Measuring productivity in service industries

The growth of the service economy
presents special challenges
for productivity analysts; output
is often difficult to quantify, and measurement
of labor input requires great care

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The increased importance of service industries over the last two decades and current concern over productivity growth have stimulated interest in productivity measures for this expanding sector of the economy.

The service sector, as defined here, encompasses the major industry groupings of trade, finance, insurance, communications, public utilities, transportation, and government, as well as business and personal services. It accounts for almost three-fourths of the Nation's employment and provides the greatest potential, as well as some of the greatest difficulties, for developing productivity measures.

Over the last decade, the Bureau of Labor Statistics has been expanding the number of service industries for which it publishes productivity measures, and at present provides measures for 16 industries, representing almost a third of the employment in the sector. The Bureau is continuing to develop additional measures, and hopes eventually to extend coverage to most of the service sector.

This article describes that effort, discusses some of the problems of measuring productivity, particularly labor productivity in service industries, and explains how the Bureau is working to resolve some of the problems.

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Linking output to input

Productivity measures relate real physical output to real input. They range from single factor measures, such as output per unit of labor input or output per unit of capital input, to measures of output per unit of multifactor input. Such measures also reflect changes in technology, scale of production, educational levels of workers, managerial techniques, and many other factors in addition to the contributions of the particular inputs.

Although BLS is currently developing multifactor productivity measures, at present, the published productivity measures relate output to labor input. This is the most extensively developed and widely used productivity measure because of its relevence to economic analyses and because, as a practical matter, labor is the most easily measured input.

Problems of measuring output

In many ways, the problems of measuring output in the service industries are similar to those of measuring output in the goods-producing industries. That is, the output indicator must be quantifiable and independent of the input measures. If an output measure for an activity is based on an input measure, as is the case in some instances in the national accounts, obviously no change in productivity can be ascertained. In the case of general government, for example, output in the national

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income and product accounts is measured in terms of compensation of government employees. The deflated or constant-dollar measure is derived from changes in employment. Hence, changes in the output measure are closely related to changes in the input measure.

It is also important to distinguish between intermediate and final services. In productivity measurement, we attempt to ensure that the indicators represent output flowing from the industry being measured rather than intermediate steps in the service flow. In this sense, productivity measurement differs from work measurement, which generally refers to the analysis of the operation of an activity and the labor requirements at each intermediate stage. Productivity measurement refers only to the final service and its relationship to input.

For example, in the trucking industry, a count of the ton-miles of freight moved would be the appropriate indicator of the final output—that is, the result of all the activities of the industry. The intermediate steps, such as pickup and delivery, platform work, billing, and collecting, are considered to be subsumed in the final output.

In the case of an organization or an industry providing one type of service, output is merely a count of the units of this service, however defined. In the more usual case of an industry producing a number of heterogeneous services, the various units must be expressed in some common basis for aggregation. For example, the output of franchised new-car dealerships should be a combination of the number of cars sold and the repair activities of the dealers, with appropriate weighting.

To obtain a productivity measure that is an average of the changes of individual components, the appropriate weights for combining the various elements in the output measure are in terms of their factor input requirements. In a labor productivity measure, the weights are unit labor requirements.

Homogeneity among services, after considerations of quality and specifications, is indicated by similarity in unit labor requirements. In this way, the output measure for the development of labor productivity statistics differs from more traditional production measures based on total price or value-added price weighting.

When there are quality changes within the service, adjustments must be made in the output measure to account for the fact that the output is no longer the same homogeneous unit. However, the indicator of quality change for labor productivity measurement differs from the usual concept of quality change associated with consumer price measurements in that it reflects differences in producers' labor requirements or labor costs rather than consumer utility differences.

Ideally, then, the output measure should incorporate data on the number of services provided, differentiated

by unit labor requirements, and in sufficient detail to adjust for quality changes. In practice, however, such data are not generally available for service industries (and, in many cases, for goods-producing industries as well). As a result, approximations based on alternative approaches must be used.

The principal alternative is to remove the change in price from the change in total value of the volume of services. This approach is tantamount to price weighting quantities of services provided. Insofar as price relationships among the various component services of a service industry are similar to the unit labor requirements or unit labor costs, this is a close approximation of the desired measure. And because it is easier to measure price change for a specified group of services than it is to measure the number of services provided directly, this is the approach most generally followed.

However, the adjustment requires data in sufficient detail to adequately represent the price trends of the components included in the price change. Otherwise, price movements of the covered areas will be implicitly imputed to the uncovered areas. But because the relationship among the price movements of similar services is much stronger than the relationship among quantity changes, this alternative still has greater viability than imputing quantity changes for uncovered services.

In practice, BLS uses the two approaches to develop output measures for service industries. In some instances, quantity data are available, particularly for utilities and transportation industries. In others, price deflation is employed, and for some, deflation at lower levels of aggregation is combined with labor input weighting at higher levels. For example, in developing the measure for gasoline service stations, gasoline sales, repair, and other services are deflated separately and summed, but in the case of retail food stores, sales by major department are deflated and combined with employee labor cost weights.

Measuring labor input

With regard to labor input measures, the principal problems are data gaps. Information is needed on hours worked by all persons—nonsupervisory workers, supervisory workers, and self-employed and unpaid family workers—in an individual industry. But although data on hours worked are collected by various government agencies as part of such ongoing programs as the Bureau's occupational safety and health surveys, they tend to be limited in scope, or otherwise inconsistent with the output data developed.

The principal source of data on employment and hours is the BLS Current Employment Survey of establishments. This payroll series provides good measures of the employment and hours of nonsupervisory workers. However, it is collected on an hours paid basis, rather

than on an hours worked basis. To the extent that hours paid for but not worked are changing, this measure has limitations. To overcome this problem, the Bureau is measuring hours at work as a proportion of hours paid for a sample of establishments in the survey and will use these data to adjust the industry hours paid series.

In general, data on the hours of supervisory workers are poor. Although employment data on supervisory workers are available from the payroll survey, hours data are not. Other sources, such as the censuses of population, are used to estimate this component of the labor input measure.

Data on the number of self-employed, an important component of the input series measure for retail industries, come from the Internal Revenue Service (IRS). The IRS data lag current estimates by 3 years, but may be projected forward with special tabulations from the Current Population Survey (CPS).

These CPS tabulations break out the numbers and hours of self-employed and unpaid family workers at the 3-digit Standard Industrial Classification level. Although the sample size at this level is small and the statistical error is high, the data are the only continuous series of the number and hours for unpaid family workers and for the hours of the self-employed.

The measures derived from these data are unweighted hours; that is, the hours of various types of employees are treated as being equally productive. This would not be a problem if the proportions of workers at different levels of productivity were constant over time. However, to the extent that there are changes in the composition of the work force, such as age, sex, and occupational mix, it may be desirable to adjust the labor input measure for these changes which otherwise would be reflected in the productivity measure.

Data gaps hamper the making of these adjustments. Industry data on employment and hours by age and occupation are limited, although various sources, such as the CPS and BLS occupational employment surveys, provide some pieces. And while worker groups may be differentiated into productivity levels according to their wages or compensation, pay is a factor which may reflect other than productivity differences.[1]

Measures for service industries

At present, BLS publishes indexes of output per unit of labor input for industries in each major service activity—trade, communications, transportation, utilities, and business and personal services, a total of 16 separate measures. Data for these industries, presented in table 1, indicate a wide range of productivity growth since 1973, the year in which a productivity slowdown for the general business economy appeared to begin. In many cases, the growth rates exceeded those for indus-

Table 1. Average annual rates of change in output per hour of all employees in selected service industries, 1965–73 and 1973–80

[In percent]

SIC Code	Industry	1965–73	1973–80
401	Transportation: Railroad transportation, revenue traffic	4.2	2.2
4111;4131;414 (parts)	Bus carriers	−1.5	−0.4
4213 (parts)	Intercity trucking[1]	2.7	0.5
4511	Air transportation[1]	5.3	4.3
4612,13	Petroleum pipelines	7.9	0.0
	Communications:		
4811	Telephone communications	4.7	7.0
	Public utilities:		
491;492;493	Gas and electric utilities	4.9	0.7
491;493 (part)	Electric utilities	5.4	1.3
492;493 (part)	Gas utilities	3.9	−0.4
	Trade:		
54	Retail food stores	2.2	−1.2
5511	Franchised new car dealers	2.6	0.5
5541	Gasoline service stations	4.9	3.1
58	Eating and drinking places	1.1	−1.0
5912	Drug and proprietary stores	6.2	1.9
	Services:		
7011	Hotels, motels, and tourist courts	1.8	1.3
721	Laundry and cleaning services	1.7	−1.1

[1] Output per employee.

tries in the goods-producing sector.

In addition, a measure for commercial banking is being developed, and work has begun on measures for the insurance and hospital industries. In a related area, productivity measures for Federal agencies which provide functions such as recordkeeping, insurance, libraries, building and grounds maintenance, and medical services have been published.

It is not possible within the confines of this article to discuss all of the productivity measures prepared by the Bureau, but reference to some of the more important and interesting ones in each of the major areas can illustrate the difficulties encountered in constructing such statistics.

Trade. The Bureau has published measures for retail trade industries since 1975 (with the data beginning in 1958). At present, statistics are published for five important industries—retail food stores, new car dealerships, gasoline service stations, eating and drinking places, and drugstores. Work is underway on a measure for apparel stores, including shoe stores, to be published separately. The effort to develop productivity measures in the wholesale area has not yet succeeded.

For most retail trade industries, data on gross sales in current dollars, deflated by the appropriate price indexes, are used to estimate real output. This method, as mentioned earlier, can yield good estimates of real output. However, such measures can reflect shifts among services with different values, but having the same labor requirements. Therefore, the overall industry productivi-

ty index can show movements without any change in component elements.

In retail industries, a large portion of the value of sales has been provided by the manufacturer and the wholesaler of the product sold. A net output measure would be desirable, because it would most closely correspond to the value added by the retailer. However, a gross or total sales measure will yield the same results as a net or value-added measure if the value added as a percent of sales (gross margin) does not change over time. Available data indicate that, among retail industries for which productivity data are published, gross margins have not changed significantly over time.

To incorporate labor input weights, the indexes for most of the retail trade industries are developed in two stages. First, deflated output measures based on sales volume are developed for detailed merchandise lines. These are aggregated to higher levels and then combined with labor costs weights. For example, in retail food stores, sales for 13 key merchandise lines are deflated using specially prepared price indexes based on CPI components. The merchandise lines are aggregated to five department lines—meat, produce, frozen food, dry groceries, and dairy and all others. These are then aggregated with labor cost weights from Department of Agriculture data to develop the overall output measure for groceries. The labor input data for retail trade productivity statistics are generally derived from the Bureau's establishment survey, supplemented by IRS and CPS data.

Transportation. BLS publishes productivity measures for five transportation industries—railroads, intercity trucking, intercity buses, air transportation, and petroleum pipelines. These measures cover 57 percent of transportation employment.

Conceptually, productivity measures for the transportation industries are easier to develop than those for other non-goods producing industries. This is because transportation industry output—the movement of goods or passengers or both from one point to another—is more easily quantified. Output units in transportation have two dimensions, amount and distance; they reflect not only how much has been transported, but also how far. As such, ton-miles, passenger-miles, barrel-miles, and so forth are the primary output indicators for these industries.

Although the basic information for developing good transportation productivity measures is available and is, of course, being used, there are some data gaps that place certain limitations on the BLS measures. For example, it is sometimes impossible to adjust the productivity measures adequately for changes in the average length of haul. The unit labor requirements associated with the movement of goods and passengers are usually greater for short hauls than for long hauls. Therefore, a shift from a long haul to a short haul trip or vice versa could be reflected as a change in productivity although only the mix of trips had changed.

For the two major freight-carrying industries, railroads and trucking, undifferentiated ton-mile information is reported for total freight operations. In trucking, the ton-mile data are also reported separately for three types of carriers—general, contract, and others. But output measures should reflect the *kinds* of commodities handled and the average distance they are moved. The preferred way to develop these measures would be to combine the tonnage and the average haul of each commodity by its respective labor requirements and aggregate the results for all commodities transported. Unfortunately, this cannot be done with available data.

However, supplementary information on tonnage for railroads is available from the ICC for about 200 commodity lines, ranging from agricultural and mining products to motor vehicles and scientific instruments. Until recently, similar information was also available for the trucking industry. BLS uses these data to adjust the overall measure of freight ton-miles for changes in the composition of goods carried.

Although this commodity adjustment is a significant improvement, refinements to the undifferentiated ton-miles cannot be developed to the extent desired. For example, separate labor requirements data are not available for weighting the individual commodity groups. The commodity index adjustments are therefore made in terms of unit revenue weights, the underlying assumption being that differences between labor requirements among commodities are similar to differences in terms of unit revenues. This does not seem unreasonable because labor costs constitute more than half of each industry's total operating costs, although the proportion could conceivably differ by commodity. For railroads, the adjusted freight ton-mile measure is combined with a measure of revenue passenger-miles to obtain the total industry output index.

For air transportation and trucking, employment is the only available measure of labor input. Thus, the productivity measures for these two industries should be interpreted with caution, for if changes occur in the average workweek, the trends in productivity would not show the true relationship between output and labor time expended on the output.

The transportation industries for which BLS publishes productivity measures all are regulated to some degree by the Federal Government. Recent efforts to reduce the paperwork burden, coupled with the effects of deregulation, have acted to eliminate some of the operating statistics previously published. As a result, some

productivity measures have had to be extended on the basis of more limited information. The outlook for expanding the data base, at least in the near future, is not favorable. However, BLS is cooperating with other government agencies to ensure that adequate statistics for transportation industries remain available.

Communications. The BLS productivity measure for telephone communications covers about four-fifths of the employment in the communications sector. The output index is derived from revenues of all telephone companies reporting to the Federal Communications Commission. The revenues are stratified by major source—local, toll, or miscellaneous—and deflated by specially prepared price indexes for these different services. The labor hours data are based on the Bureau's establishment payroll survey.

At one time, BLS published a productivity measure, the numerator of which was derived from the number of local and long-distance telephone calls, aggregated on the basis of revenue weights. This measure was discontinued in the mid-1950's because of concern that the labor input measure was not consistent with the output measure. For example, private line services, such as leased telephone lines, radio and TV transmission, teletype, and so forth, were reflected in employee hours but not in the output measure as defined. The same was true for calls between stations transmitted through private switchboards and directory services.

A different type of productivity index for the industry was initiated in 1973, with data back to 1951. The numerator of this measure was derived from annual revenue data stratified by major services and deflated, until last year, by price indexes furnished by American Telephone and Telegraph Co. Beginning in 1982, the BLS producer price index for telephone communications will be used to deflate the revenue data, and productivity indexes published for the industry since 1972 will be revised in accordance with the new procedure.

The BLS deflated revenue measure of the output of the telephone communications industry is fairly comprehensive. It includes revenues from private line services, which have grown in importance over the years, as well as those arising from the maintenance of private switchboards by telephone carriers. It also accounts for TV, radio, and computer data transmission by telephone industry facilities, and for directory services. However, certain measurement problems remain unresolved, including the unsatisfactory treatment of differences in intensity of the use of telephone equipment by customers. Intensity of use differences occur when revenue does not vary in proportion to the number of calls made because of flat charges, as in the case of local telephone service or WATS lines. Implicitly, the BLS output measure assumes that the maximum permissible usage takes place under any flat charge system used in the industry.

Business and personal services. In the area of business and personal services, which includes not only business, personal, and repair services, but also education, social services, and political organizations, BLS currently publishes only two measures of productivity, one for hotels and motels, and the other for laundry and dry cleaning services. These measures cover 13 percent of the total employment in the sector.

Because physical quantity information is not available for these two industries, output measures are developed using price-deflated value techniques. The techniques are similar to those described earlier, in that both revenues and employee-hour weights are used to aggregate the output indicators into a total industry output index.

On the input side, the hours of all persons are used as the measure of labor time. As in the trade sector, partners, proprietors, and unpaid family workers make up a significant portion of the work force. Currently, this group accounts for about 15 percent of all persons employed in laundries and 20 percent of the workers in hotels and motels.

BLS efforts to expand coverage in the business and personal service area have been hampered by two major problems. First, because many business service categories are quite broad, it is impossible to account adequately for changes in the mix of their component services. For example, we cannot publish a productivity index for automotive repair shops because there are almost no data available on the types of repairs that are made. The second problem is that not enough services are covered by the Consumer Price Index and, consequently, the deflated value of the output of many uncovered areas would have to be imputed.

Finance. In the finance area, BLS is developing a banking measure in terms of the three major services commercial banks render their customers—deposits, loans, and trust services. While banks also provide non-fund-using services, such as safe deposit and customer payroll accounting, lack of adequate data preclude deriving a measure for them. However, because the proportion of employees engaged in such services is very small, the overall output measure is little affected by the omission.

There has been much controversy over the years as to the appropriate measure of the output of banking. Some analysts have advocated a "liquidity" approach, others, a "transactions" approach. In the former, the banks are viewed as holders of money, and their output is equivalent to the net interest they receive on the volume of deposits held. This interest is the income depositors are willing to forgo to maintain deposits rather than in-

vesting directly in assets less readily converted to cash, that is, the value to customers of the liquidity they enjoy from bank services. This approach can be extended to all types of savings accounts, on the principle that the forgone net interest is the value of the bank's services.

The other approach views banking output as a series of transactions; the volume of the bank's output is proportional to the volumes of the transactions handled. BLS has adopted this second approach for its productivity measure.

Accordingly, the final output of banks is defined as an array of depository, lending, and fiduciary services. Estimates of the number of transactions for each of the three service functions must be derived. Because no direct count of the number of transactions is available in many instances, estimates are made from data on the total value of transactions and surveys of average transaction amounts.

Deposit activity is measured in terms of the number of checks transacted and the number of time and savings deposits and withdrawals. (An electronic funds transfer is treated as a transaction on par with one involving payment by check.) The data for demand deposit activities are from Federal Reserve counts and official benchmark surveys. For time and savings deposit activity, the output measure is based on data published by the Federal Deposit Insurance Corporation and on the Functional Cost Analysis conducted annually by the Federal Reserve.

Lending services provided by banks are also measured in terms of units. As in the case of deposit and trust activity, BLS does not use banks' financial data to arrive at the component output measures. Use of such data would be highly misleading even if appropriate deflators could be found. For example, an increase in the aggregate deflated value of loans might simply reflect the making of a few large loans; similarly, a decrease might indicate the repayment of a few large loans, even as the number of small loans increased.

Twelve types of loan output are measured, for the most part using data generated by the Federal Reserve and the Department of Housing and Urban Develop-

ment. Included in the loan output measure are commercial and residential mortgage loans; consumer loans; single-payment loans; credit card loans; and commercial and "other" loans. The number of loans can usually be derived by dividing the dollar value of total loans in a given category by the average face value of a loan. For the category of commercial loans, the actual number of loans extended has been available since the mid-1970's.

An experimental output measure for the trust department services of commercial banks is derived from the trend in the number of accounts. Trust accounts are stratified into five major categories, including benefit trusts, personal trusts, and estates.

After output estimates are developed for depository, loan, and fiduciary segments, they are aggregated to the industry level using employment weights.

SOME OF THE MAJOR PROBLEMS in developing labor productivity measures in the service activities and how BLS has tried to meet some of these problems have been highlighted above. Considerable work in this very important area has been conducted and the outlook for improvements in certain subareas is optimistic. For example, as price measures are improved and hours worked data become available, and as work in the area of government productivity measurement progresses, BLS will be able to provide a better picture of what is happening to productivity in more activities within the sector. Additional measures in communications, finance, insurance, and real estate, and business and personal services can and will be developed, and indexes for wholesale trade are very possible. However, there are severe conceptual as well as data problems in measuring productivity in such industries as education and social services and in the important field of medical services, and progress in these areas is expected to be much slower. □

───── FOOTNOTE ─────

[1] In connection with work on multifactor productivity measurement, BLS is exploring the possibility of making adjustments for changes in work force composition.