Hours at work: a new base for BLS productivity statistics

Using data from a recently established survey, BLS defines a new measure of labor input; hours at work replace hours paid in statistics on productivity

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In August 1989, the Bureau of Labor Statistics began publishing productivity statistics for major sectors of the U.S. economy that are based on a new measure of labor input: hours at work. Previous productivity statistics were based primarily on hours paid, which come from employer payroll records. The switch to hours at work was accomplished with data from one of the newer BLS surveys, the Hours at Work Survey.[1]

This article reports on the conversion to hours at work and the resulting effects on productivity statistics. It describes the Hours at Work Survey, which yields ratios of hours at work to hours paid, and presents results from the survey. The historical series of ratios constructed for the period prior to the Hours at Work Survey are discussed. The article concludes with a brief description of how the ratios of hours at work to hours paid are used to produce the new hours measures.

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Conversion to hours at work

On August 3, 1989, the Bureau of Labor Statistics began using hours at work in its productivity and cost measures for the major sectors: business, nonfarm business, manufacturing, and nonfinancial corporations. All of the measures for these sectors that involve hours were altered, including output per hour and compensation per hour. The measures are published eight times a year in a Department of Labor news release, "Productivity and Costs," and also appear in Bureau of Labor Statistics publications, such as the *Monthly Labor Review* and *Employment and Earnings*.[2]

In the previous measures, hours of all persons consisted of hours paid of employees in the private nonfarm business sector and hours worked of self-employed persons, unpaid family workers, employees of government enterprises, and, in the business-sector measures, farm employees. Hours paid are based on information from the Current Employment Statistics program (also known as the establishment survey), which collects data from firms' payroll records each month. Hours paid of employees accounted for about 85 percent of total hours in the old business-sector hours measure. Hours worked of self-employed persons, unpaid family workers, employees of government enterprises, and farm employees are from the Current Population Survey, a monthly household survey.[3]

In the new measures, the hours paid of employees in private nonfarm business are replaced by a measure of their hours at work that was developed with the results of the Hours at Work Survey. Because the measure of hours at work excludes paid leave, which is composed of hours that are not devoted to the production process, it is preferred to hours paid as a measure of labor input for productivity statistics.[4]

The use of hours at work instead of hours paid has little effect on the long-term average annual

growth rates of labor productivity, as measured by output per hour of all persons (table 1). For the period 1948 to 1988, the average annual growth rate of output per hour in nonfarm business is effectively unchanged when hours at work are substituted for hours paid. In manufacturing, the rate is one-tenth of a percentage point higher when the hours measure is hours at work.

Switching to hours at work increases the labor productivity growth rate slightly in nonfarm business from 1948 to 1973 and from 1973 to 1979. The rate is one-tenth of a percentage point higher in both periods, and so the falloff in productivity growth during the two periods (the productivity slowdown) remains the same: 1.9 percentage points. Therefore, the switch to hours at work explains none of the productivity slowdown in nonfarm business in the 1970's. In the most recent period, 1979 to 1988, the annual growth rate of output per hour is one-tenth of a percentage point lower when hours at work of employees are the measure of labor input.

In manufacturing, the new measure of output per hour grew at an average annual rate that was one-tenth of a percentage point greater than that of the old measure from 1948 to 1973 and two-tenths of a percentage point greater from 1973 to 1979. Hence, a small fraction of the productivity slowdown in manufacturing in the 1970's (0.1 of 1.4 percentage points) can be explained by excluding paid leave from labor input. As in nonfarm business, the productivity growth rate in manufacturing is one-tenth of a percentage point lower from 1979 to 1988 when hours at work are used.

Annual differences in labor productivity growth rates based on the new and old hours series can be much larger than the long-term differences in the growth rates (table 2). For example, from 1982 to 1983, the percent change in output per hour using hours at work was lower than the percent change in output per hour using hours paid by three-tenths of a percentage point in nonfarm business and six-tenths of a percentage point in manufacturing. Similarly, substituting hours at work for hours paid increases the percent change in output per hour from 1985 to 1986 by half a percentage point in both nonfarm business and manufacturing.

Multifactor productivity measures for business, nonfarm business, and manufacturing are also now computed using hours at work.[5] The effect of the switch to hours at work is smaller on the multifactor productivity measures than on the labor productivity measures, because there are two inputs (capital and labor) in the multifactor productivity measures. The effect on the percent change in multifactor productivity is approximately two-thirds of the effect on labor productivity, because labor's share of the value of output is about two-thirds. For example, the downward adjustment in the annual percent change in labor productivity in nonfarm business in 1983 was three-tenths of a percentage point, while the downward adjustment in multifactor productivity was two-tenths of a percentage point. The smaller adjustment in multifactor productivity can be seen also in some of the long-term growth rates (table 3). For instance, from 1948 to 1973, the average annual growth rate of the new measure of output per hour in nonfarm business was one-tenth of a percentage point higher than that of the old measure, while the growth rates of the old and new measures of multifactor productivity were the same. Note that comparisons between tables 1 and 3 are not straightforward: in some cases the smaller adjustment in multifactor productivity is not evident, because the periods ending in the 1980's are not comparable across the tables and the growth rates are rounded to one decimal place.

Hours at Work Survey

"Hours at work" refers to the time that an employee spends on the job. In addition to time spent actually working, hours at work include short rest periods, coffee breaks, standby or ready time, downtime, portal-to-portal time (if paid), washup time (if paid), travel time from job site to job site within the working day, travel time away from home if it cuts across the working day, and paid training periods. For the purpose of the Hours at Work Survey, hours at

Table 1. Growth rates of labor productivity, based on hours at work and hours paid, 1948–88

[Compound average annual rates]

Sector and period	Output per hour based on—		Difference
	Hours at work	Hours paid	
Nonfarm business:			
1948–88	1.9	1.9	0.0
1948–73	2.5	2.4	.1
1973–79	.6	.5	.1
1979–88	1.2	1.3	–.1
Manufacturing:			
1948–88	2.8	2.7	.1
1948–73	2.9	2.8	.1
1973–79	1.6	1.4	.2
1979–88	3.3	3.4	–.1

NOTE: Labor productivity is output per hour of all persons.

Table 2. Labor productivity based on hours at work and hours paid, 1948–88

[Percent change from previous year]

Year	Nonfarm business			Manufacturing		
	Output per hour based on—		Difference	Output per hour based on—		Difference
	Hours at work	Hours paid		Hours at work	Hours paid	
1948	3.8	3.8	0.0	6.1	6.1	0.0
1949	1.6	1.7	−.1	4.1	4.1	.0
1950	6.5	6.4	.1	5.5	5.4	.1
1951	3.1	3.0	.1	4.0	3.9	.1
1952	2.2	2.2	.0	2.0	1.9	.1
1953	2.2	2.2	.0	2.1	2.1	.0
1954	1.4	1.5	−.1	1.4	1.4	.0
1955	3.0	2.9	.1	4.7	4.7	.0
1956	.6	.6	.0	−.5	−.6	.1
1957	1.9	1.9	.0	2.2	2.1	.1
1958	2.3	2.4	−.1	−.6	−.6	.0
1959	3.2	3.2	.0	4.5	4.5	.0
1960	1.1	1.1	.0	.6	.5	.1
1961	3.1	3.1	.0	2.8	2.8	.0
1962	3.3	3.3	.0	4.3	4.2	.1
1963	3.6	3.6	.0	6.9	6.8	.1
1964	3.9	3.9	.0	4.8	4.8	.0
1965	2.6	2.5	.1	2.7	2.7	.0
1966	2.2	2.1	.1	1.1	1.1	.0
1967	2.6	2.3	.3	.3	−.1	.4
1968	2.9	2.6	.3	3.6	3.2	.4
1969	−.3	−.5	.2	1.6	1.2	.4
1970	.5	.3	.2	.4	.0	.4
1971	2.9	3.0	−.1	5.5	5.6	−.1
1972	3.0	3.1	−.1	3.9	4.4	−.5
1973	2.1	1.8	.3	5.4	4.9	.5
1974	−1.9	−2.2	.3	−2.6	−3.0	.4
1975	1.9	1.8	.1	2.6	2.5	.1
1976	2.8	2.6	.2	4.7	4.6	.1
1977	1.7	1.6	.1	3.1	3.0	.1
1978	.9	.8	.1	1.6	1.5	.1
1979	−1.5	−1.6	.1	.0	−.1	.1
1980	−.4	−.4	.0	.0	.0	.0
1981	1.1	1.0	.1	2.3	2.2	.1
1982	−.9	−.6	−.3	2.5	2.2	.3
1983	3.0	3.3	−.3	5.2	5.8	−.6
1984	2.1	2.1	.0	5.4	5.5	−.1
1985	1.3	1.4	−.1	4.5	4.6	−.1
1986	2.0	1.5	.5	3.8	3.3	.5
1987	1.1	1.5	−.4	3.7	3.5	.2
1988	2.0	2.1	−.1	2.7	3.6	−.9

NOTE: Labor productivity is output per hour of all persons.

work can be computed by subtracting hours of paid leave from total hours paid. Paid leave includes paid vacation time, paid sick leave, paid holidays, and other paid personal or administrative leave.

The Hours at Work Survey was developed in order to obtain ratios of hours at work to hours paid. The survey was created following a review by a BLS task force of existing surveys to determine the most appropriate method for the measurement of hours worked.[6] The task force selected the term "hours at work" and provided the definition given above. In its report, the task force recommended that data on hours at work and hours paid be collected from a sample of establishments annually. With these data, ratios of hours at work to hours paid could be computed and applied to data on hours paid from the establishment survey.[7] The Hours at Work Survey, which began in 1982, resulted from the task force recommendations.

The Hours at Work Survey is conducted annually. Annual and quarterly data on hours at work and hours paid for the previous year are

collected from a sample of nonagricultural business establishments. The sample is a stratified random sample of establishments in the Unemployment Insurance reporting system (the ES–202 program). Stratification of the sample is done both by industry and by number of employees at the establishment. During the first 6 years of the survey, approximately 4,500 establishments were sampled. Beginning with the 1987 Hours at Work Survey (which gathered data for 1987 and which was conducted in 1988), the sample size was increased to about 5,500.

The Hours at Work Survey gathers data on the hours at work and hours paid of nonsupervisory and production workers. This makes the survey consistent with the establishment survey, which collects data on hours paid of nonsupervisory and production workers from a sample of about 300,000 establishments each month.

The data on hours at work and hours paid are obtained by mail and by telephone. After an initial mailing of the questionnaires in January of each year, there are two mail followups and a telephone followup. There are two questionnaires: one for manufacturing, mining, and construction, and one for all other industries.

The usable response rate for all industries has averaged about 80 percent. In the 1988 survey, the response rate for all industries was 80.4 percent. The response rate for manufacturing (82.5 percent) was well above the rate for nonmanufacturing (68.4 percent).

The data from the Hours at Work Survey are used to compute annual and quarterly ratios of hours at work to hours paid for 2-digit Standard Industrial Classification (SIC) industries in manufacturing and for industry groups, such as construction and retail trade, outside of manufacturing. The annual ratios of hours at work to hours paid from 1981 to 1988 are shown in table 4.

The ratio of hours at work to hours paid for nonagricultural business rose from .924 in 1981 to .931 in 1988. The ratio has been at or near .930 in most years since it first reached that level in 1983. A ratio of .930 implies 18.2 days of paid leave per year for a full-time, year-round worker. This amounts to slightly more than 3½ weeks of paid leave and is approximately the amount of paid leave received by a worker with a 2-week paid vacation (10 workdays off) and 8 paid holidays.

Movements in the ratio of hours at work to hours paid have inverse effects on productivity measures. When the ratio rises, the adjustment in the productivity measure is downward (as in nonfarm business in 1983). When the ratio falls, the adjustment in the productivity measure is upward (as in nonfarm business and manufacturing in 1986).

The relationship between hours at work and hours paid varies with the business cycle. This was especially evident in the early 1980's. The ratio for all industries jumped from .926 in 1982 to .930 in 1983 as the economy moved from recession to expansion. In the beginning of an economic expansion, there is usually an increase in the proportion of junior employees, who receive less paid leave; there may also be an increase in overtime hours at the start of an expansion. Both of these phenomena raise the average ratio of hours at work to hours paid. Under such conditions, the percent change in hours at work is greater than the percent change in hours paid, and the growth of output per hour based on hours at work will be less than that based on hours paid.

The relationship between hours at work and hours paid is also affected by shifts in employment among sectors of the economy. Between 1981 and 1988, employment shifted from manufacturing to nonmanufacturing: employment in manufacturing fell by 0.8 million and employment in nonmanufacturing rose by 12.4 million. Throughout the life of the Hours at Work Survey, the ratio in nonmanufacturing (.936 in 1988) has always been well above the ratio in manufacturing (.918 in 1988), so that a shift in employment toward nonmanufacturing has a positive effect on the overall ratio.

Table 3. **Growth rates of multifactor productivity, based on hours at work and hours paid, 1948–85**

[Compound average annual rates]

Sector and period	Multifactor productivity based on—		Difference
	Hours at work	Hours paid	
Private nonfarm business:[1]			
1948–85	1.3	1.2	0.1
1948–73	1.8	1.8	.0
1973–79	.1	.0	.1
1979–85	.3	.4	–.1
Manufacturing:			
1948–85	2.0	1.9	.1
1948–73	2.2	2.1	.1
1973–79	.7	.6	.1
1979–85	2.4	2.5	–.1

[1] Private nonfarm business is nonfarm business less government enterprises.

NOTE: Multifactor productivity measures based on hours at work for 1986, 1987, and 1988 were not available at the time this article was prepared.

Table 4. **Ratio of hours at work to hours paid for production and nonsupervisory workers, by industry, 1981–88**

Industry	1981	1982	1983	1984	1985	1986	1987	1988
Nonagricultural business	0.924	0.926	0.930	0.931	0.932	0.925	0.930	0.931
Mining	.937	.925	.916	.921	.926	.924	.928	.924
Construction	.978	.982	.980	.973	.983	.970	.956	.978
Manufacturing	.912	.909	.914	.915	.916	.912	.910	.918
Durable	.907	.905	.911	.911	.915	.908	.904	.916
Lumber	.935	.929	.944	.940	.946	.945	.949	.952
Furniture and fixtures	.941	.931	.936	.937	.938	.940	.936	.928
Stone, clay, glass	.906	.903	.910	.915	.923	.927	.920	.923
Primary metals	.891	.879	.901	.909	.908	.896	.906	.915
Fabricated metals	.919	.912	.919	.917	.921	.918	.904	.924
Machinery (except electrical)	.900	.906	.902	.909	.915	.905	.911	.919
Electrical equipment	.906	.899	.909	.902	.903	.899	.900	.905
Transportation equipment	.893	.898	.908	.898	.905	.882	.862	.900
Instruments	.907	.904	.886	.901	.904	.897	.896	.901
Miscellaneous manufacturing	.927	.921	.919	.931	.920	.942	.930	.935
Nondurable	.920	.916	.918	.921	.917	.916	.919	.919
Food and kindred products	.927	.924	.921	.912	.914	.921	.916	.917
Tobacco	.892	.853	.865	.831	.872	.877	.896	.888
Textile mills	.943	.937	.944	.939	.943	.942	.950	.946
Apparel	.948	.939	.937	.955	.931	.934	.940	.942
Paper	.883	.890	.897	.895	.897	.878	.890	.889
Printing and publishing	.905	.915	.919	.918	.924	.920	.910	.922
Chemicals	.895	.882	.886	.893	.897	.887	.888	.890
Petroleum and coal products	.899	.892	.878	.889	.892	.887	.899	.888
Rubber and plastic products	.918	.906	.916	.931	.919	.924	.927	.929
Leather	.931	.930	.936	.925	.931	.927	.935	.932
Transportation	.875	.871	.879	.890	.917	.918	.927	.918
Communications	.887	.883	.881	.876	.868	.879	.873	.879
Electric, gas, sanitary services	.876	.873	.882	.881	.886	.870	.876	.855
Wholesale trade	.934	.936	.928	.920	.931	.921	.928	.947
Retail trade	.947	.959	.960	.961	.952	.936	.952	.948
Finance, insurance, real estate	.914	.905	.901	.907	.925	.913	.918	.909
Services	.920	.936	.948	.944	.932	.936	.938	.928

Historical series

Because productivity statistics for the major sectors of the economy go back to 1947, while the Hours at Work Survey data begin in 1981, historical series are needed for the ratios of hours at work to hours paid for the period 1947 to 1980. Various sources of data for the historical series were explored, including the Survey of Employer Expenditures for Employee Compensation, the Current Population Survey, the Annual Survey of Manufactures, the Occupational Safety and Health Survey, and BLS area wage surveys (which collect data on leave practices as well as on wages).[8]

In the Survey of Employer Expenditures for Employee Compensation, the Bureau of Labor Statistics collected information on hours paid and hours of paid leave.[9] The survey was conducted biennially from 1966 to 1974 and then for a final time in 1977. The survey covered the private nonfarm economy and gathered separate data on office and nonoffice workers. With the information on hours paid and hours of paid leave, measures of hours at work were calculated. Ratios of hours at work to hours paid were constructed for 2-digit SIC manufacturing industries and for industry groups in nonmanufacturing, using unpublished hours data obtained in the survey by 2-digit SIC industry.[10] Also, for the 2-digit SIC manufacturing industries, ratios of hours at work to hours paid for production workers are available for the years 1959 and 1962. These ratios are from a survey that preceded the Survey of Employer Expenditures for Employee Compensation, called the Survey of Employer Expenditures for Selected Supplementary Compensation Practices for Production and Related Workers in Manufacturing Industries.[11]

Together, the two surveys of employer expenditures provide ratios of hours at work to hours paid for many of the years from 1959 to 1977 for manufacturing and from 1966 to 1977 for nonmanufacturing. However, there are numerous gaps in these data, and there is also a

gap between the 1977 Survey of Employer Expenditures for Employee Compensation and the 1981 Hours at Work Survey. A way to fill the gaps had to be found. After several methods were tried—including regressions with hours data from the Current Population Survey and the Annual Survey of Manufactures, as well as the use of leave practices data, hours worked from the Occupational Safety and Health Survey, or movements in output—simple linear interpolation was selected because its results were at least as good as the results obtained by these other methods.

For the years preceding the employer expenditure surveys, data are not available for the construction of satisfactory estimates of the ratios of hours at work to hours paid. Three data sources—the Current Population Survey, the Annual Survey of Manufactures, and area wage surveys—were examined that provide information with which measures of hours at work can be derived for those years. Several possible series for the ratios were calculated by dividing each measure of hours at work by hours paid from the establishment survey and benchmarking the result to one or the other of the expenditure surveys. In each case, the estimates of the ratios of hours at work to hours paid that were produced were implausible.

Because of the lack of adequate data with which to construct reliable estimates of the ratios, constants are used for the early periods. For the period 1947 to 1958, the ratios for manufacturing industries are held constant at the 1959 levels. For the period 1947 to 1965, the ratios for industry groups in nonmanufacturing are held constant at the 1966 levels. Lacking better data, the best estimates of year-to-year movements in hours at work in those early periods are the movements of the measures of hours paid.

Construction of new hours measures

The new measures of hours at work are constructed with ratios of hours at work to hours paid from the Hours at Work Survey (starting in 1981) and from historical series (1947 to 1980). In the new measures, the hours paid of employees in private nonfarm business are converted to hours at work by means of the ratios, and then these hours at work are combined with the hours at work of other persons from the Current Population Survey.

In manufacturing, the hours at work of production and nonproduction workers are computed separately. The ratios of hours at work to hours paid from the Hours at Work Survey are applied at the 2-digit SIC level to the hours paid of production workers. For nonproduction workers, ratios for the durable and nondurable manufacturing subsectors are used, because average weekly hours paid are calculated for those workers at the subsector level, rather than at a more detailed level.[12] For the years prior to 1981, nonoffice-worker ratios are used in the measures of hours at work for production workers and office-worker ratios for nonproduction workers.

In nonmanufacturing, the hours paid of all types of employees in an industry group are converted together to hours at work. For the period 1947 to 1980, the ratios of hours at work

Table 5. Adjustment ratios for the hours of all persons in nonfarm business and manufacturing, 1947–88

Year	Nonfarm business	Manufacturing
1947	0.955	0.941
1948	.955	.941
1949	.956	.941
1950	.956	.941
1951	.955	.940
1952	.955	.939
1953	.954	.939
1954	.955	.939
1955	.955	.939
1956	.955	.938
1957	.955	.938
1958	.955	.938
1959	.955	.938
1960	.955	.938
1961	.955	.938
1962	.955	.937
1963	.955	.937
1964	.955	.937
1965	.954	.936
1966	.953	.936
1967	.950	.932
1968	.948	.928
1969	.946	.924
1970	.944	.921
1971	.945	.922
1972	.945	.926
1973	.942	.922
1974	.939	.918
1975	.938	.917
1976	.937	.916
1977	.935	.915
1978	.935	.914
1979	.934	.913
1980	.934	.912
1981	.933	.912
1982	.936	.908
1983	.940	.913
1984	.939	.914
1985	.940	.915
1986	.935	.911
1987	.938	.909
1988	.939	.917

NOTE: Adjustment ratio equals new hours measure (hours at work) divided by old hours measure (computed using hours paid of employees).

to hours paid are based on data on all employees taken from the Survey of Employer Expenditures for Employee Compensation; for the years after 1980, the ratios come from the Hours at Work Survey and are calculated from data on production and nonsupervisory workers only.[13]

The ratios of hours at work to hours paid for a given year are not available from the Hours at Work Survey until late in the following year. The annual growth rates of multifactor productivity are published after the ratios become available. However, labor productivity measures for a given year are first released about a month after the year ends. Accordingly, until the ratios for that year become available, the ratios for the previous year are used in the measures that appear in the news release, "Productivity and Costs." For example, the ratios for 1988 were produced in the second half of 1989. Until those ratios were available, the ratios for 1987 were used to compute the 1988 hours measures. Each year, the new ratios will be incorporated into the labor productivity and cost measures in the issue of "Productivity and Costs" that is published in early November.

The Hours at Work Survey gathers quarterly data on hours at work and hours paid. Because the quarterly ratios exhibit a seasonal pattern, seasonal adjustment of the ratios is necessary. However, the seasonal pattern is not yet stable, so the quarterly ratios are not being used in the quarterly labor productivity measures, which are seasonally adjusted measures. An alternative method for obtaining usable quarterly ratios is to use the annual ratio for each of the quarters in a year, but this results in fourth- to first-quarter jumps in the hours and productivity measures. The option that finally was selected to obtain quarterly measures is a method devised by Frank Denton in which a quadratic minimization formula is used together with annual data to generate the measures.[14]

To show the effects on the hours measures of the application of the ratios of hours at work to hours paid, "adjustment ratios" have been calculated. The adjustment ratio for the hours of all persons in nonfarm business equals the new measure of hours, which is hours at work, divided by the old measure of hours, which is primarily hours paid (table 5). The adjustment ratios for 1981 to 1988 are not identical to the ratios of hours at work to hours paid in table 4, because the adjustment ratios refer to all persons and the ratios in table 4 refer to only production and nonsupervisory workers. Notice that the adjustment ratio for nonfarm business falls by 0.016 between 1948 and 1988. However, this fall is spread over 40 years, so the average annual rate of decline in the ratio is less than 0.1 percent. Hence, as seen in table 1, the productivity growth rate for the period is unaltered by the shift to hours at work. Also, note that even though the ratios of hours at work to hours paid are held constant in manufacturing before 1959 and elsewhere before 1966, the adjustment ratios are not constant in the early years. This is due to shifts in employment among sectors and among classes of workers, which produce composition effects. These effects are especially noticeable in manufacturing, where there is clearly a gradual decline in the adjustment ratio between 1947 and 1959. The decline is the result of two factors: (1) faster employment growth in durable manufacturing than in nondurable manufacturing (where the ratio of hours at work to hours paid is higher), and (2) faster growth in the number of employees in manufacturing versus the number of self-employed workers (whose adjustment ratio is 1).[15] □

Footnotes

[1] The Hours at Work Survey was first presented in Kent Kunze, "A new BLS survey measures the ratio of hours worked to hours paid," *Monthly Labor Review*, June 1984, pp. 3–7; in a subsequent research summary, "Hours at work increase relative to hours paid," *Monthly Labor Review*, June 1985, pp. 44–46, Kunze updated the survey results.

[2] Table C–9 in *Employment and Earnings* continues to show hours paid of employees. This table is prepared by the Bureau's Office of Productivity and Technology, as are the productivity and cost measures.

[3] The establishment survey does not cover the farm sector or self-employed and unpaid family workers, so hours worked for those individuals are taken from the Current Population Survey. This survey requests the hours worked in the survey week of each employed person in the household. Because it is a much smaller survey, and because respondents often provide information on household members other than themselves, the Current Population Survey is considered a less reliable source of hours than the establishment survey, and therefore the establishment survey is the main source of hours for productivity statistics.

[4] If hours paid and hours at work grow at the same rate, then for the measurement of productivity growth, it does not matter which measure of hours is used. However, if there is a divergence in the rates of growth over time, using hours paid rather than hours at work will yield an incorrect productivity growth rate.

[5] For descriptions of multifactor productivity measures, see *Trends in Multifactor Productivity, 1948–81*, Bulletin 2178 (Bureau of Labor Statistics, 1983); and Edwin Dean and Kent Kunze, "Recent changes in the growth of U.S. multifactor productivity," *Monthly Labor Review*, May 1988, pp. 14–22. A news release containing multifactor productivity measures for 1948 to 1988 based on hours at work is slated for publication by the Bureau of Labor Statistics in early 1990.

[6] *Report of the BLS Task Force on Hours Worked* (Bureau of Labor Statistics, 1976).

[7] The task force rejected substituting hours at work for hours paid in the establishment survey because the hours paid series are valuable and go back for decades. The task force also rejected collecting hours at work along with hours paid in the establishment survey each month. The reason given was that the survey requests data for the pay period that includes the 12th of the month, and thus it might overstate hours at work because this pay period misses most holidays. See *Report of the BLS Task Force*.

[8] Data on leave practices are for two types of leave: paid holidays and paid vacations. The data on holidays show how many holidays workers are entitled to per year, in percentage terms (for example, 20 percent of workers might be entitled to 10 holidays per year). The data on vacations indicate what percentage of workers are in establishments in which a worker receives a particular amount of vacation after a certain number of years of tenure (for example, 40 percent might be in establishments in which a worker receives 1 week of vacation after 1 year of service). Data on leave practices have been collected since 1952 in BLS area wage surveys.

[9] For details regarding the Survey of Employer Expenditures for Employee Compensation, see *Employee Compensation in the Private Nonfarm Economy, 1974*, Bulletin 1963 (Bureau of Labor Statistics, 1977).

[10] For 1966, unpublished survey data on hours are not available. However, the ratios of hours at work to hours paid for the private nonfarm economy, the manufacturing sector, and the nonmanufacturing sector for that year have been published in *Employee Compensation in the Private Nonfarm Economy, 1966*, Bulletin 1627 (Bureau of Labor Statistics, June 1969).

[11] This survey is described in *Employer Expenditures for Selected Supplementary Compensation Practices for Production and Related Workers; Composition of Payroll Hours, Manufacturing Industries, 1962*, Bulletin 1428 (Bureau of Labor Statistics, April 1965).

[12] The establishment survey does not collect data on the hours of nonproduction workers. The average weekly hours paid of nonproduction workers are calculated for the durable and nondurable subsectors with establishment data on production worker average weekly hours and with data from the Survey of Employer Expenditures for Employee Compensation. Hours paid of nonproduction workers in a specific 2-digit SIC manufacturing industry are obtained by multiplying the number of such workers in the industry (from the establishment survey) by the average weekly hours paid of nonproduction workers in the appropriate subsector. Also, before being applied to the hours paid of nonproduction workers, the Hours at Work Survey ratio for each subsector (which is for production workers) is adjusted to make it more suitable for use with nonproduction worker data. The ratio is multiplied by the ratio of hours at work to hours paid for office workers in the subsector divided by the ratio for nonoffice workers in the subsector in 1977, the last year of the Survey of Employer Expenditures for Employee Compensation.

[13] As with nonproduction workers, the establishment survey does not gather data on the hours of supervisors. To calculate the hours paid of nonproduction workers and supervisors in the sectors in nonmanufacturing, data on their employment (from the establishment survey) are used, along with the average weekly hours paid of production and nonsupervisory workers in those sectors.

[14] See Frank T. Denton, "Adjustment of Monthly or Quarterly Series to Annual Totals: An Approach Based on Quadratic Minimization," *Journal of the American Statistical Association*, March 1971, pp. 99–102. This method was also used to produce quarterly measures for the years before 1981. Note that the method yields ratios of hours at work to hours paid for the quarters in the current year, as well as for quarters in completed years.

[15] The number of employees grew by 12 percent in durable manufacturing from 1947 to 1959 and by only 2 percent in nondurable manufacturing. The number of self-employed workers fell by 13 percent in durable manufacturing and by 32 percent in nondurable manufacturing in that same timespan.