10.92 |

[a] For methods of estimation see pp. 27 and 36.

[b] Douglas's estimates of full-time weekly hours divided by six. Silk derived from original BLS data using Douglas's method.

daily hours for the same industries derived from census and BLS data for 1909 and 1914. The only appreciable difference is for iron and steel, which probably arises in large part because the BLS data include only certain departments of the industry and are overweighted with continuous-process operations.[10] The table suggests that the sampling problem, which may be important in estimating daily earnings, is relatively unimportant in estimating daily hours.

To the extent that short-time occurs within days, our method fails to take it into account, since we use full-time or prevailing daily hours. To the extent that it takes the form of not working for full days, it is caught in our data on the average number of days in operation per year. Where it occurs within the day, we underestimate hourly earnings because we divide average daily earnings by too high a figure for daily hours. However, checks of our estimates of hourly earnings against various benchmarks, to be presented later, show no

[10] The two estimates for this industry are not entirely independent, since BLS data were used to estimate the mean of the open-end class "over 72 hours" of the census data.

bias in this direction. This suggests that the error is either unimportant or is offset by an unknown error in the opposite direction.

## *The All-Manufacturing Series*

Our estimates of hourly earnings of wage earners in all manufacturing begin with estimates of average annual earnings in census years.[11] To obtain average annual earnings we divide total wage payments by the average number of wage earners. However, before performing this division, we adjusted the data to conform to the present definition of manufacturing. This meant deducting the figures for a number of industries now considered to be outside manufacturing, the most important of which are railroad repair shop products, with 366,000 workers in 1914, and illuminating gas, with 44,000 workers.[12] The purpose of this adjustment is to make the coverage of our estimates comparable with that of National Bureau estimates of productivity in manufacturing. The effect of the adjustment is to reduce average annual earnings by $6 in each census year, except in 1889, when it reduces annual earnings by $4.

For 1889, we also had to adjust the original census figures to eliminate the hand and custom trades. This adjustment makes use of the separate data on factory industries for 1899 given in the *Census of Manufactures* of 1904. It was made for each industry. When the 1899 data showed that an industry was partly a factory industry and partly a hand or custom trade, we applied the 1899 proportions to the 1889 figures. Thus the 1889 employment in awnings was reduced by 24.2 per cent and the total wage payments were reduced by 23.1 per cent, the percentages of employment and wages respectively for the custom trade in 1899, as computed from the 1899 and 1904 Censuses.[13]

[11] We consider the census years to be 1889, 1899, 1904, 1909, and 1914. The original census volumes refer to the first three of these as the years 1890, 1900, and 1905, though, by the Census of 1909, the census volumes followed the practice used here in referring to earlier censuses. It is clear that all the 1904 data refer to calendar 1904. The law authorizing the Census of 1900 provided that the information collected should be for the fiscal year ending nearest to and preceding June 1, 1900, but it was stated by the Census Bureau that "a very large proportion of the reports actually made . . . related to the business of the calendar year 1899" (*Census of Manufactures, 1890*, Part I, p. xvii). The practice in 1890 was similar to that in 1900.

[12] For a full list of these industries, see Solomon Fabricant, *Employment in Manufacturing, 1899–1939*, New York, NBER, 1942, pp. 213–214. We have not deducted the industry tinplate and terneplate, which appears in this list.

[13] Douglas makes the adjustment for hand trades in a single operation. He assumes that for all manufacturing the ratio of earnings of factory workers and hand trade workers combined to those of factory workers alone was the same in 1889 as in 1899 (*Real Wages*, p. 219). This method does not use the information provided by the two

The nature of the census employment concepts have an important effect on our annual earnings figures for census years. The annual earnings figures we would like are total payrolls divided by the number of workers in average daily attendance when the plant was in operation. This is because, at a later step, we divide annual earnings by the number of days in operation to get average daily earnings. The nature of the appropriate average employment concept can be seen more easily by reversing the order of the division: total payrolls divided by days in operation would give average daily payrolls, which, divided by the number of workers in average daily attendance, would give average daily earnings.

The actual census employment figures differ from this ideal in two opposite ways. In 1914 and 1909, employers were asked to report, from time or payroll records, the number of workers employed on the fifteenth day of each month or the nearest representative day. The employment figures for the twelve months were then added, employment in any month in which the plant was not in operation was counted as zero, and the sum was divided by twelve. The first source of error is the inclusion of these zero figures, which results in too low an average employment and too high a daily earnings figure. In effect, time lost during whole months in which an establishment was not in operation is counted twice: once in employment and once in the number of days worked.[14] In seasonal industries such as glass, where

Censuses on the change in relative earnings by industry over the decade. Our correction reduces average earnings in 1889 by about $7 more than Douglas's.

We have further adjusted the 1889 annual earnings series to include logging establishments, which were included in the census of the lumber industry after 1905. The Census of 1905 gives 1899 employment and wages for lumber including logging. We adjusted 1889 employment and wages by the ratios of the 1899 data including logging to those excluding logging.

The adjustments to the 1889 Census data can be summarized as follows: Average annual earnings as computed from the 1889 totals are $445. We reduce this by $4 because of the omission of the "Fabricant industries" (see note 12), by $6 because of the inclusion of logging, and by $18 because of the omission of the hand and custom trades, giving a new average of $417. For the number of wage earners involved in these adjustments, see John W. Kendrick, *Productivity Trends in the United States* (to be published by Princeton University Press for the National Bureau of Economic Research), Table D–8.

[14] An example may make this point clearer. Suppose that, in a given year, an establishment employs 40 men for 25 days a month for 10 months at $1.00 per day, and that it is not in operation during the other two months. The annual payroll of the establishment is $10,000. Its average annual employment will be recorded in the census as 33.3, that is $(40 \times 10) \div 12$. Its average annual earnings per full-time equivalent worker will be $300.00 as computed from census data ($10,000 ÷ 33.3). If average daily earnings are computed by dividing $300.00 by the number of days in operation (250) the result is $1.20, which is an overestimate.

the error on this account is large, we have had to make special corrections to allow for it.

The second source of error is that employers probably included in their count some workers who were on the payroll on the fifteenth day of the month but were not at work or receiving pay on that day. This source of error gives us too high an average employment and too low an average daily wage. Checks, to be reported later, of our hourly earnings figures against data built up from hourly wage rates do not suggest any consistent bias in our estimates and thus lead us to conclude that the sources of error just discussed are, in general, roughly offsetting.

In the years before 1909, the census employment concepts are somewhat different. In 1899 and 1904, employers reported average employment for each month without reference to a particular day. In 1889, the average employment concept was essentially average employment during the time the plant was in operation. Thus the first of the two sources of error is absent in 1889, while the second is not. For this reason, our earnings estimates for the early 1890's may be slightly too low. Checks against other data suggest that the error cannot be large.

For the intercensal years, we used data from the states of Massachusetts, New Jersey, and Pennsylvania as interpolators. The Massachusetts series covers the full period, the Pennsylvania series begins in 1892, and the New Jersey series in 1895. We linked the series at these points to prevent the changes in coverage from affecting the movement of the series.[15] The employment coverage of these series is shown in Table 9.

For 1890–1914 Douglas uses data from five additional states as interpolators of annual earnings: Connecticut, Iowa, Ohio, South Carolina, and Wisconsin. Of these only Ohio has a heavy weight (17 per cent of the total in 1914); the other four combined have 18 per cent of the weight in 1914. We did not use most of these states because they did not publish establishment data on days in operation per year continuously throughout the period.[16]

[15] Several series that, by our definition, are not for manufacturing industries were removed from the state totals in deriving our interpolating series. The most important deductions are as follows: *Massachusetts,* 1890–1907, railroad construction and equipment; 1908–1914, cars built by railroad companies and illuminating gas. *Pennsylvania,* 1908–1914, coal mining; 1913–1914, building trades, plants and flowers, crude oil, natural gas, laundries, mines and quarries, garages, and repair shops (public service). *New Jersey,* 1896–1914, mining (iron ore); 1902–1907, laundries.

[16] The inclusion in our annual earnings series of states that are not included in the series on days in operation might improve the annual earnings series, but could introduce

Our estimates of average annual earnings per full-time equivalent worker in all manufacturing are shown in the first column of Table 10. Chart 1 compares this series with Douglas's corresponding series. The differences are slight. Our estimate is $6 lower in each census

TABLE 9

Coverage of Interpolating Series for All Manufacturing, Census Years, 1889–1914[a]

| | Number of Wage Earners (Thousands) | | | Average Annual Earnings | |
|---|---|---|---|---|---|
| | *Census Data* | | *State Data* | *United States* | *Three States*[b] |
| | U.S. Total | Three States[b] | Three States[b] | Census Data | State Data |
| 1889[c] | 3,631 | 394[d] | 260[d] | $417 | $425[d] |
| 1899 | 4,500 | 1,277 | 720 | 420 | 430 |
| 1904 | 5,180 | 1,458 | 817 | 471 | 465 |
| 1909 | 6,261 | 1,718 | 1,300 | 512 | 514 |
| 1914 | 6,598 | 1,818 | 1,745 | 574 | 568 |

SOURCE: See text and Appendix A.

[a] All data adjusted to exclude industries not now considered part of manufacturing.

[b] Massachusetts, New Jersey, and Pennsylvania.

[c] Excludes hand and custom trades and includes logging.

[d] Massachusetts only.

year, except 1889, because of the difference in the definition of manufacturing, and $17 lower in 1889 as a result of the corrections discussed in note 13 above. One of the few large differences after 1899 occurs in 1910, when our estimate is $20 lower. This difference arises largely because we have corrected an error in the Pennsylvania statistics.[17] Our series also recovers more slowly from the depression of the 1890's and rises more in the boom of 1906–1907.

The second column of Table 10 shows the average number of days

spurious movement into the daily earnings series. Since we want annual earnings only as a means of estimating daily earnings, this would be a net loss. The problem could arise if a state included in the annual earnings series had, say, a rise in annual earnings produced solely by a rise in the number of days in operation so that the true daily earnings were unchanged. If days in operation did not rise correspondingly in the states included in the series on days in operation we would get a spurious rise in daily earnings. Accordingly, at no point in the study do we use annual earnings data for which we do not have corresponding data on days in operation. This decision might have been unwise had it resulted in marked worsening of the annual earnings series. Chart 1 suggests that it did not.

[17] Total wage payments in "oil, crude and refined" are shown as $36,400,990 for only 5,770 workers. This is carried into the all-manufacturing total. Pennsylvania, *Annual Report of the Secretary of Internal Affairs* (1911), Part III, Industrial Statistics, 1910, p. 463. The correct figure, $3,640,990, is shown on p. 400.

per year that establishments were in operation. This is a weighted average of data for the same states used in interpolating annual earnings. Within each state, we computed employment-weighted

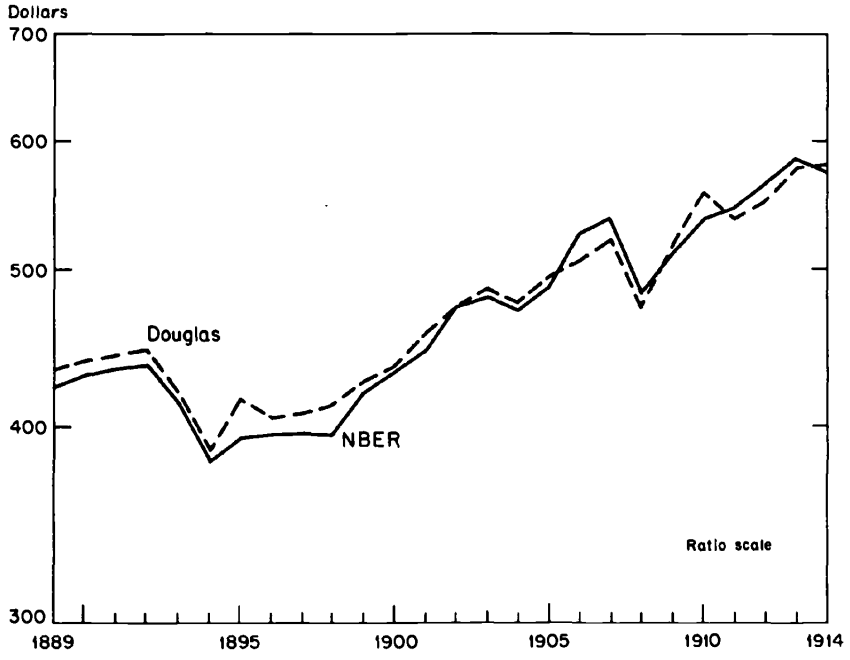
TABLE 10
Average Days in Operation per Year, Hours per Day, and Annual, Daily, and Hourly Earnings, All Manufacturing, 1890–1914

| | Average Annual Earnings[a] | Average Days in Operation per Year | Average Daily Earnings | Average Hours per Day | Average Hourly Earnings (cents) |
|---|---|---|---|---|---|
| 1889 | 417 | | | | |
| 1890 | 425 | 294 | $1.44 | 10.02 | 14.4 |
| 1891 | 429 | 297 | 1.45 | 10.01 | 14.4 |
| 1892 | 431 | 296 | 1.46 | 10.04 | 14.5 |
| 1893 | 410 | 271 | 1.51 | 9.99 | 15.1 |
| 1894 | 376 | 272 | 1.38 | 9.92 | 13.9 |
| 1895 | 392 | 284 | 1.38 | 9.97 | 13.8 |
| 1896 | 393 | 274 | 1.43 | 9.96 | 14.4 |
| 1897 | 395 | 284 | 1.39 | 9.94 | 14.0 |
| 1898 | 394 | 288 | 1.37 | 9.97 | 13.7 |
| 1899 | 420 | 290 | 1.45 | 9.94 | 14.6 |
| 1900 | 432 | 289 | 1.50 | 9.89 | 15.1 |
| 1901 | 446 | 287 | 1.55 | 9.84 | 15.8 |
| 1902 | 474 | 294 | 1.61 | 9.79 | 16.5 |
| 1903 | 481 | 291 | 1.65 | 9.71 | 17.0 |
| 1904 | 471 | 288 | 1.63 | 9.68 | 16.9 |
| 1905 | 487 | 292 | 1.67 | 9.70 | 17.2 |
| 1906 | 526 | 297 | 1.77 | 9.63 | 18.4 |
| 1907 | 538 | 294 | 1.83 | 9.60 | 19.1 |
| 1908 | 482 | 274 | 1.76 | 9.55 | 18.4 |
| 1909 | 512 | 289 | 1.77 | 9.56 | 18.6 |
| 1910 | 538 | 286 | 1.88 | 9.49 | 19.8 |
| 1911 | 545 | 284 | 1.92 | 9.47 | 20.2 |
| 1912 | 564 | 290 | 1.94 | 9.39 | 20.7 |
| 1913 | 585 | 283 | 2.07 | 9.36 | 22.1 |
| 1914 | 574 | 281 | 2.04 | 9.28 | 22.0 |

SOURCE: See text and Appendix A.
[a] Per full-time equivalent worker.

averages of days in operation by industries; the all-manufacturing averages published by some of the states are weighted by the number of establishments. (See note 15 for a partial list of industries omitted.) The weights for combining states in census years are census employment in manufacturing. For other years, they are linear interpolations

CHART 1




Average Annual Earnings per Full-time Equivalent Worker, All Manufacturing, 1889–1914

of the census weights. It may help in interpreting these data to mention that the full-time work year during this period was apparently 312 days—365 minus 52 Sundays and one holiday. This can be determined from the data of some states on days in operation by establishments. Establishments operating more than 312 days are listed as "working overtime," presumably meaning extra shifts.

The Census of 1904 also collected data on days in operation per year. Table 11 compares estimates based on these data with estimates based on state data. In each state, the number of days in operation is lower when estimated from the census data than from the state data for at least two reasons. First, the census means were computed from frequency distributions on the assumption that the mean of each class is the mid-point of the class interval.[18] Since the distribution is markedly skewed to the left, the errors involved in this assumption are

[18] It was assumed that the mean of the class "30 days and less" was 20 days.

not entirely offsetting and our estimates of the means are underestimates. More important, the census data are frequency distributions of the number of establishments without regard to size; 9 per cent of these establishments had no wage earners. Where we have examined data on days in operation for establishments classified by number of employees, we have consistently found that large establishments operated more days than small ones. This may be true, in part, because of the greater turnover of small establishments, many of which may have been in existence only part of the year. The inclusion of establishments without wage earners and the overweighting of other small establishments relative to the distribution of employment thus biased the census means downward.

TABLE 11

Estimates from Census and State Data on Days in Operation per Year in Manufacturing, 1904

| | Census Data[a] | State Data |
|---|---|---|
| Massachusetts | 280 | 294 |
| New Jersey | 283 | 286 |
| Pennsylvania | 272 | 285 |
| Three-state average[b] | 277 | 288 |
| United States | 263 | |

[a] Computed from *Census of Manufactures, 1905*, Part I, pp. 542–543. For source of state data, see Appendix A.

[b] Weighted by census employment.

The census data suggest that establishments operated more days per year in the three sample states than in the country as a whole. However, this apparent difference could also arise, in part, from the overweighting of small establishments, which are relatively more numerous in the nonindustrial states.

The series on days in operation seems to show a slight downward trend toward the end of the period. The levels reached during the prosperous years 1912 and 1913 are below those of 1890–92, 1902–3, and 1905–7. The series drops during major business contractions, falling below 275 days per year in 1893–94, 1896, and 1908. The drop in 1904 is less pronounced.

Average daily earnings, the third column of Table 10, is obtained by dividing annual earnings by days in operation. Daily earnings rise from 1890 to 1893 and then drop, reaching their lowest point in 1898.

The 1893 level is not regained until 1901. Thereafter the rise is steady except for modest declines in 1904, 1908, and 1914.

The behavior of daily earnings for 1892–93 is of a kind found early in cyclical contractions in many of our daily earnings series. Average daily earnings rise, although both annual earnings and days in operation per year fall. This rise in daily earnings could be partly spurious, reflecting some unknown kind of lack of synchronization between the two sets of data from which daily earnings are derived. However, it could also be real, reflecting the concentration of layoffs among low-paid employees and, perhaps, higher output among workers paid at piece rates. Douglas's work shows the same sort of divergence between the movement of annual earnings and hourly earnings in these years. The hourly and daily wage series move downward with a lag of a year in 1894, presumably because of wage cuts.

The fourth column of Table 10 shows average full-time hours per day in all manufacturing. This series will be used again in deriving some of our industry data on hourly earnings. We shall refer to it as the "general hours series." Throughout the study we convert weekly hours to daily hours by dividing them by six. The daily hours figures for 1914 and 1909 were computed from the frequency distributions of full-time hours per week in the *Census of Manufactures.*[19]

From 1903 to 1914 the movement of the general hours series is based on BLS data for seven industries, using Douglas's processing for six of them. The industries are cotton, silk, hosiery and knit goods, woolen and worsted, boots and shoes, lumber, and iron and steel. These were combined by census employment weights, using linear interpolation of these weights for intercensal years. The resulting

[19] In computing these means, it was assumed that the mean of the open-end class "48 hours and under" was 48 hours and that the mean of the class "over 72 hours" was 78 hours. The means of all other classes having an interval of more than one hour were assumed to be the mid-points of the class intervals. These assumptions were also followed in all computations of hours per day for individual industries except as otherwise stated.

The assumptions about the open-end classes were made after inspecting BLS bulletins giving more detailed hours data for certain industries. Full-time workweeks below 48 hours in manufacturing were extremely rare before 1914 except in a few rather small industries such as glass, pottery, and newspaper printing. These could not have pulled the mean of the class "48 hours and under" much below 48 hours. Many of the workers in steel and other industries who worked more than 72 hours worked 84, so that the 78-hour mean for this class seems reasonable.

In computing the figures shown, the industries not now considered as manufacturing were deducted from the all-manufacturing totals. In 1914 these deductions made no difference in average weekly hours computed to the nearest tenth of an hour; they lowered the average by 0.1 hour in 1909.

series was then adjusted to pass through the points computed from census data for 1909 and 1914.

This segment of the general hours series uses the hours data for all of Douglas's payroll industries except clothing and slaughtering and meat-packing. For the first of these industries Douglas interpolated the data for 1907–12; for the second, he assumed a constant 60-hour week on the basis of information other than the BLS data. The industry we have added is silk, for which we computed average hours from the BLS bulletins following Douglas's method.[20]

For 1890–1902 the movement of the general hours series is taken from Wolman's series for all manufacturing.[21] This has been linked to the segment of the general hours series for 1903–9 by means of an overlap of one year at 1903. The resulting change in the level of Wolman's series is very small; it has been raised 0.2 hour per week. Wolman's series uses all the hours data for manufacturing in the *Nineteenth Annual Report*; it thus has much broader coverage (48 industries) than Douglas's series, which is derived from the same source for this period, but is confined to 14 industries.

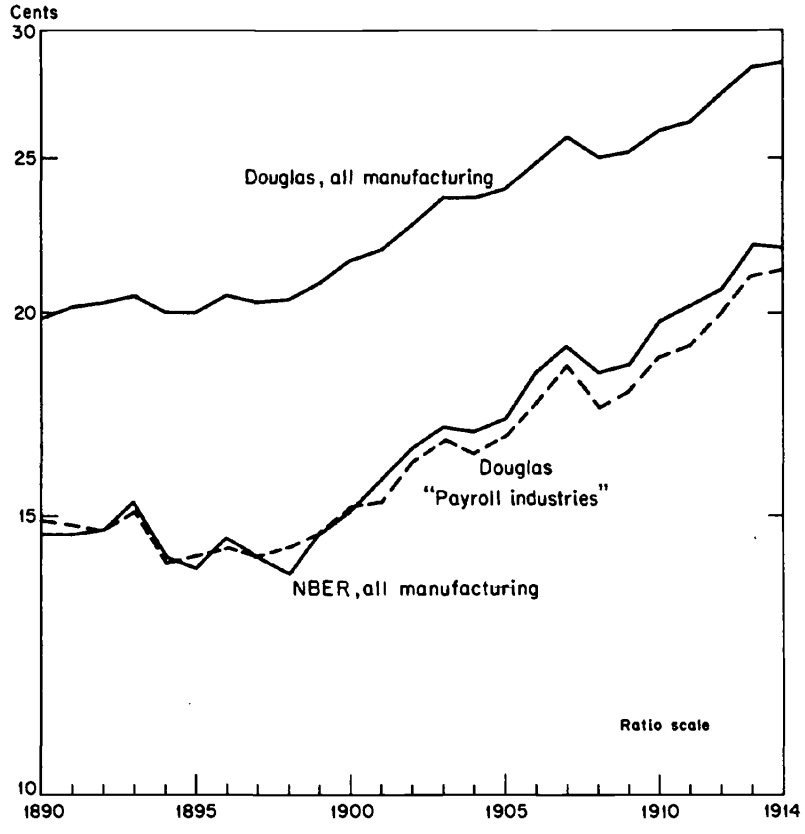
The general hours series as a whole moves downward rather steadily through the period. The average full-time workweek in manufacturing by this measure was 60.1 hours in 1890 and 55.7 hours in 1914. There is a consistent tendency for full-time hours to vary with the cycle, but it is very slight and almost lost in the trend. It may be observed in the small rises in the series in 1895, 1898, 1905, and 1909, all years of recovery from earlier cyclical troughs.

The final column of Table 10 shows our estimates of average hourly earnings in all manufacturing. Chart 2 compares this series with Douglas's series for all manufacturing and for payroll industries. The chart shows a similarity between our series for all manufacturing and Douglas's series for payroll industries that is astonishing in view of the very different sources and methods used, though the payroll series is a bit lower at the end of the period. The Douglas all-manufacturing series, however, lies much above ours as a result of the inclusion of the union industries. This series also falls less and recovers sooner than the other two series in the depression of the 1890's. The over-all rise in percentage terms from 1890 to 1914 is rather similar for the three series. Our series for all manufacturing

[20] The more onerous parts of this computation were performed some years ago under the direction of Leo Wolman and were taken from his workbooks.

[21] *Hours of Work in American Industry*, Bulletin 71, New York, NBER, 1938, p. 2.

CHART 2




Average Hourly Earnings, All Manufacturing, 1890–1914

rises 52.9 per cent; Douglas's all-manufacturing series rises 44.2 per cent, and Douglas's payroll series rises 43.0 per cent.

At four dates, our figures for average hourly earnings in all manufacturing can be compared with recent estimates by others. Three of the estimates, for 1904, 1909, and 1914, appear in an explanation of the BLS historical series on hourly earnings, though only the last two of these are regarded as part of that series.[22] The BLS estimate for 1904 is 18.2 cents, which is considerably higher than our estimate of 16.9 cents. This BLS estimate is based on occupational wage data for

[22] See "BLS Historical Estimates of Earnings, Wages, and Hours," *Monthly Labor Review*, July 1955, pp. 801–806. This article is based on a memorandum prepared by Witt Bowden.

seventeen manufacturing industries, taken from Bulletin 65 of the Bureau of Labor. Estimated man-hours (census payrolls divided by average hourly earnings) are the weights for combining the industry figures. The industries were selected for completeness of occupational and geographical coverage.

The data of Bulletin 65 are for selected occupations only, and as few as five occupations are represented in some of the industries. Although the selection of industries is such that laborers are included in most cases, the high-wage occupations seem to be overweighted. It would seem preferable where possible to use Douglas's technique for correcting this, which amounts to adjusting the 1904 figures by the ratio of earnings of selected occupations to those of all occupations for 1914.[23]

The BLS estimate for 1909, which is part of its official historical series, is obtained by extrapolating the 1904 estimate to 1909, using as an extrapolator the earnings data from the continuous BLS series for payroll industries. The 1909 estimate is 19.3 cents, compared with ours of 18.6 cents. The BLS estimate for 1914 is obtained by extrapolating the 1909 figures to 1914, using census data on annual earnings and prevailing hours to form an extrapolator. The 1914 estimate is 22.3 cents, compared with our 22.0 cents. What we regard as the upward bias in the level of the 1904 estimate seems to be largely offset by 1914 by some characteristic of the extrapolating series.

For 1890, our estimate of average hourly earnings in all manufacturing can be compared with Clarence Long's, derived from the Dewey Report in the *Twelfth Census, 1900*.[24] Long's estimate is 15.3 cents, compared with ours of 14.4 cents. These estimates are reasonably close considering the great difference in the sources and methods of the two studies. It is difficult to say which is the more accurate. Our estimates are based on state data from only one state before 1892, and our estimate of hourly earnings for 1890 is slightly biased downward by the nature of the census employment count, as explained above. However, the Dewey Report estimates also have several defects, which work in opposite directions. First, the all-manufacturing estimate is a weighted mean of median earnings by

[23] See Table 18 for comparisons of our 1904 earnings estimates by industry with Douglas's and with the BLS estimates from Bulletin 65.

[24] Clarence D. Long, *Wages and Earnings in the United States, 1860–1890*, Princeton University Press for NBER, 1960, Table A–8. The data underlying Long's estimate are from Davis R. Dewey, *Employees and Wages*, in *Twelfth Census of the United States, 1900*, Special Reports.

industries. Because the underlying wage distributions are characteristically skewed to the right, their medians will lie below their means. For comparisons with estimates of mean earnings, this biases Long's estimate downward. Second, the industry medians are weighted by the employment shown in the Dewey Report itself, and these overweight high-wage industries. When the industry medians are weighted by employment as reported in the *Census of Manufactures*, the mean for all manufacturing becomes 15.0 cents. Finally, the Dewey Report sampling of firms must be considered. The Dewey Report data are much superior to those of Bulletin 65 in that they cover all occupations in the establishments sampled. However, it is almost uniformly true of such nonrandom samples of wage data that they overweight large or high-wage firms and are, therefore, somewhat biased upward.

If we extend our series backward to 1889 by our methods, we get a figure identical with Long's estimate for 1889. This indicates that the difference for 1890 could result from random fluctuation or error in one of the series—probably ours.

## *The Industry Estimates*

Our estimates of money earnings for individual industries are derived in essentially the same way as the estimates for all manufacturing. However, we have used data from several additional states to estimate the number of days in operation per year and to interpolate annual earnings between census years. These states provided usable data only for some industries or only for short periods of time. Appendix A describes these state data; Appendix B defines the industries and tells which of the state series were used in each of our industry estimates; and Appendix C shows the coverage of the data.

The choice of industries was dictated by the availability of state data. We tried to make estimates for all industries for which there were state data from three or more states covering a substantial part of total employment in the industry. Because we had no data for several leading industrial states, including New York, Michigan, and Illinois, we were forced to omit such important industries as agricultural implements, automobiles, clothing, and meat packing. We did not attempt to include any industry with fewer than 50,000 wage earners in 1914, except that "dyeing and finishing textiles" is included because it is a component of our industry "all textiles." In three industries (electrical machinery, glass, and iron and steel) our interpolators did

not go back to 1890; these series begin in 1896, 1899, and 1892, respectively. We attempted to make estimates for some industries (including chemicals, malt liquors, and pottery and clay products) that in the end were omitted because the estimates proved unsatisfactory.

In deriving industry estimates, we met one problem not present in the estimates for all manufacturing. None of the state sources provide definitions or descriptions of the industries to which their industry series refer, and the industry titles at times proved quite misleading. To determine whether or not to use a state series in a particular industry, we compared it at each census year with the census data for the industry in that state. This comparison covered the number of establishments and workers and average annual earnings. Persistent differences in the level of annual earnings combined with incomplete coverage were assumed to reflect sampling bias that would be corrected in large part by adjusting the series to census levels, and thus did not rule out the use of the series. Large differences between state and census data in the movement of annual earnings from one census year to the next were more often grounds for not using a series. It did not prove possible to reduce these criteria for accepting or rejecting state series to mechanical rules.

The New Jersey series "cotton goods" is a good example of a state series that, despite its title, seems to have different coverage than the corresponding census industry. It was not used as an interpolator in cotton manufacturing, though it was used in all textiles. Table 12 shows the "census check" data for this industry.

TABLE 12

Census and State Data for Cotton Goods, New Jersey, Census Years, 1899–1914

| | *Number of Establishments* | | *Number of Wage Earners* | | *Average Annual Earnings* | |
|---|---|---|---|---|---|---|
| | Census Data | State Data | Census Data | State Data | Census Data | State Data |
| 1899 | 25 | 32 | 5,518 | 4,728 | $342 | $282 |
| 1904 | 17 | 30 | 5,362 | 4,917 | 377 | 304 |
| 1909 | 26 | 49 | 6,638 | 7,001 | 388 | 358 |
| 1914 | 30 | 41 | 7,394 | 7,270 | 445 | 405 |

SOURCE: *Census of Manufactures* and Annual Reports of the New Jersey Bureau of Industrial Statistics.

Because it is possible for us to combine series given separately in our sources, but not to break them down, the industry coverage of our series is always that of the broadest of their components. Where census definitions of industries change among censuses, our definition is the broadest of any of the census years. The effect of this is usually to include in an industry various minor auxiliary industries.[25] The inclusion of such auxiliary industries increases the proportion of manufacturing workers covered by our industry estimates. However, it greatly reduces the proportion of census establishments in an industry covered by our series, since the auxiliary industries often include many very small establishments incompletely covered by our state data. The state classification of industries is often finer than that of the census, especially in industries important in the state. The state interpolators are then built up from a number of these state series.[26]

The levels of average daily hours for individual industries for 1909 and 1914 are computed from census data. In two industries, we made special assumptions about the means of the open-end classes in the census distributions. For glass, short workweeks were common for part of the work force, apparently because of the heat and physical strain of some jobs. In this industry we have assumed that the mean of the weekly-hours class "48 hours and under" was 44 hours.[27] For iron and steel the means of the open-end class "over 72 hours" were computed from BLS data.[28]

The movement of hours, except for the trend from 1909 to 1914, is based ultimately on BLS data, combined in several different ways. In five industries (cotton, woolens, hosiery and knit goods, boots and shoes, and iron and steel) we have used the Douglas payroll series adjusted to the census levels of 1909 and 1914. For silk, as mentioned earlier, we computed an hours series using Douglas's methods; this was then adjusted to census levels. The hours series for "all textiles"

[25] Thus we include "glass, cutting, staining, and ornamenting" in the glass industry because it is clear from the number of establishments that it is included in the Ohio series "glass and glassware."

[26] For example, in our industry "leather; tanned, curried, and finished" the Pennsylvania data for 1910–12 show five industries: tanneries, miscellaneous leather, enameled and glazed kid, sole leather, and harness leather.

[27] This assumption is based on inspection of the data for 1907 given in BLS Bulletin No. 77, pp. 40–41.

[28] The means used are 83 hours for blast furnaces and 81 hours for steel works and rolling mills. They are the same to the nearest hour for 1909 and 1914. The estimates are based on the hours data given in BLS Bulletin No. 218, pp. 21–23. The various departments of steel mills were weighted by the employment data for 1915 in *ibid.*, p. 61.

is the weighted averages of the series for cotton, woolen, silk, and hosiery and knit goods, with no new adjustment to census levels. In the remaining industries except dyeing and finishing textiles we have used the general hours series described earlier to estimate the movement of hours from 1903 to 1914, adjusting it to the census levels of each industry. For dyeing and finishing textiles we used the "all textiles" series.

In five industries (dyeing and finishing textiles, leather, paper, glass, and foundries and machine shops) for the period before 1903, we used the data for individual industries in the *Nineteenth Annual Report*. For the two remaining industries (rubber and electrical machinery) the data of the *Nineteenth Annual Report* covered four establishments or fewer, and were considered too unreliable to use. We have, therefore, used the general hours series in these industries before 1903 as well as after.

The earnings and hours series for individual industries are presented in Table 13. The rest of this section will discuss features of the individual series.

For seven of our average hourly earnings series it is possible to make comparisons with other estimates covering the full period 1890–1914. Six such comparisons are shown in Table 14 and Chart 3. For four of these (cotton, woolen and worsted, hosiery and knit goods, and boots and shoes) the comparison is with Douglas's payroll series. For silk it is with a series computed from BLS payroll data using Douglas's method. For foundry and machine shops it is with Douglas's union rate series for metal trades; this comparison will be discussed separately after the others.

In three of the comparisons between our series and the series based on BLS payroll data, there are significant differences in level that seem to result from differences in industry definition. In all three, our industry definition is broader and the level of our wage series is lower. In two cases there are also differences between the geographical distribution of the BLS sample and that of the census industry which contribute to the difference in wage levels. The differences in geographical distribution may, in part, result from the differences in industry definition. Another possible source of differences is that our figures are averages for full years, while the BLS data are for one payroll period.

The largest difference in level is for boots and shoes, where in 1914 our series is 3.1 cents an hour below the Douglas series. It can be

TABLE 13

Average Daily Earnings, Average Daily Hours, and Average Hourly Earnings in Fourteen Manufacturing Industries, 1890–1914

| | *Cotton* | | | *Wool* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.02 | 10.31 | 9.9¢ | $1.16 | 9.98 | 11.6¢ |
| 1891 | 1.03 | 10.37 | 9.9 | 1.17 | 9.96 | 11.8 |
| 1892 | 1.02 | 10.40 | 9.8 | 1.18 | 9.96 | 11.9 |
| 1893 | 1.07 | 10.26 | 10.4 | 1.30 | 9.83 | 13.3 |
| 1894 | 1.04 | 10.01 | 10.4 | 1.14 | 9.78 | 11.7 |
| 1895 | 0.98 | 10.25 | 9.5 | 1.16 | 9.88 | 11.8 |
| 1896 | 0.99 | 10.21 | 9.7 | 1.22 | 9.88 | 12.3 |
| 1897 | 0.98 | 10.16 | 9.7 | 1.17 | 9.73 | 12.0 |
| 1898 | 0.94 | 10.30 | 9.1 | 1.22 | 9.86 | 12.3 |
| 1899 | 0.95 | 10.30 | 9.2 | 1.23 | 9.86 | 12.4 |
| 1900 | 1.02 | 10.26 | 10.0 | 1.29 | 9.86 | 13.0 |
| 1901 | 1.04 | 10.25 | 10.1 | 1.30 | 9.86 | 13.2 |
| 1902 | 1.07 | 10.20 | 10.4 | 1.32 | 9.75 | 13.5 |
| 1903 | 1.11 | 10.18 | 10.9 | 1.35 | 9.73 | 13.9 |
| 1904 | 1.08 | 10.16 | 10.7 | 1.32 | 9.66 | 13.7 |
| 1905 | 1.04 | 10.16 | 10.3 | 1.35 | 9.73 | 13.9 |
| 1906 | 1.11 | 10.11 | 11.0 | 1.44 | 9.70 | 14.9 |
| 1907 | 1.24 | 10.01 | 12.4 | 1.49 | 9.66 | 15.4 |
| 1908 | 1.20 | 9.90 | 12.1 | 1.49 | 9.63 | 15.5 |
| 1909 | 1.17 | 9.90 | 11.8 | 1.51 | 9.63 | 15.6 |
| 1910 | 1.26 | 9.69 | 13.0 | 1.52 | 9.48 | 16.1 |
| 1911 | 1.27 | 9.72 | 13.0 | 1.53 | 9.51 | 16.1 |
| 1912 | 1.30 | 9.57 | 13.6 | 1.60 | 9.38 | 17.1 |
| 1913 | 1.35 | 9.60 | 14.1 | 1.62 | 9.37 | 17.3 |
| 1914 | 1.34 | 9.50 | 14.1 | 1.76 | 9.23 | 19.0 |

(continued)

TABLE 13 (continued)

| | *Silk* | | | *Hosiery and Knit Goods* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.20 | 9.95 | 12.0¢ | $0.96 | 10.13 | 9.4¢ |
| 1891 | 1.23 | 10.02 | 12.2 | 0.98 | 10.13 | 9.6 |
| 1892 | 1.16 | 9.92 | 11.7 | 1.02 | 10.13 | 10.1 |
| 1893 | 1.27 | 9.63 | 13.2 | 1.07 | 10.07 | 10.6 |
| 1894 | 1.18 | 9.60 | 12.3 | 0.98 | 9.47 | 10.3 |
| 1895 | 1.08 | 9.60 | 11.2 | 1.00 | 10.05 | 9.9 |
| 1896 | 1.18 | 9.65 | 12.3 | 1.01 | 10.05 | 10.0 |
| 1897 | 1.11 | 9.67 | 11.5 | 0.96 | 10.05 | 9.5 |
| 1898 | 1.09 | 9.68 | 11.3 | 0.96 | 10.05 | 9.6 |
| 1899 | 1.11 | 9.70 | 11.4 | 1.02 | 10.05 | 10.2 |
| 1900 | 1.06 | 9.70 | 10.9 | 1.01 | 9.92 | 10.2 |
| 1901 | 1.05 | 9.68 | 10.8 | 1.02 | 9.92 | 10.2 |
| 1902 | 1.12 | 9.65 | 11.6 | 1.03 | 9.92 | 10.4 |
| 1903 | 1.18 | 9.63 | 12.3 | 1.08 | 9.82 | 11.0 |
| 1904 | 1.14 | 9.55 | 12.0 | 1.05 | 9.82 | 10.7 |
| 1905 | 1.24 | 9.57 | 13.0 | 1.10 | 9.80 | 11.2 |
| 1906 | 1.24 | 9.57 | 13.0 | 1.24 | 9.75 | 12.7 |
| 1907 | 1.32 | 9.57 | 13.8 | 1.20 | 9.73 | 12.3 |
| 1908 | 1.19 | 9.55 | 12.4 | 1.18 | 9.68 | 12.2 |
| 1909 | 1.32 | 9.53 | 13.8 | 1.20 | 9.70 | 12.4 |
| 1910 | 1.36 | 9.51 | 14.3 | 1.24 | 9.54 | 13.0 |
| 1911 | 1.42 | 9.48 | 15.0 | 1.27 | 9.57 | 13.3 |
| 1912 | 1.46 | 9.40 | 15.5 | 1.32 | 9.43 | 14.0 |
| 1913 | 1.67[a] | 9.36 | 17.9[a] | 1.35 | 9.27 | 14.6 |
| 1914 | 1.55 | 9.18 | 16.9 | 1.47 | 9.18 | 16.0 |

(continued)

TABLE 13 (continued)

| | *Dyeing and Finishing Textiles* | | | *All Textiles* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.54 | 9.96 | 15.4¢ | $1.08 | 10.16 | 10.6¢ |
| 1891 | 1.57 | 9.96 | 15.7 | 1.09 | 10.19 | 10.7 |
| 1892 | 1.53 | 9.89 | 15.5 | 1.09 | 10.20 | 10.7 |
| 1893 | 1.63 | 9.74 | 16.8 | 1.17 | 10.06 | 11.7 |
| 1894 | 1.55 | 9.57 | 16.2 | 1.08 | 9.83 | 11.0 |
| 1895 | 1.50 | 9.75 | 15.4 | 1.05 | 10.06 | 10.5 |
| 1896 | 1.54 | 9.75 | 15.8 | 1.08 | 10.05 | 10.8 |
| 1897 | 1.44 | 9.60 | 15.0 | 1.05 | 9.99 | 10.5 |
| 1898 | 1.48 | 9.77 | 15.1 | 1.05 | 10.09 | 10.4 |
| 1899 | 1.45 | 9.77 | 14.8 | 1.07 | 10.10 | 10.6 |
| 1900 | 1.46 | 9.77 | 14.9 | 1.11 | 10.06 | 11.0 |
| 1901 | 1.46 | 9.77 | 15.0 | 1.12 | 10.05 | 11.2 |
| 1902 | 1.54 | 9.77 | 15.7 | 1.16 | 9.99 | 11.6 |
| 1903 | 1.53 | 9.77 | 15.7 | 1.21 | 9.95 | 12.2 |
| 1904 | 1.51 | 9.79 | 15.4 | 1.17 | 9.92 | 11.8 |
| 1905 | 1.61 | 9.82 | 16.4 | 1.18 | 9.93 | 11.9 |
| 1906 | 1.64 | 9.76 | 16.8 | 1.25 | 9.89 | 12.7 |
| 1907 | 1.62 | 9.73 | 16.6 | 1.32 | 9.83 | 13.4 |
| 1908 | 1.61 | 9.65 | 16.7 | 1.28 | 9.75 | 13.2 |
| 1909 | 1.68 | 9.66 | 17.4 | 1.30 | 9.76 | 13.4 |
| 1910 | 1.72 | 9.52 | 18.0 | 1.36 | 9.60 | 14.1 |
| 1911 | 1.67 | 9.56 | 17.5 | 1.38 | 9.63 | 14.3 |
| 1912 | 1.71 | 9.43 | 18.2 | 1.43 | 9.49 | 15.0 |
| 1913 | 1.80 | 9.43 | 19.1 | 1.51 | 9.48 | 15.9 |
| 1914 | 1.87 | 9.31 | 20.1 | 1.49 | 9.35 | 16.0 |

(continued)

TABLE 13 (continued)

| | *Boots and Shoes* | | | *Leather* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.58 | 9.81 | 16.1¢ | $1.64 | 9.67 | 16.9¢ |
| 1891 | 1.57 | 9.84 | 15.9 | 1.70 | 9.67 | 17.5 |
| 1892 | 1.58 | 9.81 | 16.1 | 1.67 | 9.65 | 17.3 |
| 1893 | 1.60 | 9.79 | 16.4 | 1.65 | 9.67 | 17.1 |
| 1894 | 1.57 | 9.79 | 16.0 | 1.54 | 9.67 | 15.9 |
| 1895 | 1.51 | 9.79 | 15.4 | 1.56 | 9.69 | 16.1 |
| 1896 | 1.47 | 9.79 | 15.0 | 1.57 | 9.69 | 16.2 |
| 1897 | 1.44 | 9.76 | 14.7 | 1.56 | 9.72 | 16.0 |
| 1898 | 1.39 | 9.76 | 14.2 | 1.51 | 9.74 | 15.5 |
| 1899 | 1.42 | 9.76 | 14.5 | 1.47 | 9.70 | 15.1 |
| 1900 | 1.43 | 9.72 | 14.8 | 1.48 | 9.71 | 15.2 |
| 1901 | 1.47 | 9.74 | 15.1 | 1.49 | 9.71 | 15.3 |
| 1902 | 1.48 | 9.62 | 15.4 | 1.50 | 9.71 | 15.4 |
| 1903 | 1.57 | 9.51 | 16.5 | 1.53 | 9.70 | 15.7 |
| 1904 | 1.55 | 9.52 | 16.3 | 1.56 | 9.67 | 16.1 |
| 1905 | 1.64 | 9.51 | 17.2 | 1.54 | 9.70 | 15.9 |
| 1906 | 1.66 | 9.46 | 17.6 | 1.67 | 9.70 | 17.2 |
| 1907 | 1.75 | 9.44 | 18.5 | 1.73 | 9.71 | 17.8 |
| 1908 | 1.74 | 9.44 | 18.4 | 1.72 | 9.66 | 17.8 |
| 1909 | 1.73 | 9.42 | 18.4 | 1.76 | 9.67 | 18.2 |
| 1910 | 1.83 | 9.40 | 19.4 | 1.81 | 9.62 | 18.8 |
| 1911 | 1.86 | 9.39 | 19.8 | 1.87 | 9.63 | 19.4 |
| 1912 | 1.89 | 9.27 | 20.4 | 1.81 | 9.56 | 18.9 |
| 1913 | 1.93 | 9.21 | 21.0 | 2.14 | 9.56 | 22.3 |
| 1914 | 1.94 | 9.15 | 21.2 | 2.04 | 9.50 | 21.4 |

(continued)

TABLE 13 (continued)

| | *Electrical Machinery* | | | *Paper and Paper Products* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | | | | $1.30 | 10.90 | 12.0¢ |
| 1891 | | | | 1.30 | 10.87 | 11.9 |
| 1892 | | | | 1.33 | 10.87 | 12.2 |
| 1893 | | | | 1.35 | 10.83 | 12.5 |
| 1894 | | | | 1.34 | 10.89 | 12.3 |
| 1895 | | | | 1.30 | 10.89 | 11.9 |
| 1896 | $1.57 | 9.62 | 16.3¢ | 1.32 | 10.87 | 12.1 |
| 1897 | 1.58 | 9.60 | 16.5 | 1.30 | 10.94 | 11.9 |
| 1898 | 1.68 | 9.63 | 17.4 | 1.24 | 10.99 | 11.2 |
| 1899 | 1.65 | 9.60 | 17.2 | 1.27 | 10.38 | 12.3 |
| 1900 | 1.66 | 9.55 | 17.4 | 1.32 | 10.38 | 12.7 |
| 1901 | 1.74 | 9.50 | 18.3 | 1.32 | 10.20 | 13.0 |
| 1902 | 1.76 | 9.45 | 18.7 | 1.38 | 10.13 | 13.6 |
| 1903 | 1.92 | 9.38 | 20.5 | 1.36 | 10.22 | 13.3 |
| 1904 | 1.83 | 9.35 | 19.6 | 1.43 | 10.17 | 14.1 |
| 1905 | 1.85 | 9.37 | 19.8 | 1.46 | 10.27 | 14.2 |
| 1906 | 1.92 | 9.30 | 20.6 | 1.46 | 10.23 | 14.2 |
| 1907 | 1.94 | 9.27 | 20.9 | 1.55 | 9.81 | 15.8 |
| 1908 | 1.94 | 9.22 | 21.0 | 1.73 | 9.76 | 17.7 |
| 1909 | 1.92 | 9.23 | 20.8 | 1.63 | 9.78 | 16.7 |
| 1910 | 2.03 | 9.18 | 22.1 | 1.68 | 9.71 | 17.3 |
| 1911 | 2.05 | 9.18 | 22.3 | 1.76 | 9.70 | 18.1 |
| 1912 | 2.14 | 9.10 | 23.5 | 1.82 | 9.61 | 18.9 |
| 1913 | 2.19 | 9.09 | 24.1 | 1.87 | 9.59 | 19.5 |
| 1914 | 2.17 | 9.03 | 24.0 | 1.95 | 9.51 | 20.5 |

(continued)

TABLE 13 (continued)

| | *Rubber* | | | *Glass* | |
|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.56 | 9.88 | 15.8¢ | | | |
| 1891 | 1.53 | 9.87 | 15.5 | | | |
| 1892 | 1.52 | 9.90 | 15.3 | | | |
| 1893 | 1.61 | 9.85 | 16.3 | | | |
| 1894 | 1.51 | 9.78 | 15.4 | | | |
| 1895 | 1.50 | 9.83 | 15.2 | | | |
| 1896 | 1.57 | 9.82 | 16.0 | | | |
| 1897 | 1.54 | 9.80 | 15.7 | | | |
| 1898 | 1.56 | 9.83 | 15.9 | | | |
| 1899 | 1.55 | 9.80 | 15.8 | $1.63 | 9.00 | 18.1¢ |
| 1900 | 1.53 | 9.75 | 15.7 | 1.76 | 9.01 | 19.5 |
| 1901 | 1.58 | 9.70 | 16.3 | 1.82 | 8.94 | 20.4 |
| 1902 | 1.54 | 9.65 | 16.0 | 1.87 | 8.92 | 21.0 |
| 1903 | 1.54 | 9.57 | 16.1 | 1.81 | 9.11 | 19.9 |
| 1904 | 1.56 | 9.55 | 16.4 | 1.96 | 9.15 | 21.4 |
| 1905 | 1.59 | 9.57 | 16.6 | 2.08 | 9.23 | 22.5 |
| 1906 | 1.72 | 9.50 | 18.1 | 2.04 | 9.26 | 22.1 |
| 1907 | 1.70 | 9.46 | 18.0 | 2.10 | 9.21 | 22.8 |
| 1908 | 1.84 | 9.41 | 19.6 | 2.15 | 9.16 | 23.5 |
| 1909 | 1.84 | 9.42 | 19.5 | 2.05 | 9.17 | 22.3 |
| 1910 | 1.95 | 9.36 | 20.8 | 2.17 | 9.09 | 23.9 |
| 1911 | 1.96 | 9.35 | 21.0 | 2.22 | 9.08 | 24.4 |
| 1912 | 2.01 | 9.27 | 21.7 | 2.25 | 9.01 | 25.0 |
| 1913 | 2.06 | 9.25 | 22.2 | 2.35 | 8.99 | 26.2 |
| 1914 | 2.20 | 9.18 | 23.9 | 2.34 | 8.91 | 26.3 |

(continued)

TABLE 13 (concluded)

| | *Foundry and Machine Shops* | | | *Iron and Steel* | | |
|---|---|---|---|---|---|---|
| | Daily Earnings | Daily Hours | Hourly Earnings | Daily Earnings | Daily Hours | Hourly Earnings |
| 1890 | $1.87 | 10.10 | 18.5¢ | | | |
| 1891 | 1.91 | 10.10 | 19.0 | | | |
| 1892 | 1.87 | 10.06 | 18.6 | $1.81 | 10.67 | 17.0¢ |
| 1893 | 1.88 | 10.03 | 18.8 | 1.84 | 10.67 | 17.2 |
| 1894 | 1.86 | 10.01 | 18.6 | 1.70 | 10.75 | 15.8 |
| 1895 | 1.81 | 10.05 | 18.0 | 1.64 | 10.74 | 15.3 |
| 1896 | 1.78 | 10.03 | 17.8 | 1.68 | 10.59 | 15.8 |
| 1897 | 1.73 | 10.01 | 17.3 | 1.64 | 10.66 | 15.4 |
| 1898 | 1.76 | 10.05 | 17.5 | 1.69 | 10.69 | 15.8 |
| 1899 | 1.73 | 10.01 | 17.3 | 1.90 | 10.57 | 17.9 |
| 1900 | 1.79 | 9.96 | 18.0 | 2.01 | 10.74 | 18.7 |
| 1901 | 1.79 | 9.81 | 18.3 | 2.10 | 10.66 | 19.6 |
| 1902 | 1.88 | 9.69 | 19.4 | 2.16 | 10.66 | 20.3 |
| 1903 | 1.93 | 9.57 | 20.2 | 2.16 | 10.67 | 20.2 |
| 1904 | 1.91 | 9.52 | 20.0 | 2.03 | 10.57 | 19.2 |
| 1905 | 1.93 | 9.54 | 20.2 | 2.07 | 10.69 | 19.4 |
| 1906 | 2.02 | 9.50 | 21.3 | 2.17 | 10.67 | 20.3 |
| 1907 | 2.07 | 9.47 | 21.8 | 2.30 | 10.67 | 21.5 |
| 1908 | 2.06 | 9.42 | 21.9 | 2.25 | 10.53 | 21.4 |
| 1909 | 2.08 | 9.43 | 22.0 | 2.34 | 10.64 | 22.0 |
| 1910 | 2.15 | 9.37 | 23.0 | 2.46 | 10.58 | 23.2 |
| 1911 | 2.20 | 9.36 | 23.5 | 2.57 | 10.39 | 24.7 |
| 1912 | 2.24 | 9.29 | 24.1 | 2.56 | 10.31 | 24.8 |
| 1913 | 2.33 | 9.27 | 25.1 | 2.82 | 10.29 | 27.4 |
| 1914 | 2.33 | 9.20 | 25.3 | 2.70 | 10.12 | 26.6 |

SOURCE: See text and Appendix A.
[a] Figures for 1913 affected by Paterson silk strike; see note 36.

TABLE 14

Comparison of Estimates of Hourly Earnings, Six Industries, 1890–1914
(cents)

| | *Cotton* | | *Woolen and Worsted* | | | *Silk* |
|---|---|---|---|---|---|---|
| | NBER[a] | Douglas | NBER[b] | Douglas | Basic Series | Series based on BLS data |
| 1890 | 9.9 | 9.7 | 11.6 | 12.1 | 12.0 | 15.6 |
| 1891 | 9.9 | 9.5 | 11.8 | 12.0 | 12.2 | 14.6 |
| 1892 | 9.8 | 9.5 | 11.9 | 12.2 | 11.7 | 15.2 |
| 1893 | 10.4 | 10.1 | 13.3 | 12.8 | 13.2 | 15.2 |
| 1894 | 10.4 | 9.5 | 11.7 | 11.5 | 12.3 | 15.8 |
| 1895 | 9.5 | 9.4 | 11.8 | 11.6 | 11.2 | 15.4 |
| 1896 | 9.7 | 9.9 | 12.3 | 11.8 | 12.3 | 16.4 |
| 1897 | 9.7 | 9.6 | 12.0 | 12.1 | 11.5 | 15.2 |
| 1898 | 9.1 | 9.3 | 12.3 | 12.5 | 11.3 | 14.9 |
| 1899 | 9.2 | 9.2 | 12.4 | 12.4 | 11.4 | 14.5 |
| 1900 | 10.0 | 10.3 | 13.0 | 13.5 | 10.9 | 14.7 |
| 1901 | 10.1 | 10.4 | 13.2 | 13.6 | 10.8 | 14.4 |
| 1902 | 10.4 | 10.7 | 13.5 | 13.8 | 11.6 | 15.7 |
| 1903 | 10.9 | 11.1 | 13.9 | 14.3 | 12.3 | 15.6 |
| 1904 | 10.7 | 10.9 | 13.7 | 13.9 | 12.0 | 15.8 |
| 1905 | 10.3 | 11.1 | 13.9 | 14.3 | 13.0 | 15.9 |
| 1906 | 11.0 | 12.0 | 14.9 | 15.4 | 13.0 | 16.2 |
| 1907 | 12.4 | 13.5 | 15.4 | 16.3 | 13.8 | 17.3 |
| 1908 | 12.1 | 13.4 | 15.5 | 15.4 | 12.4 | 16.8 |
| 1909 | 11.8 | 13.0 | 15.6 | 15.6 | 13.8 | 17.5 |
| 1910 | 13.0 | 13.3 | 16.1 | 15.9 | 14.3 | 17.6 |
| 1911 | 13.0 | 13.5 | 16.1 | 16.0 | 15.0 | 17.8 |
| 1912 | 13.6 | 14.8 | 17.1 | 17.9 | 15.5 | 18.5 |
| 1913 | 14.1 | 14.9 | 17.3 | 17.6 | 17.9 | 19.6 |
| 1914 | 14.1 | 15.3 | 19.0 | 18.2 | 16.9 | 19.7 |

(continued)

TABLE 14 (concluded)

| | *Hosiery and Knit Goods* | | *Boots and Shoes* | | *Foundries and Machine Shops* | |
|---|---|---|---|---|---|---|
| | NBER | Douglas | NBER[c] | Douglas | NBER | Douglas |
| 1890 | 9.4 | 11.3 | 16.1 | 16.9 | 18.5 | 31.9 |
| 1891 | 9.6 | 11.5 | 15.9 | 16.7 | 19.0 | 31.3 |
| 1892 | 10.1 | 10.7 | 16.1 | 17.1 | 18.6 | 32.3 |
| 1893 | 10.6 | 10.8 | 16.4 | 17.3 | 18.8 | 32.2 |
| 1894 | 10.3 | 10.3 | 16.0 | 17.1 | 18.6 | 31.2 |
| 1895 | 9.9 | 11.1 | 15.4 | 17.3 | 18.0 | 31.3 |
| 1896 | 10.0 | 10.6 | 15.0 | 17.2 | 17.8 | 31.7 |
| 1897 | 9.5 | 10.1 | 14.7 | 17.3 | 17.3 | 31.7 |
| 1898 | 9.6 | 10.2 | 14.2 | 17.3 | 17.5 | 31.6 |
| 1899 | 10.2 | 10.0 | 14.5 | 17.5 | 17.3 | 32.2 |
| 1900 | 10.2 | 10.1 | 14.8 | 17.8 | 18.0 | 33.2 |
| 1901 | 10.2 | 10.9 | 15.1 | 17.8 | 18.3 | 34.0 |
| 1902 | 10.4 | 11.8 | 15.4 | 18.6 | 19.4 | 35.2 |
| 1903 | 11.0 | 12.5 | 16.5 | 19.5 | 20.2 | 36.3 |
| 1904 | 10.7 | 12.0 | 16.3 | 20.0 | 20.0 | 36.4 |
| 1905 | 11.2 | 12.9 | 17.2 | 20.4 | 20.2 | 36.6 |
| 1906 | 12.7 | 13.5 | 17.6 | 20.7 | 21.3 | 37.8 |
| 1907 | 12.3 | 14.4 | 18.5 | 21.6 | 21.8 | 38.9 |
| 1908 | 12.2 | 14.4 | 18.4 | 21.2 | 21.9 | 36.7 |
| 1909 | 12.4 | 14.2 | 18.4 | 22.0 | 22.0 | 36.9 |
| 1910 | 13.0 | 14.5 | 19.4 | 21.9 | 23.0 | 38.6 |
| 1911 | 13.3 | 14.5 | 19.8 | 22.2 | 23.5 | 39.6 |
| 1912 | 14.0 | 15.4 | 20.4 | 22.3 | 24.1 | 39.9 |
| 1913 | 14.6 | 16.7 | 21.0 | 24.1 | 25.1 | 40.6 |
| 1914 | 16.0 | 17.2 | 21.2 | 24.3 | 25.3 | 41.3 |

SOURCE: NBER series from Table 13. Douglas series: Paul Douglas, *Real Wages in the United States, 1890–1926*, Boston, 1930, pp. 96 and 101.

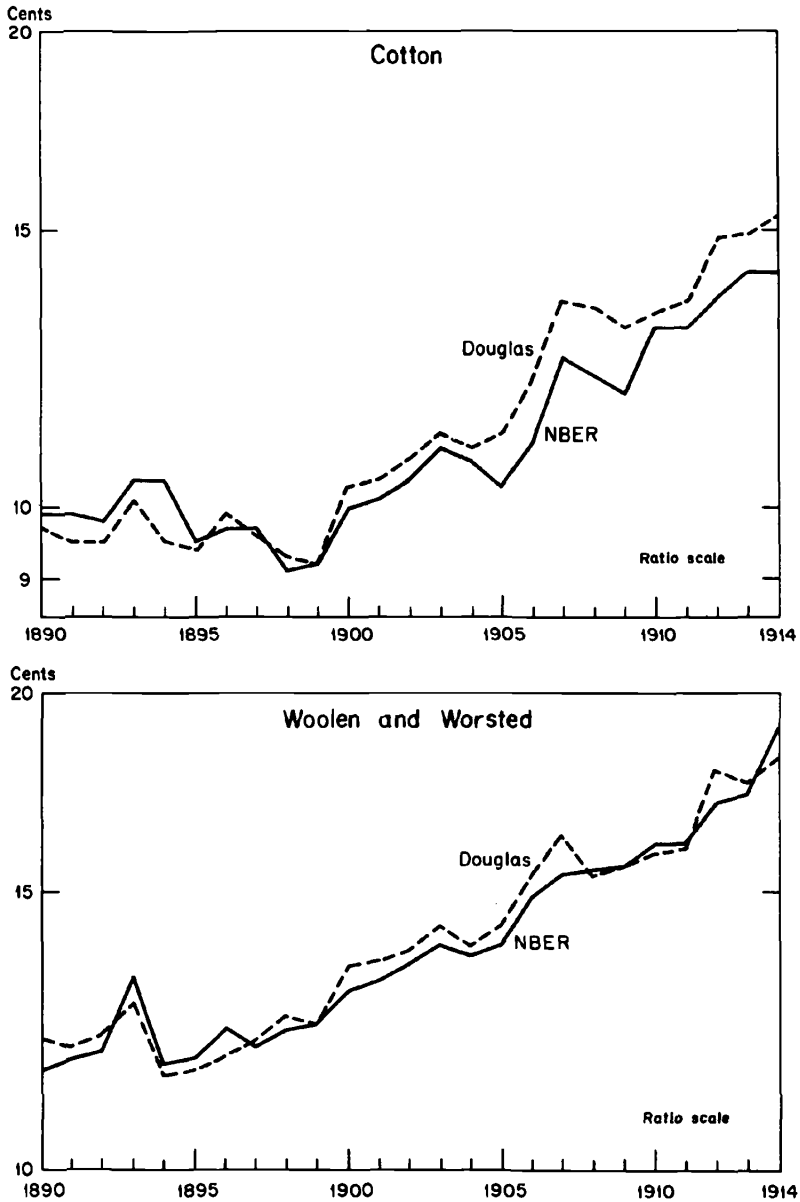
[a] Includes cotton smallwares and cotton lace.

[b] Includes felt goods and wool hats.

[c] Includes boot and shoe cut stock and findings.

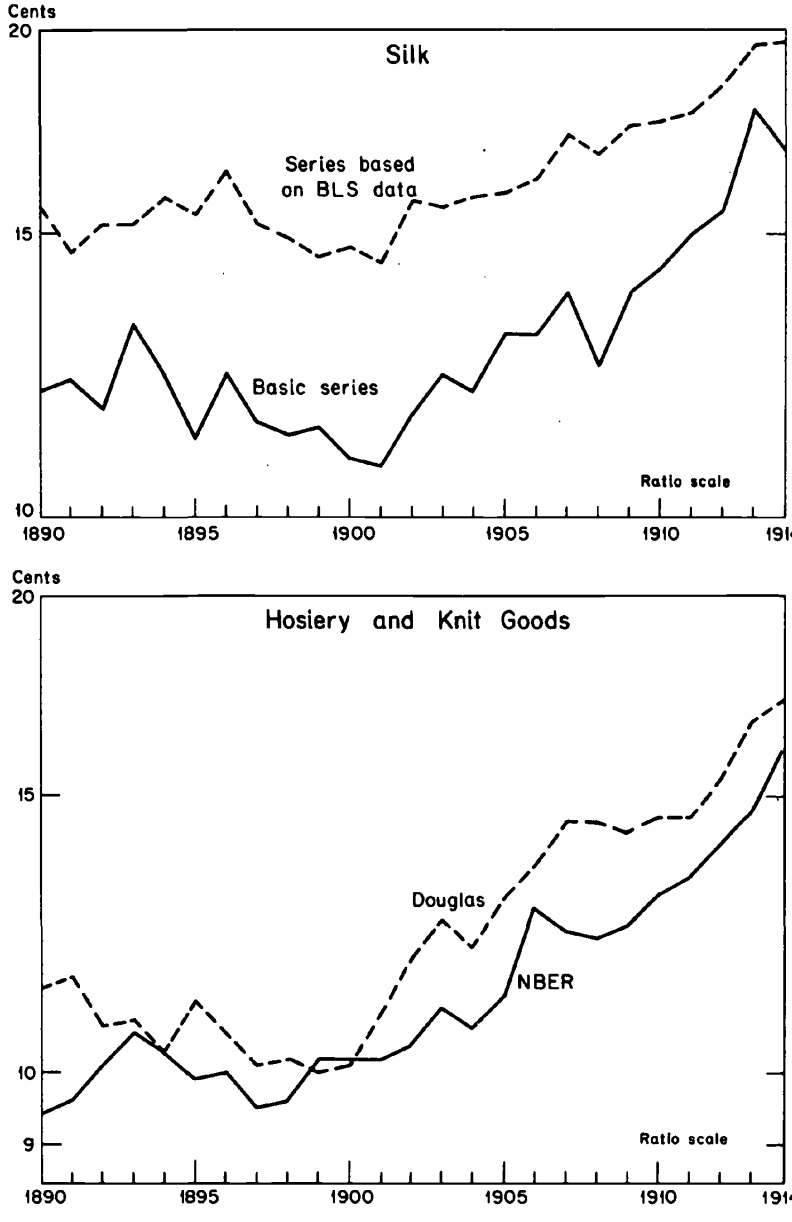
CHART 3

Comparisons of Estimates of Average Hourly Earnings in Six Industries, 1890–1914



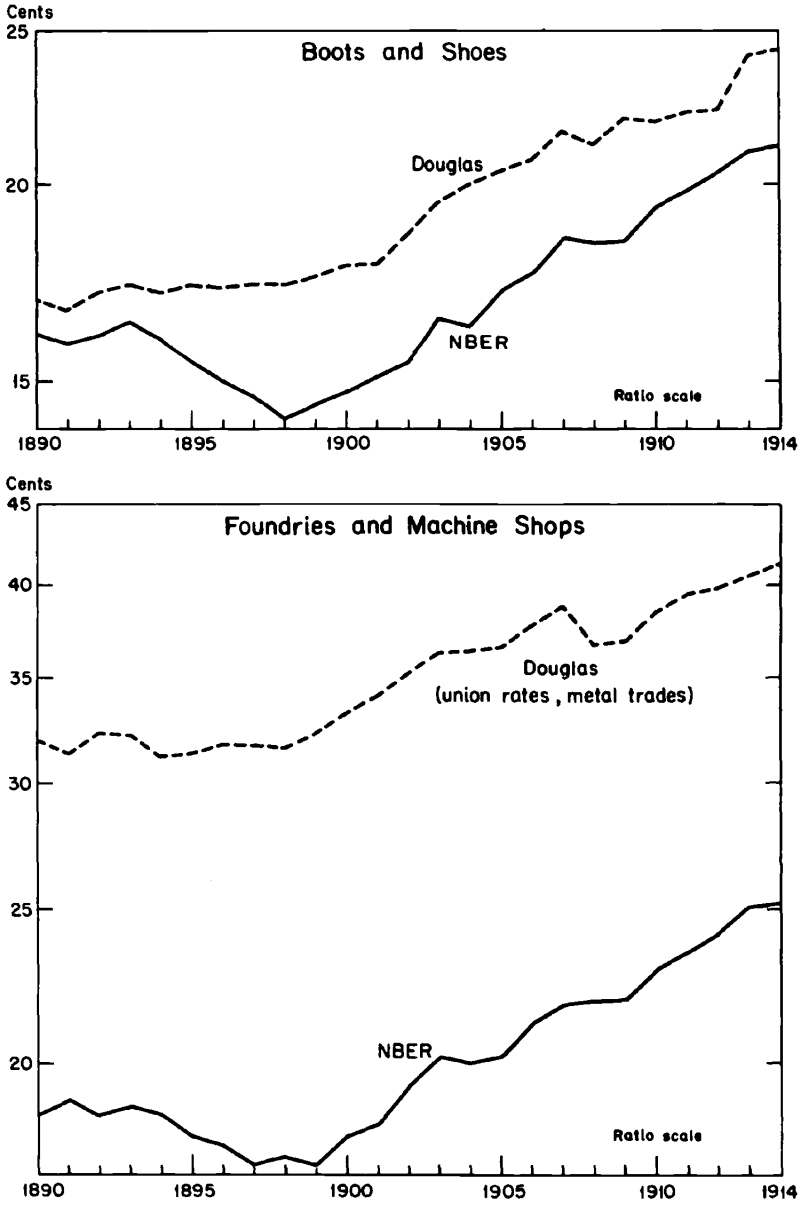

(continued on next page)

CHART 3 (continued)




(continued on next page)

CHART 3 (concluded)



estimated from the 1914 Census data that about 0.3 cent of this difference is due to our inclusion of the lower-paying industries "boot and shoe cut stock" and "boot and shoe findings." The rest we presume results from the exclusion from the BLS sample of firms "whose main or sole products are pegged shoes or specialties such as slippers, leggings, felt boots, etc."[29] In this industry there are no significant differences in geographical distribution between the census data and the BLS sample.

The second largest difference in level is in the silk industry; 2.8 cents per hour in 1914. Here the BLS sample excludes establishments "manufacturing exclusively machine twist, sewing and embroidery silks, braids, laces, novelties, etc."[30] That these are low-paying branches of the industry may be inferred from the relatively low annual earnings in New York State, which produced almost two-thirds of the total output of fringes, braids, and bindings. There are also differences in geographical distribution some of which seem unrelated to the differences in industry definition. New Jersey and Massachusetts, both high-wage states, are overrepresented in the BLS sample, though Massachusetts produced a slightly higher share of fringes, braids, and bindings than of total output.[31]

In hosiery and knit goods there is a rather small difference in level between our series and Douglas's (1.2 cents in 1914), though there is a major difference in industry definition. The BLS data are confined to establishments making hosiery and knit underwear; they exclude establishments making such products as sweaters, bathing suits, gloves and mittens, and jersey cloth. Massachusetts, a high-wage state, is greatly overrepresented in the BLS sample.

In the cotton industry, our series lies below Douglas's after 1899; the difference reaches 1.2 cents by 1914. This difference does not arise from industry definition. Our definition includes two small branches of the industry, cotton smallwares and cotton lace, not included in the BLS data. These branches employed 13,000 of the 393,000 workers in the industry in 1914. They were confined to the northern states and had higher average annual earnings than the industry as a whole. Excluding them widens the difference in 1914 between our series and Douglas's by about 0.1 cent.

The source of the difference seems instead to be the geographical

[29] BLS Bulletin No. 232, p. 20.
[30] BLS Bulletin No. 190, p. 195.
[31] *Ibid.*, and *Census of Manufactures, 1914*, Vol. II, pp. 127 and 141–142.

composition of the BLS sample. This sample heavily overweights New Hampshire; it has 19 per cent of the BLS weight and less than 6 per cent of census employment. New Hampshire hourly earnings in the cotton goods industry can be roughly estimated from the census data at 17 cents in 1914, compared with the national average of 14.0. Much of the corresponding underweighting arises from the omission of several states producing relatively small amounts of cotton textiles. The most important of these are Virginia, Maryland, Tennessee, and Mississippi. The average annual earnings of the omitted states as a group are well below the national average, and these states also had a longer workweek than the national average.[32]

In the woolen industry, despite differences in industry definition, there is no appreciable difference in level between Douglas's series and ours. The two do not differ by as much as 1 cent in any year.

The series in each of the five sets just discussed differ in movement as well as in level. The differences in movement are most pronounced in the 1890's. Almost all of our series and many of Douglas's reach a peak in 1893 and then decline rather sharply.[33] However, of the five series based on BLS payroll data shown in Table 14, only two (cotton and woolens and worsteds) follow this general pattern. The Douglas series for hosiery and knit goods is higher both in 1891 and 1895 than in 1893; the silk series based on BLS data is higher in 1895 than in 1893, and Douglas's for boots and shoes shows no appreciable decline during the whole depression of the 1890's. Our series, based on state data for all three of these industries, follows the typical pattern of an 1893 peak and a sharp decline. In boots and shoes the decline is unbroken from 1893 to 1898, in marked contrast to the Douglas series.

These differences in movement seem to be related to the size of the sample in the *Nineteenth Annual Report*. The two payroll series that conform best to the general pattern had the largest samples. The average number of workers covered by these series for 1890–99 was 7,045 in cotton and 3,131 in woolen and worsted. In the poorly

[32] See BLS Bulletin No. 239, p. 30 and *Census of Manufactures, 1914*, Vol. II, pp. 21, 26, and 47. The BLS sample is that of identical establishments for which 1914 and 1916 data were secured; it is this sample that governs the level of Douglas's series. New Jersey is included only in cotton finishing; we have not included it among the "omitted states" mentioned in the text.

[33] The declines are typically prolonged as well as sharp. Of our eleven industry series that go back to 1893, the earliest to regain its 1893 level is iron and steel, which does so in 1899. Three industries do not regain their 1893 level until 1906 or 1907 (silk, dyeing and finishing textiles, and leather).

conforming series it was 1,683 in silk, 1,206 in boots and shoes, and 824 in hosiery and knit goods.[34]

During the 1890's, only one of our series for the first five industries shown in Table 14 ever departs appreciably from the general pattern. In cotton, our hourly earnings series remains unchanged from 1893 to 1894, while Douglas's falls. It can be seen in Table 13 that this stability of hourly earnings results from proportional falls in daily hours and daily earnings. The hours series may here be reflecting actual rather than full-time hours, since the fall is reversed in 1895. We may, therefore, have overestimated hourly earnings in 1894 by double counting time not worked, once in the reduction in days in operation and once in the reduction in hours.

Our series for these first five industries reach their low points at different dates; woolens and worsteds in 1894, hosiery and knit goods in 1897, cotton and boots and shoes in 1898, and silk not until 1901. Two of the four series based on BLS data that show clear cyclical declines (boots and shoes does not) have their low points in the same year as our series: woolens and worsteds and silk. The other two, cotton and hosiery and knit goods, reach their lowest point in 1899, somewhat later than our series.

After 1900, there are few differences in movement between the series in the two sets. Our series for boots and shoes declines in the business contraction of 1904 while Douglas's does not, and it does not recover in 1909 from its fall in 1908. Our series for hosiery and knit goods turns down in 1907, two years before Douglas's and one year before most of the series for other industries. This series is dominated by the Pennsylvania data, which show a sharp drop in wages in the hosiery branch of the industry from 1906 to 1907.[35] Our basic series for silk reaches a peak in 1903 and drops during the business contraction of 1904, while the series based on BLS data drops in 1903. In 1913 our basic silk series shows a sharp peak as a result of the Paterson strike.[36] The BLS series rises less from 1912 to 1913 and continues to rise to 1914.

[34] This inference about the effect of sample size is supported by the behavior of the Douglas payroll series not shown in Table 14. Three of these (iron and steel, lumber, and slaughtering and meatpacking) conform to the general pattern. In all three the average sample coverage for 1890–99 is over 2,400 workers. In clothing, the pattern is atypical; wages in 1896 are above those of 1893. Here the sample coverage is 1,043 workers.

[35] Pennsylvania, *Annual Report of the Secretary of Internal Affairs*, Part III, Industrial Statistics, Vol. XXXV, 1907 (1908), pp. 123–124 and 179.

[36] This strike, involving almost 22,000 workers and lasting 22 weeks, was conducted by the Industrial Workers of the World. The Paterson area employed about 25,000 of the

In woolen and worsted, our series fails to fall in 1908, while Douglas's shows the drop characteristic of most of the series. This is one of the instances in which our series for annual earnings and days in operation both fall, but days in operation fall more (see p. 36 above). There is an unusual fall in the Douglas series in 1913 not present in our series. In the cotton industry our series is unusual in that the wage decline of 1904 continues in 1905; the Douglas series shows the typical one-year decline.

We turn now to the final comparison in Table 14, that between our series for foundries and machine shops and the Douglas union-rate series for metal trades. The difference in level is very large throughout the period. In 1890, the union rate series is 72 per cent above ours and in 1914, 63 per cent.

Our definition of foundries and machine shops, though very broad, is considerably narrower than that of the union-rate series for metal trades. In several occupations in the metal trades series, especially blacksmiths and helpers, boiler makers and helpers, and machinists and helpers, most of the rates shown are from railroad repair shops, and there a few quotations from miscellaneous industries such as automobile repairing and breweries.[37] However, this difference in industry definitions seems to account for only a small part of the difference in level between our series and the union-rate series. When we estimate hourly earnings in railroad repair shops for 1909 and 1914 using our usual method of combining census and state data, the estimates lie from zero to 8 per cent above our corresponding

28,000 New Jersey silk workers, including dye-house workers. A detailed account of the strike, highly favorable to the employers, is given in New Jersey, Bureau of Statistics of Labor and Industries, *Thirty Sixth Annual Report* (1914), pp. 175–242. See also S. Perlman and P. Taft, *Labor Movements*, Vol. IV of *History of Labor in the United States*, J. R. Commons, ed. (1935), pp. 274–277.

Our New Jersey series for average earnings in silk, including dyeing, moves as follows for 1912–14 (in cents): 1912, 19.7; 1913, 26.7; 1914, 21.0. This series is overweighted in intercensal years in our national series, since we have data from only three states in our interpolating series after 1904. New Jersey had 26 per cent of the census employment in the industry in 1914, and has 36 per cent of the weight in our interpolating series.

Just why the strike produced this sharp rise in our earnings series is not clear. A wage increase of 5 to 10 per cent was announced at the end of the strike (New Jersey, *Thirty Sixth Annual Report*, p. 227), although the union had been broken. The account in the New Jersey Report also indicates that about 2,000 workers were at work throughout the strike and more were at work during parts of it; these may have been predominantly highly skilled workers, or they may have received extra pay during the strike. Our estimate of earnings would also be raised if, on days when a mill was reported as not in operation, a few workers were present and paid, or if the data included in wage payments amounts paid during the shutdown to the augmented force of company guards.

[37] BLS Bulletin No. 171, pp. 245–267.

estimates for foundries and machine shops. The great bulk of the difference in level must, therefore, be due to other causes. These can be discussed in relation to the union-rate segment of the Douglas series (1907–14) from which the whole series takes its level. First, the union-rate data are confined, generally, to large cities. Second, they cover only eight occupations, six of skilled workers and two of helpers of skilled workers. They omit laborers, apprentices, and many semiskilled occupations.[38] Third, it seems probable that, in a given occupation and city, union rates were above the average wage, either because the union was most successful in organizing high-paid workers or because rates were raised by the unions. As mentioned earlier, Wolman has estimated that only 6.5 per cent of workers in the metal trades (excluding iron and steel) were organized in 1910.[39]

Our series for foundries and machine shops declines more in the depression of the 1890's than the Douglas metal trades series. Our series declines 8.0 per cent from 1893 to 1897, and the metal trade series declines 3.4 per cent from 1892 to 1894. In the business contraction of 1904 our series declines slightly, while Douglas's rises very slightly. However, Douglas's series falls rather sharply in the business contraction of 1908, while ours rises slightly because in Massachusetts and New Jersey days in operation fall more than annual earnings.

The iron and steel industry is the seventh industry in which our series can be compared with others, and here several other series are available. These are shown in Table 15 and Chart 4.

Our estimates lie below Douglas's by about 3 cents an hour in the closing years of the period and about 5 cents an hour early in the period. The movement of the two series is very similar, except that ours fails to fall appreciably from 1907 to 1908. In both level and movement, the series published by the United States Steel and Bethlehem Steel Corporations are much closer to our series than to Douglas's.[40] However, both of these company series rise from 1913 to 1914, which is not true of the other two.

The probable reason for the high level of the Douglas series is that the BLS data do not cover all the departments of the industry. They

[38] State reports from Ohio giving occupational wage data for foundries and machine shops in this period show more than ninety occupations in Cleveland, and additional occupations in other cities.

[39] See p. 20 above.

[40] These two series were derived by dividing total payrolls by man-hours, according to letters received from the two corporations. Bethlehem states that these are actual rather than standard hours, though neither letter explains how man-hours were measured or estimated.

do not cover crucible furnaces, rod mills, or structural shape mills, or the conversion of rolled products into finished products such as wire, pipes and tubes, nails, or bolts. Such conversion was frequently done in the same establishment where the steel was rolled, in which case it

TABLE 15

Average Hourly Earnings in the Iron and Steel Industry, 1892–1914
(cents)

| | NBER | Douglas | U.S. Steel | Bethlehem Steel |
|---|---|---|---|---|
| 1892 | 17.0 | 22.2 | | |
| 1893 | 17.2 | 22.9 | | |
| 1894 | 15.8 | 19.9 | | |
| 1895 | 15.3 | 20.7 | | |
| 1896 | 15.8 | 21.2 | | |
| 1897 | 15.4 | 20.3 | | |
| 1898 | 15.8 | 20.5 | | |
| 1899 | 17.9 | 21.8 | | |
| 1900 | 18.7 | 23.4 | | |
| 1901 | 19.6 | 23.8 | | |
| 1902 | 20.3 | 25.4 | 20.1 | |
| 1903 | 20.2 | 25.8 | 20.7 | |
| 1904 | 19.2 | 24.0 | 19.2 | |
| 1905 | 19.4 | 24.5 | 19.8 | 20.0 |
| 1906 | 20.3 | 25.5 | 20.4 | 20.0 |
| 1907 | 21.5 | 26.4 | 21.4 | 21.0 |
| 1908 | 21.4 | 23.9 | 21.4 | 21.0 |
| 1909 | 22.0 | 24.5 | 21.6 | 22.5 |
| 1910 | 23.2 | 26.8 | 22.4 | 22.0 |
| 1911 | 24.7 | 27.3 | 23.4 | 23.1 |
| 1912 | 24.8 | 28.3 | 23.8 | 24.8 |
| 1913 | 27.4 | 30.6 | 25.2 | 26.2 |
| 1914 | 26.6 | 29.8 | 25.7 | 27.1 |

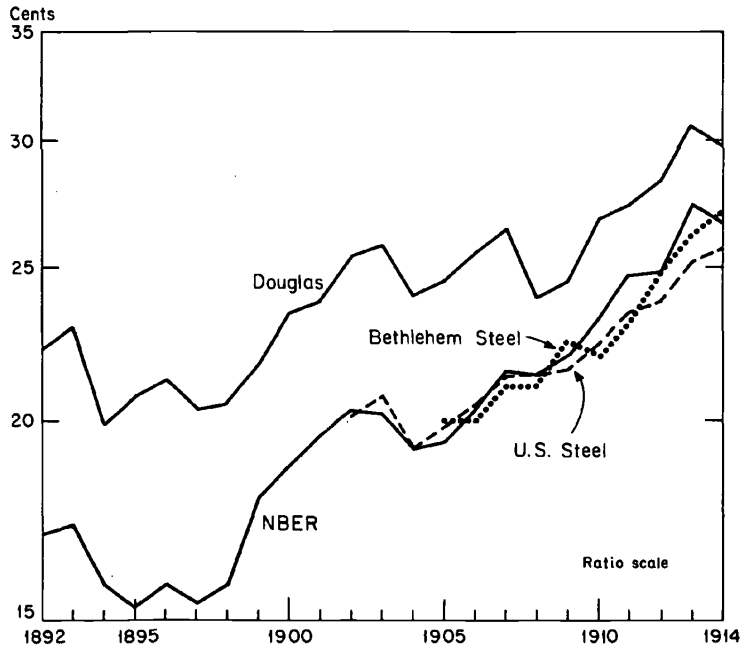
SOURCE: For NBER series, see text. Douglas series: Paul Douglas, *Real Wages in the United States, 1890–1926*, Boston, 1930, p. 101. U.S. Steel: United States Steel Corporation, *47th Annual Report, 1948*, p. 28. Bethlehem Steel: Bethlehem Steel Corporation, *Annual Report, 1954*, p. 19.

is included in the census industry. These departments appear to have lower hourly earnings than the included departments. In addition, the regular BLS data exclude workers not assigned to any department engaged directly in production—the power, mechanical, and yard

force. A special BLS study for 1910 shows that such workers were more than one-third of the total and that their average earnings were slightly less than those of "productive" workers.[41]

CHART 4

Average Hourly Earnings, Iron and Steel, 1892–1914




The study just mentioned also permits us to estimate average hourly earnings for the whole industry for May 1910 at 21.6 cents.[42] This is somewhat below any of the figures shown in Table 15 for that year. This figure is also affected by exclusions; the 1910 study omits all plants of the Bethlehem Steel Corporation and also omits departments producing sheet, tin and terne plate, wire, nails, and bolts.

[41] *Report on Conditions of Employment in the Iron and Steel Industry*, Senate Document 110, 62nd Congress, 1st Session (1911), Vol. 1, pp. xxviii–xxix. The average hourly earnings in productive occupations were 22.3 cents; in the power, mechanical, and yard force, 21.0 cents. This last figure was computed from a frequency distribution given in the source.

[42] Computed from the data cited in footnote 41 and a similar frequency distribution for general occupations in the productive departments given in the same table.

Although our earnings estimates for the steel industry are supported by the data available from other sources, our estimates of standard hours are lower than any others. Table 16 shows three series for average weekly hours, 1902–14. The comparisons are not extended back of 1902, since there is only one estimate (Douglas) of the

TABLE 16

Average Weekly Hours in the Iron and Steel Industry, 1902–14

| | NBER[a] | Douglas[b] | U.S. Steel |
|---|---|---|---|
| 1902 | 64.0 | 67.3 | 68.4 |
| 1903 | 64.0 | 67.4 | 66.6 |
| 1904 | 63.4 | 66.8 | 67.4 |
| 1905 | 64.1 | 67.5 | 68.9 |
| 1906 | 64.0 | 67.4 | 68.6 |
| 1907 | 64.0 | 67.4 | 68.5 |
| 1908 | 63.2 | 66.5 | 65.1 |
| 1909 | 63.8 | 67.2 | 68.8 |
| 1910 | 63.5 | 67.2 | 68.4 |
| 1911 | 62.3 | 66.3 | 67.2 |
| 1912 | 61.9 | 66.1 | 69.0 |
| 1913 | 61.7 | 66.3 | 68.9 |
| 1914 | 60.7 | 65.5 | 67.6 |

SOURCE: For NBER series, see text. Douglas series: Paul Douglas, *Real Wages in the United States, 1890–1926*, pp. 96 and 101. U.S. Steel: United States Steel Corporation, *47th Annual Report, 1948*, p. 28.

[a] Standard workweek; Douglas adjusted to census levels in 1909 and 1914; see p. 42.

[b] Standard workweek.

movement of hours available before then. In addition to the estimates shown in Table 16, an estimate for 1910 of 68.5 hours can be made from the special BLS study of that year.[43]

If we had used any of these higher estimates of weekly hours and applied them to our estimates of daily earnings, the resulting hourly earnings would lie below the other hourly earnings series. There is

[43] *Report on Conditions of Employment in the Iron and Steel Industry*, p. xliii. Average hours for general occupations and for power, mechanical, and yard force were computed from frequency distributions. The assumed means of the class intervals were chosen so as to reproduce as closely as possible the published mean for productive occupations. Ethel B. Jones has pointed out to us that our hours estimates may be low because they are benched to census data on prevailing hours of establishments. Within these establishments there were probably departments with longer hours than those of the establishment as a whole.

some possibility that such an earnings series would be more accurate than the one we have used, since our estimates after 1908 lie above the series on earnings in United States Steel, and these, in turn, were probably above the industry average.[44] On the other hand, the omission of departments making finished products from rolled steel may well explain the higher level of the Douglas hours estimates, while this plus the omission of two other departments with short workweeks, sheet and tinplate, could explain the high level of hours shown by the 1910 study. There are presumably no such omissions in the hours series published by United States Steel. However, in general the workweek for all companies was longest in the departments producing the products where U.S. Steel had the largest share of industry output (ingots and heavy rolled products).[45]

This completes the discussion of earnings series that can be compared with alternative series. For some series already discussed, and some others, comparisons can be made in 1914 with the data published by the National Industrial Conference Board. These comparisons are shown in Table 17, together with Douglas's estimates where available. In two cases, cotton and paper and paper products, the NICB divides our industry into two parts. In both cases, our estimate lies between the two NICB figures, though in both cases a weighted average of their figures lies above ours.[46]

Where direct comparison between our figures and the NICB figures

[44] U.S. Steel had a large proportion of its employment in the Pittsburgh district, which was in general the highest wage district (see *ibid.*, p. xxxiv). Within this district, U.S. Steel employees had higher earnings than those of small companies, but somewhat lower earnings than those of large independent companies. This last statement is based on comparisons of average earnings by type of company in each of five departments (blast furnaces, open hearth furnaces, blooming mills, plate mills, and bar mills) computed from frequency distributions in *ibid.*, Vol. IV, p. 264. Large independent companies ranked first except in open hearth furnaces, where U.S. Steel ranked first. U.S. Steel ranked last in bar mills.

[45] For U.S. Steel's share of output by products in 1913 and 1914 see Temporary National Economic Committee, *Investigation of Concentration of Economic Power*, Part 31 (1941), p. 17,747. The corporation's share of industry production was 50.3 per cent for ingots and 50.6 per cent for rails in 1914, while in sheet it was 39.3 per cent and in tubes and pipe, 44.8. In 1910, the standard workweek of productive workers in tube mills was 62.0 hours compared with 69.8 for all departments (*Report on Conditions of Employment*, p. xliii); in 1914 the standard workweek in sheet mills was 52.3 hours, compared with 64.9 in all departments (Wolman, *Hours of Work in American Industry*, p. 9, computed from BLS data). On the other hand, U.S. Steel produced more than half the industry output of wire rods and tinplate in 1914, and in these departments the standard workweek was also short.

[46] Weighting the NICB cotton figures by census employment in the South and the non-South gives an industry estimate of 15.1 cents. Weighting the NICB figures for paper and for paper products by census employment gives an average of 21.2 cents.

is possible, theirs are higher in six cases and lower in two; in boots and shoes the figures are the same. The largest difference is 3.2 cents an hour in electrical apparatus. In two other industries the difference is between 2 and 3 cents an hour.

There are six industries for which Table 17 permits direct comparisons between three sets of data. In three of these—iron and steel, boots and shoes, and foundries and machine shops—the NICB figure is closer to ours than to Douglas's. The NICB figure for iron

TABLE 17

Comparison of Estimates of Average Hourly Earnings by Industry, 1914
(cents)

| | NICB[a] | Douglas | NBER |
|---|---|---|---|
| Iron and steel | 26.3 | 29.8 | 26.6 |
| Electrical apparatus | 27.2 | n.s. | 24.0 |
| Foundries and machine shops | 27.8 | 41.3[b] | 25.3 |
| Cotton, North | 17.6 | 15.3 | 14.1 |
| Cotton, South | 11.7 | | |
| Hosiery and knit goods | 17.8 | 17.2 | 16.0 |
| Silk | 19.6 | 19.7[c] | 16.9 |
| Wool | 18.2 | 18.2 | 19.0 |
| Leather | 21.7 | n.s. | 21.4 |
| Boots and shoes | 21.2 | 24.3 | 21.2 |
| Paper and pulp | 23.3 | n.s. | 20.5 |
| Paper products | 18.7 | | |
| Rubber | 25.0 | n.s. | 23.9 |

n.s. = not given in source.

[a] National Industrial Conference Board, *Wages and Hours in American Industry*, New York, 1925, Chapter IV. Data are for July.

[b] Metal trades, union rates.

[c] NBER estimate from BLS data, using Douglas's method.

and steel further confirms the level of our estimates for that industry. In the other three industries—hosiery and knit goods, silk, and wool —the NICB data lie closer to the Douglas or BLS figures than to ours. This suggests that in these industries the NICB industry definition is similar to that of the BLS, but this inference cannot be checked directly.

We can also make comparisons for 1904 between some of our industry estimates and BLS estimates from Bulletin 65.[47] Table 18

[47] These are from "BLS Historical Estimates of Earnings and Hours." The methods used in making these estimates are briefly discussed on pp. 38–39.

compares these estimates with ours and Douglas's. Our estimates are consistently below those of the BLS, probably because the BLS data are based on wage rates for selected occupations only. The Douglas estimates, though based on the same data as the BLS estimates, are very close to ours for two industries, cotton goods and woolens and worsteds. This is because Douglas, in effect, corrects his 1904 estimates by the 1914 ratio of wages in selected occupations to wages in all occupations. In hosiery and knit goods, the Douglas estimate is somewhat closer to the BLS estimate than to ours, perhaps because

TABLE 18

Comparison of Estimates of Average Hourly Earnings by Industry, 1904
(cents)

| | BLS[a] | Douglas | NBER |
|---|---|---|---|
| Cotton goods | 13.0 | 10.9 | 10.7 |
| Dyeing and finishing textiles | 18.0 | n.s. | 15.4 |
| Foundries and machine shops | 24.3 | 36.4[b] | 20.0 |
| Hosiery and knit goods | 12.7 | 12.0 | 10.7 |
| Leather | 17.6 | n.s. | 16.1 |
| Woolens and worsteds | 15.0 | 13.9 | 13.7 |

SOURCE: BLS series: *Monthly Labor Review*, July 1955, p. 802. NBER series: See text. Douglas series: Paul Douglas, *Real Wages in the United States, 1890–1926*, Boston, 1930, pp. 96 and 101.

n.s. = not given in source.

[a] These figures, presented in the source to the hundredth of a cent, have been rounded to the nearest tenth of a cent.

[b] Metal trades, union rates.

the Douglas and BLS data cover a more narrowly defined industry than ours. For foundries and machine shops the Douglas estimate is, of course, much higher than the other two because it has been linked to the series of union rates for the metal trades.

Comparisons of industry estimates for 1890 are also of interest, since this year forms the link between series for earlier periods and those for our period. Table 19 compares our estimates and Douglas's, which extend forward from 1890, with some estimates from the Aldrich Report, which extends backward, and from the Dewey Report. The estimates from the Aldrich and Dewey data are those of Clarence D. Long.

The various sets of estimates shown in Table 19 display no consistent pattern. This is in keeping with the view expressed earlier that the

Dewey Report estimates reflect offsetting biases: the upward bias usually present in small nonrandom wage samples and the downward bias of the median relative to the mean. Both of these biases are present in the estimates from the Aldrich data, the first to a much more marked degree. Our own data, we feel, have a rather uniform slight downward bias. In the eight comparisons of our figures with the Dewey Report medians, ours are lower in three cases and higher

TABLE 19

Comparison of Estimates of Average Hourly Earnings by Industry, 1890
(cents)

| | Aldrich Report[a] | Dewey Report[b] | Douglas[c] | NBER[d] |
|---|---|---|---|---|
| Boots and shoes, factory product | n.s. | 17.0 | 16.9 | 16.1 |
| Cotton goods | 12 | 10.0 | 9.7 | 9.9 |
| Dyeing and finishing textiles | n.s. | 12.0 | n.s. | 15.4 |
| Foundries and machine shops | n.s. | 16.0 | 31.9[e] | 18.5 |
| Hosiery and knit goods | n.s. | 10.0 | 11.3 | 9.4 |
| Leather | 16 | 15.0 | n.s. | 16.9 |
| Rubber | n.s. | 15.0 | n.s. | 15.8 |
| Woolens and worsteds | 13 | 10.0 | 12.1 | 11.6 |

n.s. = not given in source.

[a] From Clarence D. Long, *Wages and Earnings in the United States, 1860–1890*, Princeton University Press for NBER, 1960. Median of occupational daily wages divided by mean daily hours. Long uses the median for comparability with the Dewey Report data; elsewhere he presents mean daily wages from the Aldrich Report.

[b] *Ibid.*, Table A–8. Median hourly wages.

[c] Paul Douglas, *Real Wages in the United States, 1890–1926*, Boston, 1930, pp. 96 and 101.

[d] See text.

[e] Metal trades, union rates.

in five. The Douglas payroll estimates lie closer to our figures than to the Dewey medians in cotton and wool, and closer to the Dewey medians in boots and shoes and in hosiery and knit goods. The Aldrich Report medians are above the Dewey medians in every case, and above our estimates in two of the three cases. The downward bias of the median seems to be especially important in the Dewey Report data for the woolen industry, where the median earnings are no higher than in cotton or hosiery and knit goods. On all other evidence, wages in the woolen industry lie significantly above wages in these other two industries.

We conclude this section with some comments on a few of the series in Table 13 whose movements have not yet been discussed. It should be noted that "all textiles" is more than the combination of our five series on individual textile industries. It also includes two smaller industries not shown separately: (1) carpets other than rag, and (2) cordage, twine, jute, and linen goods. In addition, the state data used as interpolators include some series that could not be assigned to a particular textile industry, such as "mixed textiles" or "cotton and woolen textiles." For this reason the movement of the series should be somewhat more reliable than that of its components. In computing the all-textile series, we combined data by states and states by census employment.

The series for glass presented unusual difficulties. The number of days worked per year in the glass industry is very low. In 1914, an average of 256 days was worked in the states for which we have data; in other industries the average number of days worked was between 270 and 289. The New Jersey reports mention each year that "closing down for the months of July and August is an established practice in all glass factories," and census data on employment by months in 1914 show that in the glass industry (exclusive of cutting, staining, and ornamenting) employment in the lowest month, August, was only 57.7 per cent of employment in the peak month, March.

Such seasonality in employment would lead us to overestimate daily and hourly earnings if we applied our usual method. The census computes average employment for the year by summing employment for the twelve months and dividing by twelve. If we divide total wage payments by employment so computed to obtain average annual earnings, we have already allowed for the fact that some plants do not operate in the summer months. If we now divide these annual earnings by days worked, we again allow for summer closings, and this double counting of days not worked gives too high a daily wage.[48]

To prevent the overestimation of daily earnings on this account, we have adjusted the census employment figures for glass (exclusive of cutting, staining, and ornamenting, which is part of our series) before computing annual earnings. The adjustment consists of discarding the three months during which employment is lowest

[48] Rather late in our work we discovered that a similar seasonal problem was present in another of our series, pottery and clay products. The brick industry, a major component of this series, is highly seasonal, and we could devise no satisfactory method of allowing for this. Accordingly, the series for pottery and clay products was discarded.

(July, August, and September) and using the average employment for the remaining nine months.

Because this adjustment is somewhat arbitrary, we needed an independent check on the level of our series for glass. Such a check is afforded by the Dewey Report.[49] The Dewey Report data for glass for 1899 (the year ending June 1, 1900) cover 6,148 workers, out of a total industry employment of 52,818. The data cover the middle-Atlantic, central, and southern states and do not exclude any occupations. We have combined the three frequency distributions of wage rates per hour (for males 16 and over, females, and males under 16) for all areas and occupations and computed the mean of the combined distribution, which is 18.9 cents. This lies between the figures for 1899 (18.1 cents) and 1900 (19.5 cents) of our basic series, and suggests that the adjustment described in the preceding paragraph is an appropriate one.

The cyclical movement of our series for glass is unusual and may not be reliable. The trough in 1903 is a year earlier than for most industries, while the trough in 1909 is a year late (see Table 13). Exactly the same movements in 1903 and 1909 appear in the series for paper and paper products. For both industries, in key states in 1908, there are declines in employment and days in operation without corresponding declines in annual earnings.

The period 1890–1914 is one in which a number of new industries were growing rapidly. Unfortunately, we were unable to get state data for most such industries and they are not well represented in our industry series. For the industries shown in Table 13, there is no clear relation between the rise in wages and the rate of growth in employment. However, by looking within the rubber industry, we can contrast the wage movement of the old, stable branches with that of a new, rapidly growing branch. The old branches are rubber boots and shoes and rubber hose and belting; the new branch is rubber, not elsewhere specified (n.e.s.), which by 1910 consisted largely of rubber tires and tubes. Although we do not have separate series on these branches for 1900–1910, we can approximate them closely by state

[49] *Employees and Wages*, pp. 482–483. The Dewey Report is greatly superior to the *Nineteenth Annual Report* in that for most industries it has considerably larger samples of workers, and its data cover all the workers in the establishments sampled. It has not been widely used because it covers only two years (the years ending June 1, 1890 and June 1, 1900) and because the basic data are presented as detailed frequency distributions for which medians are the only averages given. The distribution of hourly wage rates for glass has seventy-four classes, most of them one cent wide.

series. In 1909, Ohio had 39 per cent of employment in rubber, n.e.s., and was unimportant in the other two branches. The production of rubber boots and shoes was highly concentrated in Massachusetts, and that of rubber belting and hose in New Jersey. Table 20 shows the movement of daily earnings and of census employment in the rubber industry in these three states for 1899–1910. The earnings series are the state data before adjustment to census levels. Such adjustment would lower the level of the Ohio series somewhat,

TABLE 20

Average Daily Earnings and Wage Earner Employment in the Rubber Industry, Three States, 1899–1910

| | *Average Daily Earnings* | | | *Number of Wage Earners* | | |
|---|---|---|---|---|---|---|
| | New Jersey | Massachusetts | Ohio | New Jersey | Massachusetts | Ohio |
| 1899 | $1.54 | $1.58 | —[a] | 3,385 | 11,510 | 3,505 |
| 1900 | 1.58 | 1.55 | $1.45 | | | |
| 1901 | 1.58 | 1.70 | 1.51 | | | |
| 1902 | 1.60 | 1.57 | 1.72 | | | |
| 1903 | 1.62 | 1.57 | 1.81 | | | |
| 1904 | 1.68 | 1.61 | 1.80 | 3,920 | 12,677 | 4,815 |
| 1905 | 1.63 | 1.66 | 1.82 | | | |
| 1906 | 1.64 | 1.76 | 2.04 | | | |
| 1907 | 1.77 | 1.70 | 1.92 | | | |
| 1908 | 1.90 | 1.86 | 2.04 | | | |
| 1909 | 1.80 | 1.81 | 2.08 | 6,550 | 10,346 | 11,065 |
| 1910 | 1.81 | 1.85 | 2.31 | | | |

SOURCE: See Appendix A.
[a] Not shown; sample inadequate.

but would not affect its movement appreciably. The faster rise in earnings in Ohio is undoubtedly related to the faster growth of employment; a large part of it comes early in the period, suggesting that the beginning stages of the rapid expansion caused the greatest labor shortages.

Beginning in 1899 we have series for thirteen industries excluding "all textiles." From 1899 to 1914 there is a very slight tendency for the earnings differentials among these industries to narrow. The coefficient of variation of the thirteen average hourly earnings figures drops from 21 per cent in 1899 to 19 per cent in 1914.

## *The Combined-Industry Series*

In this section we combine the industry average hourly earnings series of the preceding section into a weighted average which serves as a check on the all-manufacturing series. We cannot make a similar check for average daily hours because the hours series for all manufacturing and for the individual industries are based on the same data. However, for earnings, the all-manufacturing series covers a much wider range of industries than the individual industry series do, while the latter include data from a number of states not used in the all-manufacturing series.

In combining the industries series we treat "all textiles" as one industry; it already includes the separate series for the other textile industries. "All textiles" and the eight nontextile industries of the preceding section are combined using census employment weights with linear interpolations of weights between census years. The industry series that do not go back to 1890 are brought in by linking so as not to disturb the movement of the combined series. The resulting series for nine industries combined is compared with the all-manufacturing series in Table 21 and Chart 5.

The two series never differ by more than one cent. The all-manufacturing series lies 0.1 cent below the nine-industry series in 1890 but rises until it is 1.0 cent higher in 1913, indicating that industries whose wages rose less than the average are overrepresented in the nine-industry series. The principal difference in movement occurs in the business contraction of 1908, when the nine-industry series rises slightly while the all-manufacturing series falls. The rise in the nine-industry series throughout 1907–09 occurs despite the fact that all but two of its components (leather and foundries and machine shops) fall either from 1907 to 1908 or from 1908 to 1909. However, only three fall between the first pair of years, and three others rise sharply. The sharp rises are in paper, rubber, and glass; in each case, in the leading states, employment and days in operation fall, but days in operation fall more than annual earnings.

The nine-industry series was also computed with constant 1914 weights. We have not shown this series here, since it never differs by more than 0.1 cent from the variable-weight series. This indicates that the rather considerable differences among the industries in rates of growth of employment are not strongly related to wage levels. This lack of relation was confirmed by examining a scatter diagram in

which percentage changes in employment from 1899 to 1914 were plotted against 1914 average hourly earnings, with the principal component industries of all textiles plotted separately.

TABLE 21

Average Hourly Earnings in All Manufacturing and in Nine Manufacturing Industries Combined, 1890–1914
(cents)

| | All Manufacturing | Nine Industries |
|---|---|---|
| 1890 | 14.4 | 14.5 |
| 1891 | 14.4 | 14.7 |
| 1892 | 14.5 | 14.6 |
| 1893 | 15.1 | 15.2 |
| 1894 | 13.9 | 14.5 |
| 1895 | 13.8 | 14.0 |
| 1896 | 14.4 | 14.2 |
| 1897 | 14.0 | 13.9 |
| 1898 | 13.7 | 13.9 |
| 1899 | 14.6 | 14.3 |
| 1900 | 15.1 | 14.8 |
| 1901 | 15.8 | 15.2 |
| 1902 | 16.5 | 15.8 |
| 1903 | 17.0 | 16.3 |
| 1904 | 16.9 | 16.1 |
| 1905 | 17.2 | 16.3 |
| 1906 | 18.4 | 17.1 |
| 1907 | 19.1 | 17.8 |
| 1908 | 18.4 | 17.9 |
| 1909 | 18.6 | 18.0 |
| 1910 | 19.8 | 18.9 |
| 1911 | 20.2 | 19.4 |
| 1912 | 20.7 | 20.0 |
| 1913 | 22.1 | 21.1 |
| 1914 | 22.0 | 21.2 |

SOURCE: All Manufacturing: Table 10. Nine Industries: computed from Table 13.

CHART 5

Average Hourly Earnings, All Manufacturing and Nine Industries Combined, 1890–1914