Chapter 11.
Industry Productivity Measures

Background

Studies of output per hour in individual industries have been part of the U.S. Bureau of Labor Statistics (BLS) program since the 1800s. Prompted by congressional concern that human labor was being displaced by machinery, a study of 60 manufacturing industries was released as “Hand and Machine Labor” in 1898. This report provided striking evidence of the savings in labor resulting from mechanization in the last half of the 19th century. The effects of productivity advances upon employment remained an important focus of BLS throughout the 1920s and 1930s. During this period, the Bureau also began publishing industry indexes of output per hour, which were based on available production data from the periodic “Census of Manufactures” and employment statistics collected by BLS.

In 1940, Congress authorized BLS to undertake continuing studies of productivity and technological changes. The Bureau extended earlier indexes of output per hour developed by the National Research Project of the Works Progress Administration, and published measures for selected industries. This work, however, was reduced in volume during World War II, owing to the lack of meaningful production and employee hour data for many manufacturing industries.

With the arrival of World War II, the program began to focus on the most efficient use of scarce labor resources. BLS undertook a number of studies of labor requirements for defense industries, such as synthetic rubber and shipbuilding. After the war, the industry studies program resumed on a regular basis and was supplemented by a number of industry studies based on the direct collection of data from employers. Budget restrictions after 1952 prevented the continuation of direct collection of data. Consequently, the preparation of industry measures was largely limited to those industries where data were readily available.

More recently, labor productivity growth has been recognized as an important indicator of economic progress and as a means to higher income levels. Interest in productivity trends has also been heightened by other factors, including public interest in the effects of technology and innovation on economic growth and concern over increasing foreign competition and domestic labor’s share of that growth.

Over the years, the Industry Productivity Program has incorporated refinements in production theory and index number theory and has expanded the number of series it produces. In 1987, the program published the first multifactor productivity measures for detailed industries. These measures relate output to combined inputs of capital, labor, energy, materials, and purchased services. In 1995, following a careful review of its methods and the economic literature, the program released labor productivity measures that incorporated an annual chain-weighted index for measuring changes in industry output. The Tornqvist index aggregates the growth rates of various industry outputs with annual weights based on the products’ shares in total value of industry production. In 1999, the program published industry unit labor cost measures for the first time. These measures reflect the relationship between labor compensation and real output.

In 1998, the program completed a major industry expansion, increasing coverage from 180 industries to more than 500, as defined by the Standard Industrial Classification (SIC) system. In 2000, industry multifactor productivity measures were expanded to cover all 140 three-digit SIC manufacturing industries. Industry labor productivity measures were converted from the SIC system to the North American Industry Classification System (NAICS) in 2003, and industry multifactor productivity measures were converted from SIC to NAICS in 2007. Efforts to expand industry coverage in the service sector continue. In 2009, the program expanded coverage of labor input measures to include all three- and four-digit NAICS industries.

IN THIS CHAPTER

Labor productivity measures

Concepts

Labor productivity measures describe the relationship between output and the labor time involved in its production. Annual labor productivity measures are available starting in 1987 for most covered industries.

To calculate a labor productivity index, an index of industry output is divided by an index of hours:

$$\frac{Q_t}{Q_0} \div \frac{L_t}{L_0}$$

where

$\frac{Q_t}{Q_o}$ = the index of output in the current year,

$\frac{L_t}{L_o}$ = the index of labor input in the current year,

t = the current year, and
o = the base year.

For an industry producing a single uniform product or service, the output index is simply the ratio of the number of units produced in the current year divided by the number of units produced in the base year. Similarly, the all-person-hour index equals hours expended in the current year divided by hours expended in the base year.

More typically, industries produce a number of different products or perform a number of different services. For these industries, output is calculated with a Tornqvist formula:

$$\frac{Q_t}{Q_{t-1}} = \exp\left[\sum_{i=1}^{n} w_{i,t}\left(\ln\frac{q_{i,t}}{q_{i,t-1}}\right)\right]$$

where

$\frac{Q_t}{Q_{t-1}}$ = the ratio of output in the current year (t) to the previous year (t-1),

n = number of products,

$\ln\frac{q_{i,t}}{q_{i,t-1}}$ = the natural logarithm of the ratio of the quantity of product i in the current year to the quantity in the previous year, and

$w_{i,t}$ = the average value share weight for product i.

The average value share weight for product i is computed as:

$$w_{i,t} = (s_{i,t} + s_{i,t-1}) \div 2$$

where
$$s_{i,t} = p_{i,t}q_{i,t} \div \left(\sum_{i=1}^{n} p_{i,t}q_{i,t}\right)$$

and $p_{i,t}$ = price of product i at time t.

The Tornqvist formula yields the ratio of output in a given year to that in the previous year. The ratios arrived at in this manner then must be chained together to form a series. If t = 3 and the base year is denoted by o, then

$$\frac{Q_t}{Q_o} = \frac{Q_3}{Q_o} = \left(\frac{Q_3}{Q_2}\right)\left(\frac{Q_2}{Q_1}\right)\left(\frac{Q_1}{Q_o}\right).$$

The resulting chained output index, $\frac{Q_t}{Q_o}$, is used in the productivity formula. The all-person-hour index for an industry with multiple products is calculated in the same manner as in the single-output case.

Methods and data sources

Output

Industry output is usually measured as a weighted index of the changes in the various products or services (in real terms) provided for sale outside the industry. Real output is most often derived by deflating nominal sales or values of production using BLS price indexes, but for a few industries it is measured by physical quantities of output. Each of these methods is discussed in turn.

Deflated value output indexes. Deflated value output indexes are derived from data on the value of industry output adjusted for price change. The adjustment for price change is accomplished by dividing the nominal value of output by one or more price indexes. Nominal values are adjusted where possible to reflect the total value of industry output from both employer and nonemployer firms and to remove sales between establishments in the same industry. Industry revenues or production values are distributed to detailed output categories and "deflated" at that level with detailed producer price indexes (PPIs) or consumer price indexes (CPIs) produced by BLS. Where possible, deflated value output indexes are Tornqvist aggregations of the deflated values of individual products or services. The resulting output indexes are conceptually equivalent to indexes that are developed using data derived from physical quantities of output.

For most manufacturing industries, sectoral value of production is derived by removing intraindustry transfers and resales from shipments and adjusting the shipments for changes in inventory. Current-dollar industry value of production is distributed to detailed primary product classes, secondary products, and miscellaneous receipts based on values of industry shipments and wherever-made shipments collected in the U.S. Census Bureau's "Annual Survey of Manufactures" and "Census of Manufactures".

For industries in retail trade and food services and drinking places, current-dollar industry sales from the Census Bureau's "Annual Retail Trade Survey" are distributed to individual product lines based on detailed data from the "Census of Retail Trade." Current-dollar sales for each product line are deflated separately with appropriate BLS price indexes—

usually CPIs, but PPIs are used in some cases. For some product lines, weighted combinations of two or more price indexes are used.

For industries in wholesale trade, sectoral output is measured by deflating current-dollar revenues that have been adjusted to remove intraindustry sales. Current-dollar industry sales from the Census Bureau's "Monthly and Annual Wholesale Trade Survey" are distributed to individual product lines based on detailed data from the "Census of Wholesale Trade." Current-dollar revenues are deflated separately for each detailed product line using appropriate PPIs from BLS or price deflators from the Bureau of Economic Analysis (BEA).

Deflated value output for most other service industries is measured by deflating current-dollar revenues from the Census Bureau's "Service Annual Survey" and "Census of Service Industries." Nominal values are deflated at the most detailed level possible, with PPIs or CPIs from BLS. For most industries, the deflated revenues are then combined using the Tornqvist formula described above.

Physical quantity output indexes. Where possible, physical quantity output indexes are Tornqvist aggregations of the quantities of individual products. The basic data on quantities generally reflect primary products for each industry, at the most detailed level possible. Physical quantity output indexes are used for a few industries mainly in mining, utilities, and transportation, and for commercial banking and the postal service industry.

Data Sources. Industry output indexes are prepared using basic data published by various public and private agencies, at the most detailed level possible. The economic censuses and annual surveys of the U.S. Census Bureau, U.S. Department of Commerce are the primary sources of data used in developing deflated value output measures. Data for physical quantity output measures come from a number of data sources, including the U.S. Departments of Energy, Interior, Transportation, and Agriculture, as well as from the Federal Reserve Board, the Federal Deposit Insurance Corporation, and the U.S. Postal Service. Data from trade associations also are used for some industries.

Labor input

Labor input reflects the total annual hours of all persons in an industry. Indexes are prepared for all three- and four-digit NAICS industries and for the government sector, as well as for other industries for which productivity measures are published. Employment and hours of all persons include those of paid employees, the self-employed (partners and proprietors), and unpaid family workers (persons who work in a family business or farm without pay for 15 hours a week or more). Total annual hours for each industry are estimated separately for each class of worker as the product of employment, average weekly hours, and the number of paid weeks per year. The annual hours of each class of worker are then aggregated to derive total industry hours. Hours of all persons at the industry level are treated as homogeneous, with no distinction made between hours of different groups of employees. The labor input indexes are developed by dividing aggregate hours for each year by the base-period aggregate.

Data Sources. Labor input measures are based primarily on data from two BLS surveys. The primary source of data is the Current Employment Statistics (CES) survey. The survey collects monthly data on total paid employment by industry, as well as data on employment and average weekly hours for production workers in goods-producing industries and for nonsupervisory workers in service-providing industries. Historically, the CES survey provided estimates of average weekly hours of only production and nonsupervisory workers, but the survey has now begun collecting information on the average weekly hours of all employees.

The Industry Productivity Program estimates average weekly hours of nonproduction workers and supervisory workers using data from the Current Population Survey (CPS) in conjunction with the CES data. Annual relationships between nonproduction (supervisory) worker average weekly hours and production (nonsupervisory) worker average weekly hours calculated from CPS data are applied to the annual CES production (nonsupervisory) worker average weekly hours for each industry. The CPS data also are used to estimate the number and hours of the self-employed and unpaid family workers.

CES and CPS data are available for most three- and four-digit NAICS industries. BLS Quarterly Census of Employment and Wages (QCEW) data or Census Bureau nonemployer or small-firm data are used together with the CES and CPS data when needed to derive detailed industry estimates.

Although the employment and hours of all persons are usually based on CES and CPS survey data, estimates for some industries are derived from other sources. Estimates for industries in the farm sector are based on data from the U.S. Department of Agriculture, and measures for industries in the nonfarm agriculture sector are based primarily on data from the QCEW and the CPS. For mining industries, estimates of nonproduction worker hours are derived from data collected by the Mine Safety and Health Administration. Labor input measures for total air transportation are calculated with data from the Bureau of Transportation Statistics (BTS), U.S. Department of Transportation. For line-haul railroads, labor input measures are derived with data from the Surface Transportation Board (STB), U.S. Department of Transportation, and supplemented with data from the Association of American Railroads (AAR). Employment of postal service employees is from the CES and the hours data are from the U.S. Postal Service.

Unit labor costs

Unit labor costs represent the cost of labor required to produce one unit of output. The unit labor cost indexes are computed by dividing an index of industry labor compensation by an index of real industry output. Unit labor costs also describe the relationship between compensation per hour and real output per hour (labor productivity). Increases in hourly compensation increase unit labor costs, while increases in labor productivity offset compensation increases and lower unit labor costs.

Compensation, defined as payroll plus supplemental payments, is a measure of the cost to the employer of securing the services of labor. Payroll includes salaries, wages, commissions, dismissal pay, bonuses, vacation and sick leave pay, and compensation in kind. Supplemental payments include legally required expenditures and payments for voluntary programs. The legally required portion consists primarily of Federal old age and survivors' insurance, unemployment compensation, and workers' compensation. Payments for voluntary programs include all programs not specifically required by legislation, such as the employer portion of private health insurance and pension plans.

Data Sources. For service-providing, mining, and utility industries, labor compensation is derived using annual wage data from the QCEW published by BLS along with data on employer costs for fringe benefits from the Census Bureau and the BEA. For industries in manufacturing, annual payroll and fringe benefit data from the Census Bureau are used.

Multifactor productivity measures

Concepts

The industry multifactor productivity indexes calculate productivity growth by measuring changes in the relationship between the quantity of output produced by an industry and the quantity of inputs consumed in producing that output, where measured inputs include capital and intermediate purchases (including raw materials, purchased services, and purchased energy) as well as labor input.

Multifactor productivity is derived as the difference between the growth rate of output and the growth rate of a Tornqvist index of capital, labor, and intermediate purchases inputs:

$$\ln\left(\frac{A_t}{A_{t-1}}\right) = \ln\left(\frac{Q_t}{Q_{t-1}}\right) - \left[w_k\left(\ln\frac{K_t}{K_{t-1}}\right) + w_l\left(\ln\frac{L_t}{L_{t-1}}\right) + w_{ip}\left(\ln\frac{IP_t}{IP_{t-1}}\right)\right]$$

where

ln = the natural logarithm of the variable,

A = multifactor productivity,

Q = output,

K = capital input,

L = labor input,

IP = intermediate purchases input, and

$w_{k,}\, w_{l,}\, w_{ip}$= cost share weights.

The input cost share weights are two-year averages of the cost shares for each input (capital, labor, and intermediate purchases, respectively), in years t and t-1, where

$$w_i = \frac{(s_{i,t} + s_{i,t-1})}{2}$$

$$s_{i,t} = \frac{p_{i,t}\ x_{i,t}}{\sum (p_{i,t} x_{i,t})}$$

$p_{i,t} =$ price of input x_i in period t.

Since the growth rates are represented by differences in logarithms, the antilogs of the differences must be chained to form the index of multifactor productivity.

Methods and data sources

Output

The output measures are the same as those used in calculating labor productivity.

Labor input

The labor input measures are the same as those used in calculating industry labor productivity. Industry labor input is based on the total hours of all persons, and it is not adjusted for composition change as are the labor input series that BLS uses for private business and private nonfarm business multifactor productivity measures.

Capital

The measure of capital input is based on the flow of services derived from the stock of physical assets. Physical assets are the equipment, structures, land, and inventories used in the production process. Financial capital is excluded. Capital services are estimated by calculating real capital stocks. Changes in the stocks are assumed proportional to changes in capital services for each asset. Stocks of different asset types are Tornqvist aggregated, using estimated rental prices to construct the weights for assets of different types.

Capital is composed of numerous different assets purchased at different times. Asset detail includes 25 types of equipment, 2 types of nonresidential buildings, 3 types of inventories (by stage of processing), and land. The measure of capital for each year includes that year's investment in an asset plus the remaining productive stock from all previous years' investments. Capital stocks of equipment and structures for each industry are calculated using the perpetual inventory method, which takes into account the continual additions to and subtractions from the stock of capital as new investment and retirement of old capital occur. Real (constant dollar) investments in various assets are estimated by deflating current dollar investments with appropriate price deflators. The perpetual inventory method measures real stocks at the end of a year equal to a weighted sum of all past investments, where the weights are the asset's efficiency relative to a new asset. A hyperbolic age-efficiency function is used to calculate the relative efficiency of an asset at different ages.

The hyperbolic age-efficiency function can be expressed as

$$S_t = (L - t) / (L - (B)t)$$

where

S_t = the relative efficiency of a t-year-old asset,

L = the service life of the asset,

t = the age of the asset, and

B = the parameter of efficiency decline.

The service life of the asset for each cohort of each type of equipment and structure is assumed to be normally distributed around an average service life for that asset type. For most assets, these service lives are the same across all industries. The parameter of efficiency decline is assumed to be 0.5 for equipment and 0.75 for structures. These parameters yield a function in which assets lose efficiency more slowly at first, and then lose efficiency more rapidly later in their service lives.

Current-dollar values of inventory stocks are calculated for three separate categories of manufacturers' inventories: finished goods, work in process, and materials and supplies. Inventory stocks for each year are calculated as the average of the end-of-year stocks in years t and $t-1$ to represent the average used during the year as a whole. Current-dollar inventory values for the three categories of inventories are deflated with appropriate price indexes.

Land stocks are estimated as a function of the movement in constant-dollar net structures stocks for each industry.

Weights. The various equipment, structure, inventory, and land stock series in constant dollars are aggregated into one capital input measure using a Tornqvist index formula. Capital stocks multiplied by rental prices are used to estimate the cost share weights. Rental prices are calculated for each asset as

$$RP = [(P \text{ x } R) + (P \text{ x } D) - (p^t - p^{t-1})] \text{ x } (1 - uz - k) / (1 - u)$$

where

RP = the rental price,

P = the deflator for the asset,

R = the internal rate of return,

D = the rate of depreciation for the asset, and

$P^t - P^{t-1}$ = the capital gain term representing the price change of the asset between years t and t-1.

$(1 - uz - k)/(1 - u)$ reflects the effects of taxation where

u = the corporate tax rate,

z = the present value of $1 of depreciation deductions, and

k = the effective investment tax credit rate.

The internal rate of return is derived using data on property income. Total property income is estimated for each industry by subtracting the value of labor and intermediate purchases from the value of output.

This method of calculating rental prices is similar to that used in calculating multifactor productivity for major sectors of the economy, except that no attempt is made to incorporate the effects of indirect business taxes, for which data are lacking at the industry level.

Rental prices are expressed in rates per constant dollar of productive capital stocks. Each rental price is multiplied by its constant-dollar capital stock to obtain asset-specific capital costs, which are then converted to value shares for Tornqvist aggregation.

Data sources. For manufacturing industries, capital indexes are developed from data published and maintained by the Census Bureau and BEA. Price indexes for different asset categories are derived from PPIs developed by BLS. For air transportation, capital measures are derived using data from BTS, BEA, and the Air Transport Association (ATA). For line-haul railroads, data from STB and Amtrak are used.

Intermediate purchases

The index of intermediate purchases is a Tornqvist index of separate quantities of materials, services, fuels, and electricity consumed by each industry. Except for electricity consumed by manufacturing industries, for which direct quantity and price data are available, the quantities are estimated by deflating current-dollar values.

Constant-dollar materials consumed are derived by dividing the annual industry purchases by a weighted price deflator. Materials deflators are constructed for each industry by combining detailed PPIs and import price indexes from BLS using weights derived from the BEA benchmark input-output tables. Aggregate price indexes for deflating purchased business services are constructed in a similar manner.

Annual total fuels consumed by each industry also are deflated with weighted price deflators. PPIs for individual fuel categories are weighted together with weights reflecting detailed fuels expenditures by industry from the Energy Information Administration (EIA), U.S. Department of Energy.

Data sources. For manufacturing industries, nominal values of materials, fuels and electricity, and quantities of electricity consumed by each industry are based on annual data from the economic censuses and annual surveys of the Census Bureau. To avoid double counting, estimates of materials consumed by each industry are adjusted to exclude the value of materials transferred between establishments in the same industry. The values of purchased business services are estimated using benchmark input-output tables and annual industry data from BEA and the Census Bureau.

For air transportation, source data on cost of materials, services, fuels, and electricity from the BTS are deflated using cost indexes from ATA. For line-haul railroads, estimates from the STB are supplemented with data from other sources including AAR, Amtrak, EIA, and the Edison Electric Institute. The nominal values are deflated with PPIs from BLS and implicit price deflators from BEA.

Weights. The separate indexes of real materials, services, fuels, and electricity are aggregated into a total intermediate purchases index using the Tornqvist formula. The weights for each component are derived by dividing the current-dollar cost of each by the total combined cost of intermediate purchases, and averaging these weights at times *t* and *t-1*.

Weights for major input components

The indexes representing quantity change for each of the three major inputs—capital, labor, and intermediate purchases—also are combined using the Tornqvist formula to create an index of combined inputs. The relative weights for each year are derived from the total cost for each input. Labor compensation is used for the labor weight. The sum of current-dollar values for materials, services, fuels, and electricity constitute the weight for intermediate purchases. The weight for capital is derived as a residual, by subtracting the costs of labor and intermediate purchases from the total value of output. The cost shares are averaged at time *t* and *t-1*.

Presentation

Annual BLS industry labor productivity measures are published in the *Productivity and Costs by Industry* news releases. Annual indexes of output per hour also are published in the *Monthly Labor Review* and rates of change are published in the *Statistical Abstract of the United States.* News releases and data tables can be accessed online by visiting the Labor Productivity and Costs Web site at **http://www.bls.gov/lpc/**. Industry multifactor productivity measures are published in the *Multifactor Productivity Trends for Detailed Industries* news releases, and can be accessed online by visiting the Multifactor Productivity Web site at **http://www.bls.gov/mfp/**.

Uses and limitations

Measures of industry output per hour are useful for tracking changes in productive efficiency and the effects of technological improvements in particular industries over time or to compare performance among industries. Individuals and companies also use these data as benchmarks to compare against their firms' performances.

Industry productivity series also are used to explain the sources of productivity growth in the aggregate economy. Industry productivity trends provide information that helps researchers and policymakers better understand how industries and sectors contribute to aggregate productivity growth. Industry productivity analysis also can provide information to assess the impact of policy changes or external shocks on particular industries, and the resulting impact on economic growth of the larger economy.

Unit labor costs are used to analyze trends in production costs. Trends in unit labor costs shed light on the relationship between labor productivity, hourly compensation, and the cost of production. These data are used to assess the changing efficiency, cost structure, and competitive position of individual industries.

The measures of output per hour are subject to certain qualifications. First, existing techniques may not fully take into account changes in the quality of goods and services produced. Second, although efforts have been made to maintain consistency of coverage between the output and labor input estimates, some statistical differences may remain. Third, estimates of outputs and inputs for detailed industries are subject to more volatility and error than estimates for more aggregate sectors. Finally, year-to-year changes in output per hour are irregular and, therefore, are not necessarily indicative of changes in long-term trends. Conversely, long-term trends are not necessarily applicable to any one year or to any period in the future. Because of these and other statistical limitations, these indexes cannot be considered precise measures; instead, they should be interpreted as general indicators of movements of output per hour.

The measures of output per hour relate output to only one input—labor time. They do not measure the specific contribution of labor, capital, or any other factor of production. The measures reflect the joint effect of a number of interrelated influences such as changes in technology, capital per worker, capacity utilization, intermediate inputs per worker, layout and flow of material, skill and effort of the workforce, managerial skill, and labor-management relations.

Indexes of multifactor productivity are subject to many of the same limitations previously mentioned, with the exception of the effects of changes in the ratios of other factor inputs to labor. The construction of multifactor productivity measures permits an analysis of the effects of the changes in capital per hour and intermediate purchases per hour on output per hour. Labor productivity is related to multifactor productivity in the manner given by the following formula:

$$\ln\left(\frac{Q_t}{Q_{t-1}}\right) - \ln\left(\frac{L_t}{L_{t-1}}\right) = \ln\left(\frac{A_t}{A_{t-1}}\right) + w_k\left[\ln\left(\frac{K_t}{K_{t-1}}\right) - \ln\left(\frac{L_t}{L_{t-1}}\right)\right] + w_{ip}\left[\ln\left(\frac{IP_t}{IP_{t-1}}\right) - \ln\left(\frac{L_t}{L_{t-1}}\right)\right].$$

The above equation shows that the rate of change in labor productivity (on the left side of the equation) is equal to the change in multifactor productivity plus the effects of factor substitution; that is, the combined effects of changes in the weighted capital-labor ratio and the weighted intermediate purchases-labor ratio (which are represented on the right side of the equation). Conversely, the equation also shows that the change in multifactor productivity equals the change in labor productivity, adjusted to remove the weighted changes in capital and intermediate purchases relative to labor.

Technical References

Duke, John and Lisa Usher. “BLS completes major expansion of industry productivity series,” *Monthly Labor Review*, September 1998, pp. 35–51. Available online at **http://www.bls.gov/opub/mlr/1998/09/art4full.pdf**.

Dumas, Mark, Brian Friedman, and Mark Sieling. “Labor productivity in the retail trade industry, 1987–99”, *Monthly Labor Review*, December 2001, pp. 3–14. Available online at **http://www.bls.gov/opub/mlr/2001/12/art1full.pdf**.

Holman, Corey, Bobbie Joyeux, and Christopher Kask. “Labor productivity trends since 2000, by sector and industry,” *Monthly Labor Review*, February 2008, pp. 64–82. Available online at **http://www.bls.gov/opub/mlr/2008/02/contents.htm/art4full.pdf**.

Kask, Christopher, David Kiernan, and Brian Friedman. “Labor productivity growth in wholesale trade, 1990–2000,” *Monthly Labor Review*, December 2002, pp. 3–14. Available online at **http://www.bls.gov/opub/mlr/2002/12/art1full.pdf**.

Kask, Christopher and Edward Sieber. “Productivity growth in ‘high-tech’ manufacturing industries,” *Monthly Labor Review*, March 2002, pp. 16–31. Available online at **http://www.bls.gov/opub/mlr/2002/03/art2full.pdf**.

Kunze, Kent, Mary Jablonski, and Virginia Klarquist. “BLS modernizes Industry Labor Productivity Program,” *Monthly Labor Review*, July 1995, pp. 3–12. Available online at **http://www.bls.gov/opub/mlr/1995/07/art1full.pdf**.

Russell, Matthew, Paul Takac, and Lisa Usher. “Industry productivity trends under the North American Industry Classification system,” *Monthly Labor Review*, November 2004, pp.31–42. Available online at **http://www.bls.gov/opub/mlr/2004/11/art4full.pdf**.

U.S. Department of Labor, Bureau of Labor Statistics. *Employment and Hours of All Persons for a Comprehensive Set of Industries.* June 2010. Available online at **http://www.bls.gov/lpc/iprhours10.htm**.

U.S. Department of Labor, Bureau of Labor Statistics. *Construction of Average Weekly Hours for Supervisory and Nonproduction Wage and Salary Workers in Detailed Industries.* August 2005. Available online at **http://www.bls.gov/lpc/iprswawhtechnote.pdf**.

Wilder, Patricia S. and Ziaul Z. Ahmed. “Multifactor productivity trends in manufacturing industries, 1987–96,” *Monthly Labor Review*, June 2001, pp. 3–12. Available online at **http://www.bls.gov/opub/mlr/2001/06/art1full.pdf**.