

# **PRODUCTIVITY IN THE SERVICES SECTOR**

**Jack E. Triplett and Barry P. Bosworth**

**Brookings Institution**

**1775 Massachusetts Ave, NW**

**Washington, D.C. 20036**

**email: [JTRIPLETT@BROOK.EDU](mailto:JTRIPLETT@BROOK.EDU)**

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### **I. Overview and introduction**

From 1949 to 1973, the Bureau of Labor Statistics (BLS) estimates that U.S. non-farm multifactor productivity grew at 1.9% per year. After 1973, multifactor productivity grew only 0.2% per year (table 1). Despite a 20-year intensive research effort to find the cause, no convincing explanation of the post-1973 productivity slowdown exists.

Whatever the ultimate cause, circumstantial evidence suggests that services industries play some important role in the slowdown. In the first place, the aggregate numbers indicate that the productivity slowdown is greater in the non-goods producing portions of the economy. While no official estimate of productivity in services is published by the BLS, nonfarm multifactor productivity slowed by 1.7 percentage points (from 1.9% per year to 0.2%), and manufacturing productivity fell by 0.6 percentage points (from 1.5% per year to 0.9%). Because manufacturing accounts for about 22% of non-farm business, this implies a 2 percentage point slowdown in the non-manufacturing sector.<sup>1</sup>

If the data are right, one might infer, as did Baumol (1967) many years ago, that productivity improvements in services are harder to achieve than in goods producing industries. If so, the shift of the economy toward a larger share of services implies a reduction in the national rate of productivity improvement.

But this view of manufacturing and services is undoubtedly too simple. Substantial disparities exist among productivity growth rates within the manufacturing sector and also within the non-manufacturing sector. It simply is not true that all individual services industries have productivity growth rates that are lower than all individual manufacturing industries, or even below the average for manufacturing industries.

But more importantly, perhaps, the data may not be right. One popular hypothesis about the productivity slowdown is that it is a product of mismeasurement. According to this hypothesis, the mismeasurement of output contributes to the productivity slowdown because an increasing portion of output is not captured in the basic statistics.

Again, circumstantial evidence points to the services industries. Griliches (1994) pointed out that some of the services industries whose productivity growth rates in the 1947-1973 era were as high or higher than productivity growth in manufacturing industries had, since 1973, much lower productivity improvements. Additionally, the productivity slowdown has been particularly intense in services industries where output is hard to measure--health services, for example, have the greatest labor productivity slowdown of any industry in table 2, and both banking and health services have large multifactor productivity slowdowns (see table 3). This points again to possible mismeasurement.

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<sup>1</sup> The nonfarm multifactor productivity numbers are due for revision in the near future, to incorporate the revisions to GDP that were released in October, 1999. This will undoubtedly raise the non-goods estimate but not the manufacturing productivity estimate, because the productivity numbers published by the BLS for the nonfarm and manufacturing sectors are based on different data and underlying output concepts.

Another puzzle involves computers. The 1992 capital flow table shows the purchases, by industry, of computer equipment (Bonds and Aylor, 1998). The five industries that are the largest purchases of computers are all services--in order, financial services, wholesale trade, business services, insurance, and communications. Those five services industries account for more than 50 per cent of US investment in computers. Within these industries computers have created new forms of service output that may not be fully captured in the statistics. An example is the growth of ATM machines in banks that reduce the time spent waiting in line for teller transactions, make the transactions available on weekends, and have, with computer-assisted verification systems for credit card purchases, virtually eliminated the need to carry traveler's checks on foreign travel to many countries. Prior to the 1999 revisions to GDP, ATM usage was not reflected in the measure of banking output in the national accounts.

In all of these services industries, conceptual and empirical problems in measuring output and prices are notorious: For example, an economic consulting firm is part of the business services industry. How do we measure the output of an economic consulting firm? How would we construct a price index for economic consulting? And how would we compute the productivity of economists? The science of economics is no closer to developing methods for measuring the output of economists' own activities than it is for measuring the output of banks, law firms, and insurance agents. All of these services poses difficult problems for constructing price indexes and real output measures and therefore for measuring productivity.

This paper gives a progress report of a project we are conducting, with collaborators, on service sector output and productivity. Its major message is that there is no central theme to the problem of services measurement. Each industry we have examined contains unique problems. If quality change is, as Shapiro and Wilcox (1996) put it, the "house-to-house fighting" of price indexes, measuring service output requires, at least, a hedgerow-by-hedgerow assault.

In the next section, we present some measures of the growth in labor and multifactor productivity within the services industries in a form that is consistent with the published measures for the aggregate economy. This allows us to document the wide dispersion of productivity growth rates across industries and the pervasiveness of the post-1973 slowdown. Section III summarizes recent research on individual sectors that have been subjects of Brookings workshops on measurement issues in services industries.

## **II. Available Data**

Reviewing trends in service sector productivity and measurement issues requires a decision between two alternative databases that can be used for productivity analysis. Other researchers in this field face the same choice.

On the one hand are the aggregate, sector, and industry estimates published by BLS, which cover both labor productivity and multifactor productivity. As a general statement, we believe that the BLS productivity figures, where available, are the best current sources of U.S. productivity trend information.

However, the BLS industry labor productivity estimates do not cover all industries at present, although an expansion is underway that will eliminate most of the lacunae. An aggregate services sector productivity number—which we need for this review—is not available from BLS, though it is possible to infer one (see table 1). It is difficult to combine published manufacturing and nonmanufacturing industry productivity estimates to reach the published aggregates, such as the nonfarm business labor productivity number (Gullickson and Harper, 1999, show aggregation with "Domar" weights). These are liabilities if one's objective is to compare industry labor and multifactor productivity trends with aggregate and sector labor and multifactor productivity trends.

A second alternative is to make use of the gross product originating (GPO) by industry data published by the Bureau of Economic Analysis (BEA). The GPO data are consistent with national accounts, and with the estimate of nonfarm business output. Using BEA gross product data to compute productivity yields estimates that are consistent across industries, can be aggregated to sector and economywide totals, and are consistent between labor productivity and multifactor productivity concepts.

Set against these advantages, however, is the fact that GPO and other BEA data are not exactly what we want for computing industry productivity measures.<sup>2</sup> For its productivity measures, BLS starts from gross output per industry and adjusts for intraindustry sales. GPO is value added and value added deducts, additionally, inputs purchased from other industries. (Value added is used in national accounts in order to obtain an unduplicated total for GDP.) The BLS output measure is preferable for industry productivity purposes. The BEA series on full-time equivalent employees by industry, which we use, is converted into employment hours by BLS, and nonemployee hours are added; then, an adjustment is made for labor quality. Because these adjustments are larger for the earlier post-war period than for the last decade, our measure of labor input produces a larger productivity slowdown than the BLS labor input measure (see the first two lines of table 2). Finally, the BLS produces capital input by industry by following the Jorgenson (1989) principles for producing capital services and capital rental prices. The BLS capital input measure is conceptually superior to the use of BEA net capital stock by industry, which we employ in the calculations for table 3.

In table 4 we calculate the effect of the alternative output concepts, which turns out to matter more for some of the services industries we discuss than for manufacturing. In subsequent work, we will carry out similar comparisons for labor input and capital input choices.

Thus, the choice is between comprehensive and consistently compiled industry data from BEA or data that are more fragmentary and less consistent, but more appropriate for productivity analysis, from BLS. Ultimately, our decision to use GPO data and BEA capital and labor measures was motivated by the desire to have a comprehensive data set for all industries, one for which consistent labor and multifactor productivity measures could be derived. We also needed a dataset from which we could split trends at the 1973 onset of the productivity slowdown. A complimentary study of the productivity slowdown that begins with BLS data is Gullickson and Harper (1999). Their study covers 1947-77, and 1977-92. These are not optimal years for analyzing the productivity slowdown, which began in 1973, not 1977.

Data on Gross Product Originating (GPO) by industry as published by the Bureau of Economic Analysis (BEA) provide a means of examining the role of the service industries within a framework that is in principle consistent with the aggregate economy-wide productivity estimates for nonfarm business. The data are published at the level of 65 private-sector industries; and with the 1996 revisions (Yuskavage, 1996), estimates are available for gross output (shipments), gross product (value-added) and its components, and intermediate inputs beginning in 1977.<sup>3</sup> Because the estimates are tied into the 5-year benchmark input-output tables, they are consistent with the national accounts aggregates. The measures of real gross output and real gross product (value added) incorporate the chain Fisher indexes used for the national accounts. For most industries, real product is derived by separately deflating inputs and outputs, 'double deflation'.

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<sup>2</sup> We should note that BEA does not explicitly produce productivity data, and so the following remarks are not meant as criticism of BEA statistics for their own purposes.

<sup>3</sup> The data on gross product and its components in current prices extends back to 1947.

However, the GPO series have not yet incorporated the revisions to GDP that were released by BEA in October, 1999. Some of these revisions are substantial. For example, when BLS incorporated them into revised estimates of non-farm labor productivity, the post-1973 growth rate was raised by 0.4 percentage points per year (from 1.1 percent to 1.5 percent—see table 2). When these GDP revisions are eventually incorporated into the GPO series, they will also cause revisions to the industry multifactor productivity rates. The data in this paper reflect pre-October data for GDP, except where noted.

We have used an older data set to extend the estimates for the real value of gross product back to 1960 in order to have a rough perspective on the contribution of the service industries to the post-1973 productivity slowdown.

### ***A. Labor Productivity***

Estimates of gross product per worker are constructed using the BEA's data on persons engaged in production.<sup>4</sup> We did not incorporate hours worked into the analysis, but variations in hours appear to be significant only in the 1960s. The resulting measures of labor productivity are summarized in table 2.

The level of output per worker, shown in column 2, varies widely by industry, but the average for the broad definition of services is nearly identical to that for manufacturing (\$57,000 and \$59,000, respectively). Labor productivity is particularly high in the capital-intensive sectors of communications, public utilities and FIRE (finance, insurance, and real estate—but the real estate number is affected by the inclusion of owner-occupied housing, which has no labor input). The notion of low productivity service-sector jobs is accurate only for retail trade and the miscellaneous collection of other services.

Growth rates of labor productivity are reported in columns (3)-(6), where we distinguish between the pre- and post-1973 experiences. We also show the average growth of the last decade. For a number of industries, post-1987 productivity growth is considerably faster than shown in the 1973-97 data.

For comparison purposes, the first two rows of table 2 show the aggregate series for the nonfarm business sector. The first row shows the nonfarm productivity rate previously published by the Bureau of Labor Statistics (BLS).<sup>5</sup> For the pre-1977 period, the rates are the published version, from the major sector detail of the national accounts (version A) and Fisher indexes of gross product for the private-sector aggregate from our constructed estimates of the underlying industry detail (version B). The discrepancy of 0.2 percentage points over the 1960-73 period is indicative of the error introduced by our use of the old data to extend the output estimates back before 1977.

The industry detail reveals a very pervasive pattern of slowing productivity growth after 1973 (column 3 versus column 4). Within the goods-producing industries, the rate of growth in labor productivity continues to be quite rapid for agriculture and there has been a strong recovery in mining over the 1987-97 period. Although labor productivity change in construction is negative over the full 37 years, the post-1973 experience actually represents an improvement over the prior period. While the slowdown is often said to have come to an end for manufacturing, the recovery is largely the result of a

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<sup>4</sup> Person engaged in production are defined as full-time equivalent employees plus the self-employed. Employees on part-time schedules are included as a fraction of a full-time employee on the basis of weekly hours. Unpaid family workers are excluded.

<sup>5</sup> As shown in table 1, the 1.1 previously published BLS labor productivity rate in table 2 has now been revised to 1.5. Additionally, the estimate of 0.9 in table 2 shows the effect of using employment, instead of hours.

rapidly expanding electronics industry.<sup>6</sup> Excluding electronics, durable and nondurable manufacturing both still show a deceleration of productivity gains. It is particularly large for nondurables and it has continued to deteriorate in the most recent period.

The productivity slowdown is more pronounced in the broadly-defined service sector which includes a very heterogeneous mix of industries. For the service sector as a whole, the post-1973 labor slowdown is 1.8 percentage points, measured from the whole period (2.2 minus 0.4), and 1.5 percentage points, using only the last decade's data.<sup>7</sup>

Within the transportation industries, deregulation was followed by substantial productivity gains for railroads, as was anticipated; but the gains from deregulation seem small or nonexistent for trucking and airlines. The high reported rate of productivity improvement for communications (2.9 percent for 1987-97) actually represents a slowing relative to the 1960-73 period; but there are questions about the extent to which the price indexes incorporate new technologies.

Wholesale trade is an exception in showing an acceleration of productivity growth in the last decade. It is also one of those industries that has made an extensive investment in computers. However, the quality of the data is affected by a blurring of the distinction between manufacturer's distribution activities and wholesalers and the backward integration of retailers into wholesaling. Moreover, the old U.S. SIC system contained a definition of wholesale trade that caused many retailing establishments in office supplies, hardware, and other retailing activities to be classified as wholesalers, which complicates the interpretation of the wholesale trade productivity numbers.

The retail trade sector is reported to have a modest slowdown. But the statistical methodology may not fully capture the effects of continuing changes in store formats. and, as noted, the old SIC system caused many of the most technically dynamic retailers incorrectly to be included in the data for wholesale trade.

Finance, insurance and real estate (FIRE) and the category "other services" include many of the industries where the problems of defining and measuring real output are most severe. For several of these industries, annual rates of change in labor productivity are actually negative.<sup>8</sup> In industries representing about 13 percent of GDP, the estimates of real output growth are based on changes in employment. Recent research also has suggested that there are major problems with the price indexes used to derive output of medical care.<sup>9</sup> Productivity growth has accelerated substantially within finance, but that is primarily due to the large output gains recorded for security brokers during the recent stock market boom. The conceptual basis of the output measures for banking and insurance continues to be an area of

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<sup>6</sup> The importance of computer manufacture in the post-1994 improvement in productivity growth is emphasized by Gordon (1999a). Because of data limitations, his definition of electronics is a broad one that includes all of SIC 36 and 38 machinery manufacturing industries. This aggregate's productivity growth for the pre-1973 period is not properly interpreted as electronics productivity, partly because much more of it was non-electronic in those days, and partly because the part that was electronic was not as well measured.

<sup>7</sup> This 1.8 point slowdown, calculated directly from the industry data, can be compared with the estimated slowdown (by backing off the manufacturing estimate from the total) of 2.0 percentage points, in table 1.

<sup>8</sup> Banking, insurance agents (and carriers before 1987), personal services, business services (before 1987), and repair, health, legal, and educational services. The negative rates of growth in labor productivity for many service industries were emphasized in Sliffman and Corrado (1996).

<sup>9</sup> The methodology used to compute gross output and product by industry is reported in Yuskavage (1996), and an overview of the problems with medical care prices is provided in Berndt et al (1998).

substantial debate. Labor productivity is recorded as declining in large portions of other services, including health services.

In summary, the distribution of labor productivity gains by industry and the pattern of the post-1973 slowdown is consistent only in broad terms with a focus on mismeasurement of output in the service industries. The slowdown has not disappeared in the manufacturing sector, though that sector is of sharply diminished importance in a service-dominated economy. The decline in productivity growth in the early 1970s also seems too abrupt to attribute to a deterioration in the quality of the data.

Within services, the patterns of change are quite disparate and different industries raise different types of potential problems. Furthermore, evidence of a slowdown in productivity growth is quite pervasive across industries, rather than being focused exclusively on industries with difficult measurement problems. For example, it is not clear why auto repair, with negative post-1973 productivity, should be mismeasured (Levy, 1999). Yet, while some of the negative values for productivity change might be explained as the consequence of shifts in the composition of output, their frequency in the service sectors is suggestive of an understatement of real output growth.

### ***B. Multifactor Productivity.***

BEA publishes estimates of the stock of plant and equipment by industry which we have used to compute crude measures of multifactor productivity (MFP) at the level of individual industries.<sup>10</sup> Those estimates are shown in table 3.

Since the capital inputs generally grow faster than employment, the growth of MFP is usually less than that for labor productivity. Further, because the growth of capital slowed sharply relative to labor inputs after 1973, the post-1973 slowdown in private-sector MFP is only about half as large as that for labor productivity. At the level of the total private sector, the MFP growth rate slowed by 0.8 percentage points between 1987-97 and 1960-73, compared to 1.5 points for labor productivity. The contribution of increased capital per worker is particularly large in communications, wholesale trade, and financial institutions. After deducting the contribution of increased capital per worker, nearly half of the industries had negative rates of change in MFP over the 1973-97 period, and most of those are in finance and other services. The gains in labor productivity are larger than those for MFP only in transportation, business services, entertainment, and social services.

The estimates of MFP shown in table 3 use gross product (equivalent to value added) as the measure of output. The BLS studies of productivity generally focus on gross output at the industry level, and define multi-factor productivity within a framework that allows for three inputs: capital, labor and inputs purchased from other industries. A recent study by Gullickson and Harper used that framework to examine the trends in industry productivity over the 1947-92 period.<sup>11</sup> While they use a more refined methodology and focus on different subperiods, the results are broadly similar in finding negative productivity trends for construction, finance and many of the industries included in other services.

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<sup>10</sup> Thus, we are using the net stock of fixed capital as a proxy for the index of capital inputs. The theoretically appropriate measure is the productive stock, which yields the flow of capital services, as emphasized by Jorgenson (1989). The distinction between the net, or wealth, capital stock and the productive capital stock is discussed in Triplett (1996). Capital and labor are combined with a Tornqvist index using the share of labor compensation in GDP after adjusting for the self-employed.

<sup>11</sup> Gullickson and Harper (1999). The BLS definition of gross output differs from that of the BEA by excluding intra-industry shipments. In addition, the Gullickson-Harper estimates of multi-factor productivity use a more elaborate measure of the capital input that includes land and inventories, and the labor input is based on hours worked, with an adjustment for labor quality.

The BEA data set includes measures of gross output only for the 1977-97 period; as shown in column 2 of table 4, the distinction between gross output and gross product is important for several industries – particularly public utilities, insurance, and health services. While the choice of the output concept has a large effect on labor productivity, it is less significant for MFP because purchased materials are included as an input in the calculation of the later. If the analysis is limited to those industries for which both output concepts are available, the aggregate growth of gross output exceeds that of gross product by about 0.1 percentage points, but reliance on the gross output concept would significantly raise the growth of labor productivity in the service sector and lower it for the goods-producing industries.

Our use of BEA net capital stocks by industry introduces potential problems among services industry productivity estimates, especially those industries that are heavy users of computers (which have short service lives). We will explore the implications of this step in a revision.

### **C. Intermediate Products and Aggregate Productivity**

Finally, it is important to note that conclusions about potential bias in the estimates of industry productivity may not carry through to the aggregate economy. The output of some industries is largely consumed as an input by others. Thus, an understatement of productivity growth in one industry may be offset by an overstatement for those industries which use its output.

For example, the real output of business and other services is extrapolated on the basis of employment, producing an assumed zero rate of growth in labor productivity. Yet, as shown in column (3) of table 4, 80 percent of the industry's output is delivered to other industries. Thus, any errors in measuring business services output lead to compensating effects on the inputs and productivity of industries that use business services. Improved measures of real output for business services would have only a minor impact on the estimates of economy-wide productivity growth.

On the other hand, employment is also used to project the output of the banking industry, but nearly two-thirds of its output goes to final demand. The recent revision to the measure of banking in GDP will have an effect on economy-wide GDP. An even more extreme example is provided by medical care services where nearly all of the output is directed to final demand.

Gullickson and Harper used input-output analysis to adjust for the proportion of an industry's output that is an input to others for those industries with negative productivity trends.<sup>12</sup> They concluded that the inter-industry effects would reduce the economy-wide impact of a change in the industry productivity by about one-third.

### **III. Individual Services Sectors**

As noted in the introduction, there is no overall theme to measurement problems in services industries. Each appears to be a special case, with specific measurement problems unique to the unique characteristics of services industry output. Each industry problem requires a specific solution, an attack designed uniquely for the special problems posed by the nature of the industry's output. This section

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<sup>12</sup> Gullickson and Harper (1999), p. 58-59.

reviews some of the problems and the state of the statistics in topics that have been addressed in the series of Brookings Workshops on Measuring Prices and Output of Services Industries.<sup>13</sup>

## **Business Services**

Business services include a diverse set of activities, such as professional and consulting services (other than legal and financial), advertising, data processing and building maintenance. As noted above, about 80 percent of the output of the business services industry is purchased by other domestic firms. The 20 percent that goes to final demand is sold to government and overseas.

The gross product originating (GPO) of the business services sector has more than doubled as a share of GDP over the past quarter century to about 5 percent. It is also one of the fastest-growing export sectors. Yet until recently we had no measures of real output of the industry, or of real exports, and GPO is projected on the basis of employment data (Yuskavage, 1996).

In many cases, measuring the output of business services involves an effort to determine who should receive credit for the productivity gains recorded by the users of business services. When the output of business services is projected on the basis of employment or the use of other inputs, all productivity gains are assigned to the purchaser of the service. If the provider of the service is credited with some productivity gain, it comes at the expense of measured productivity gains in the purchasing industry. Thus, to the extent that business services are intermediate products, they have no implication for the measurement of economy-wide productivity, only its distribution. On the other hand, understanding why the economy is making more use of business services, and why they contribute so strongly to U.S. export performance, demands better measures of output, so improving the measurement of business services is important for other reasons, even if not for measuring aggregate productivity growth.

Since 1995, the BLS has expanded the Producer Price Index to measure the prices or fees for some components of business services. It now publishes indexes for accounting, legal, advertising agency, and engineering services. In each of these cases, the BLS asks respondents to re-price at periodic intervals a bundle of services that was observed in the period where pricing was initiated. This is an application of what is known, internationally, as “model” pricing, a methodology that was first developed by Statistics Canada for pricing construction. The BLS methods and results were described in Gerduk (1999) and Swick (1999).

Model pricing amounts to collecting a hypothetical price for a defined bundle of services. The BLS does ask respondents to take account of market conditions, and they make some adjustments for quality change. However, respondents may simply mark up the individual inputs that go into the bundle of services. The new PPI indexes appear similar to the pattern of change in average hourly earnings.

The problems are even more severe in other areas of business services, such as business consultants, because it is difficult to define the firms’ activities in a way that leads to clear measures of their output. A few attempts have been made to collect from business services providers information about what they contribute to the output of their customers. Examples are Nachum (1999), who surveyed a group of European management consulting firms, and Gordon (1999b), who collected information from U.S. consultants. The results are interesting, but have not so far yielded any breakthroughs on the most difficult of the problems. In some cases, management consultants are used to validate decisions already made by management, as a tool to assure broader employee cooperation in a major corporate change, for example; even if this use of the consultant improves the productivity of the purchasing firm, extracting an

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<sup>13</sup> Agendas for the workshops, and some of the papers, are accessible at: [www.brook.edu/es/research/rs7.htm](http://www.brook.edu/es/research/rs7.htm).

estimate of the consultant's effect from surveys—either of the seller or the buyer of the service—is not a promising approach.

Because business services are so diverse, measuring them requires an industry-by-industry approach, and painstaking resolutions of unique problems that are found in individual industries.

## **Retail Trade**

For effective measurement of real output and thus productivity in the retail trade sector, several conceptual problems must be resolved. Much of the industry's innovation is reflected in shifts in the distribution of sales among stores with different formats and changes among product lines within stores. Yet, these shifts are explicitly ruled out in the construction of the major price indexes which focus on a specific product in a specific store. The shift of sales from department stores to lower-priced discount outlets, for example, is treated as a reduction in quality (and therefore output), not a reduction in price. Nor is there any estimate of the value of increased product variety. Additionally, the old SIC system may be one of the mismeasurement culprits, because some retail establishments with high productivity may be incorrectly classified in the wholesale trade industry, as noted in a previous section.

At present, two statistical agency programs provide measures of real output in retailing. The BLS produces indexes of output and output per labor hour at the level of three and four-digit SIC codes. BEA publishes a measure of Gross Product Originating (GPO) at the level of total retail trade and measures of gross output for more detailed sub-groups within the retail category. The BLS employs a consistent methodology for all of its industry productivity work of using a concept of *gross output* that is equivalent to shipments or sales, not value added; and the indexes are Tornqvist aggregations of output at the lowest available level of detail.<sup>14</sup> The BEA, on the other hand, uses a measure of the gross margin – sales minus cost of goods sold -- as its basic concept of gross output in the retail sector. The two estimates are more nearly similar than might be expected, however, because BEA assumes that the margin is a fixed percentage of sales at the lowest level of detail.

Generally, the output measure for an industry is what the industry sells. A shoe store sells shoes, which is the way the BLS measures retail output. The problems with the BLS approach are well represented by the example of computers. Because of manufacturers' improvements in computational speed and capacity, the real value of computer store sales has grown spectacularly, over 25 percent per year since the mid 1980s. Much of that growth is in the increased quality per machine. The computer stores, however, are basically selling boxes; and while the number sold has increased, it has not grown at anywhere near the increase in the output of computer manufactures. An index that combines the increase in computer quality with growth in the number of machines bears little relationship to the actual activities of the computer store (even though it is the appropriate way to measure the output of the computer producer).

There are several suggested lines of research to deal with these problems. One option would involve the construction of input price indexes, as for manufacturing, so that a measure of the real value of the gross margin could be obtained by double deflation. However, many analysts doubt that indexes of sufficient accuracy could be developed to obtain, in effect, the real value of the margin as the residual of changes in two large numbers.

Alternatively, it might be possible to develop price indexes that could be used to deflate the gross margin directly. For example, one approach would identify characteristics of stores that account for

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<sup>14</sup>Kunze and Jablonski (1998).

variation in the gross margins, and construct an hedonic index based on changes in those characteristics or their prices. The BLS is currently conducting a research program that asks individual retailers for the replacement cost of goods sold as well as the retail price. At the same time, they propose to obtain information on the store characteristics, such as number of SKUs, square footage, storage area, and whether the store is a discount, gourmet, warehouse, or combination outlet. This will provide a data set that will allow for the exploration of the sources of variation in retail margins.

Output and productivity in retail trade have been greatly affected in the past by cost-shifting from the store to the customer—self-service retail trade, for example. The evidence is overwhelming that the changes are positively perceived by consumers. But part of the cost shifting ought to be deducted from retail productivity, and increasing services to customers should be added (Oi, 1992; 1998).

## **E-commerce**

One widely cited estimate (Whinston et al, 1999) puts the volume of e-commerce at \$301 billion, with a growth rate of 173 per cent per year. What are the issues for measuring productivity that come out of the growth of e-commerce?

First, it helps to understand what are not issues for measuring productivity. The estimate of \$301 billion cannot be interpreted as the net contribution of e-commerce to GDP. Only about \$101 billion of the total represents final e-commerce sales (Whinston et al, 1999). The other two-thirds represent high-tech investment by e-commerce firms and purchases of other inputs, such as software and web site hosting services. These inputs would be netted out of any GDP estimate, so the \$301 billion double counts in the traditional national accounting sense. Although it is of some use to know the total volume of transactions that are associated with e-commerce, the total volume of transactions does not give a measure of unduplicated output, which traditionally is calculated by value added.

Even some of the \$101 billion of e-commerce sales are not net additions to GDP. In the case of computers and software (by far the largest category of e-commerce sales at present), only the e-commerce *margin* properly is included in GDP, not the total e-commerce transaction, because manufacturers' sales of computers and software are counted in the manufacturing industries.

Although the growth rates of e-commerce are impressive, its size is still miniscule, even compared to catalog sales. There is no evidence that GDP or aggregate productivity is currently missing very much because of e-commerce.

Moreover, unlike the situation with service sector statistics in the past, the Census Bureau has already mounted survey activity to determine how many retail sales take place over the Internet (Mesenbourg, 1999). It appears likely that e-commerce sales will be smoothly integrated into existing retail sales information before they get very large. Accordingly, the macro implications of e-commerce are not very important, and, actually, not very interesting.

The more important questions are: What does e-commerce do to the productivity of firms that adopt it? How does it affect internal business processes, and therefore productivity? What are the effects of displacement on other, competing, industries? And what does it do to competition and the structure of existing industries? Unfortunately, data to study those questions will be harder to obtain.

Some of those questions concern inputs to production. The U.S. statistical system has historically been weak in providing information about detailed input usage, and this is especially true for inputs of high-tech equipment, software, and services. That means there is little benchmark information to

determine the changes that will be wrought by e-commerce. Essentially, there is no good picture of business processes and input usage in U.S. statistics before the advent of e-commerce.

Many final sales over the Internet, and many business-to-business Internet sales as well, are substitutions for more traditional kinds of retailing, not only against traditional “brick and mortar” stores, but more specifically mail order catalogs. How readily do people substitute Internet transactions for older types of transactions?

Papers by Brynjolfsson, Smith, and Bailey (1999) and by Goolsbee (1999) suggest that Internet buyers are, first, quite sensitive to price differences, but quite sensitive as well to various nonprice elements, such as advertising, trust, delivery times, and so forth. Indeed, there seem to be two competing forces, which have been described as an “arms war” between business and consumers. On the one hand, it has often been suggested that the Internet makes it easier for consumers to search for prices, which should reduce the amount of price dispersion in markets. On the other hand, businesses use the Internet to increase product differentiation and tailor products to individual buyers, thereby increasing the amount of price dispersion. Studies (Brynjolfsson et al, 1999) have found that when consumers learn about nonprice aspects of the transaction, they turn out to be more sensitive to the nonprice aspects than to the price dispersion. The studies also find a large amount of price dispersion on the internet, which is consistent with the finding that nonprice aspects of the transaction, including advertising, are very important to Internet sales. The widely-publicized notion of a frictionless Internet economy, with no advantages with respect to seller’s size, is not supported by current research.

As another issue, some of the changes wrought by e-commerce cross the traditional “production boundary” used in national accounts. For example, a book bought from a conventional bookstore implies that the consumer incurs travel costs and time costs to go to the bookstore to make the purchase. Those costs are not now counted in the acquisition price of the book. A book purchased over the Internet, however, incurs handling and shipping costs that are included in the price of the book. Conversely, some people like shopping or like to browse in bookstores, which cannot be done over the Internet. Looked at this way, these services are part of the value created by traditional retailing, and the Internet provides fewer retailing services. If our statistics simply compare the price of the book in the two settings we will omit the value of retailing services (which are not explicitly priced) to the ultimate buyer, and miscount as well costs to the buyer that are non-market in the one case (travel costs to the store) but are explicit and charged for in the other (shipping and handling for e-commerce sales).

These problems are no different from other kinds of retailing shifts. There is serious concern that we already mismeasure output in the retailing sector because implicitly-priced store services are not directly accounted for (see the section on retail trade). So in this sense, e-commerce does not raise new issues, but it may raise them in new and particularly intractable forms.

Finally, there are interactions between e-commerce and other economic changes. Declines in communication costs, and perhaps to a lesser degree, in transportation costs, are a major force behind the growth in e-commerce. We may not be measuring the decline in the costs of communication well. The growth of e-commerce may just be a response to other economic innovations that are more fundamental, and e-commerce may not be the major technological change in itself.

A closely related matter is the decline in prices for Internet service providers. Work is underway on this in both the U.S. (in a Brookings sponsored project) and Canada. But because Internet service contracts are increasingly being bundled into the purchase price for computers, or else Internet service is being paid for by advertising, obtaining price indexes and real output measures for Internet service providers is likely to pose difficulties that have not yet been addressed.

## Insurance

Labor productivity for insurance carriers dropped precipitously after 1973, and turned negative, as did multifactor productivity. (The 1973-97 productivity growth rates are  $-0.1$  for labor productivity and  $-2.3$  for multifactor productivity—see tables 1 and 2). Negative productivity growth rates are always suspect, but they are especially so in the case of insurance, because this industry is among the largest purchasers of computer equipment. The use of computers for claims and premium processing is obvious.

After 1987, however, the insurance carriers industry shows very rapid rates of productivity growth, 4.6 per cent for labor productivity and 2.1 per cent for multifactor productivity, perhaps because investment in IT equipment has borne fruit. As a result, recent productivity growth in the insurance carriers industry exceed its pre-1973 rates.<sup>15</sup>

Despite the insurance industry's recent impressive productivity growth, there are reasons to believe that its output may still be mismeasured, and that the industry's true productivity growth may be stronger than the available current data show. We conclude that a major unresolved problem in measuring the output of insurance is the measurement and valuation of risk. The management of risk is what insurance companies sell. Anecdotal evidence suggests that insurance companies have greatly improved their ability to manage and control for risk. Because there is no explicit adjustment for risk in present price and real output measures, we suspect that output levels and output growth are both understated.

A major difficulty in focusing on what seems to us the real question—that is, measuring and valuing risk—is that insurance has been the topic of one of those long-standing national accounts disputes that seemingly are never resolved. There are a number of interlocking issues, partly real issues and partly, we feel, confusions, which were discussed extensively in the April, 1998 Brookings workshop on measuring insurance.

Two major issues are: (1) Should the *current price* measure of insurance output be the insurance company's revenue from premiums or, instead, its premiums minus claims paid out? (2) However the first question is resolved, should the insurance company be treated as operating in two lines of business, namely, (a) selling insurance and (b) investing reserves?<sup>16</sup>

**(1) The current price (nominal) output measure---premiums versus premiums minus claims.** This output definition controversy corresponds to two different conceptual models about the insurance company's production process.

The premiums minus claims view is equivalent to a *risk-pooling* model where the insurance company is merely a facilitator and administrator. The policyholders create a pool for sharing risk, essentially operating as a cooperative, and the members of the cooperative pay a service fee to the insurance company for administering the pooling scheme. The price of insurance in this model is the

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<sup>15</sup> The gains are not shared by the insurance agents industry. This industry will not be considered further in the present discussion.

<sup>16</sup> A third issue is also debated: If the answer to question (2) is positive, should the investment part of the insurance company's output be imputed back to insurance purchasers in the form of imputed increases in the quantity of insurance? The latter question amounts to asking whether there is a difference between insurance *company* output in industry productivity measures and insurance *product* information in, for example, the consumer price index. Because this last issue is important for measuring CPIs and for measuring real consumption, but not for industry productivity measures, it is not included in the present paper.

service fee for administering the plan. The rationale for this approach to insurance is presented by Hill (1998) and it is the view that is incorporated into the Systems of National Accounts, or SNA (Commission of the European Communities et al, 1993).

In the risk-pooling model of insurance, the insurance company's productivity could rise if it becomes more efficient at processing premiums and claims. But if the premium falls because the insurance company finds ways to identify more risky business (and either rejects it, or prices it to match its greater risk) or if it finds ways to eliminate inflated or fraudulent claims, the effects would be eliminated from the insurance margin, and hence from the insurance industry productivity measure.

In the alternative view the insurance company *assumes* the risk. The policyholder buys the service of protection of assets or income from loss. The output is the insurance premium times the quantity of risk assumed. The price charged for assuming risk is  $p = P/R$ , where  $p$  is the price of insurance,  $P$  is the premium charged, and  $R$  is a measure of risk assumed (Bradford and Logue, 1998). Under this model, the price of insurance reflects both efficiencies in processing premiums and claims and efficiencies in matching and administering risk, so both sets of factors influence insurance industry productivity.

A major implementation problem with the risk-pooling insurance model (the national accounts convention for insurance) arises out of the fact that the insurance business does not function the way this model suggests. Although there are insurance companies with the word *mutual* in their names, there is very little evidence that they act as cooperatives on behalf of the policyholders. In the April, 1998 Brookings workshop one participant remarked that he had sat on the board of directors for a major insurance company, but nothing he ever heard there suggested that the company thought it was acting on behalf of the policyholders. One of us had a similar conversation with an executive in a large European insurance company. Because insurance companies do not operate as if they were providing administrative services to policyholders, no price or fee corresponding to the risk-pooling model of insurance can be found. Eurostat, in work leading up to its Harmonized Indexes of Consumer Prices (HICP), found that insurance companies could not provide a price that corresponded to the risk-pooling concept (Astin, 1999). Thus, even if a risk-pooling model of insurance were the only one that was compatible with national accounting conventions, it cannot be implemented, in terms of estimating real output from consistently defined measures of current-price output and of prices.

The risk-assuming model of insurance, which yields the gross insurance premium as a measure of current dollar output of insurance, yields a much larger gross output for the insurance industry than does the premiums minus claims view. Sherwood (1999) in his table 2, shows that the smaller definition runs from one-third to one-fifth of the larger one (data are for casualty insurance). This must have implications for international comparisons of productivity. However, it is not exactly clear whether the two concepts of insurance yield different rates of productivity growth in the U.S. economy. Although Sherwood (1999) calculates that the effect of the alternatives on *total* nonfarm business sector output is small, he does not explicitly calculate the effect on insurance industry productivity and does not reach definitive conclusions.

**(2) Insurance company investment earnings:** There is a growing consensus that the investment earnings of insurance companies should be added into their *industry* output. Because of moral hazard, insurance companies collect premiums in advance of claims liabilities. The surpluses are invested. Evidence strongly suggests that competition among insurance companies leads to the distribution of insurance industry investment earnings back to the policyholders in the form of reduced premiums, and it is commonly observed that casualty insurance companies do not cover the full cost of their claims from their premiums earnings. Treating an insurance company as producing a joint product (insurance policies and investment activity) is not a conceptual step very far beyond the current treatment of other industries

that have jointly-produced products. Whether national accountants should also treat the insurance *policyholder* as earning the insurance company's investment income in the form of more insurance (the treatment prescribed in the SNA) is not central to the question of computing industry productivity measures. (For the record, we do not think this national accounts approach yields a sensible measure of real consumption or of the price of insurance in the CPI.)

If the insurance industry has used computers merely to process more efficiently premiums, premium notices, and claims services, the effects are probably captured in the existing productivity numbers. This use of computers implies substitution of capital for labor and the existing insurance productivity numbers (4.6 per cent increase in labor productivity and 2.1 per cent increase in multifactor productivity since 1987) are consistent with substantial capital-labor substitution in this industry. On the other hand, if computers combined with innovations in risk management make it possible for insurance companies to be more efficient in assessing and valuing risk, then it is not at all certain that these technological improvements are incorporated into existing statistics.

The Bureau of Labor Statistics, in its producer price index and productivity measurement programs, has begun to measure the output of the insurance industry with a gross premiums plus investment income approach (Sherwood, 1999; Dohm and Eggleston, 1998). This is a step forward. Incorporating more explicit measures of risk, and valuation of improvements in insurance companies' ability to manage risk, is the next step toward improving the output measurement of insurance.<sup>17</sup>

## **Banking**

Like insurance, the measurement of banking output in national accounts has been the subject of a long-standing controversy that impedes progress. In the NIPA, as in the SNA, current-price banking output is defined as the spread between borrowers' and depositors' interest rates, plus fees for services that are explicitly priced. The issues in measuring banking output were the subject of a Brookings workshop in November, 1998.

Subsequently, BEA introduced a change in its extrapolator for real banking output in the October, 1999 GDP revisions. This extrapolator is effectively the measure of banking output that has long been used by the BLS for its banking labor productivity measures. It includes counts of various banking processes, such as checks cashed and number of ATM transactions. Because we have not yet been able to examine the effects of the BEA change on banking industry output growth, we have deferred discussion of banking productivity for this paper.

For the record, we think the BEA change is an improvement, but that more work on banking output measurement, both conceptual and empirical, is needed.

## **Medical care.**

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<sup>17</sup> Some additional national accounting concerns are present. First, problems arise because the Bureau of Economic Analysis (BEA) does not have a separate capital account. The insurance premium, and not premiums minus claims, is the cost to current production for keeping the capital stock whole against unforeseen losses. Second, double-counting is of concern to BEA because it wants to use the output of the car repair industry, minus a more or less arbitrary adjustment for repairs to business cars, as a measure in Personal Consumption Expenditures. Finally, insurance claims are not always spent to replace the item of capital equipment that was lost (emphasized by Hill, 1998).

It has become commonplace that medical care inflation outstrips the overall inflation rate. For example, between 1985 and 1995, the medical care component of the CPI rose 6.5% per year, when the overall CPI rose only 3.6 per cent.

Until fairly recently, deflators for medical care output have been based almost exclusively on the medical care components of the CPI. Many economists believe that the CPI medical price indexes overstated inflation in medical care.<sup>18</sup> If so, productivity growth in medical care is understated. Significantly, measured productivity in the health care industry has been negative. From 1973-97, health care industry productivity declined by 2.6 % per year, and from 1987-97 by 1.8 % per year.

In 1992, BLS introduced new price indexes for health care in its Producer Price Index (PPI) program. These new indexes introduced a new methodology for measuring the price of medical care. Rather than pricing the cost of a day in the hospital, as did the historical CPI, the BLS now draws a probability sample of treatments for medical conditions. For example, for the PPI price index for mental health care treatment in a hospital the probability selection might be “major depression.” The BLS then collects the monthly change in costs for treating that identical medical condition (see Berndt et al, 1998, and Catron and Murphy, 1996, for more information on BLS procedures). The new medical care PPI indexes are great improvements on the previously-available CPI medical price information (see the assessment in Berndt et al, 1998). Overall, the new PPI indexes present a picture of lower medical care inflation, compared to CPI measures, for the period where the two overlap (Catron and Murphy, 1996). BLS subsequently introduced similar methodology into the CPI (Cardenas, 1996).

However, even with the new PPI methodology it has been difficult for BLS to find data to adjust for changes in the efficacy of treatment. Although there is some controversy on how far statistical agencies should go in building measures of treatment efficacy into price and output measures, we doubt if anyone seriously disagrees that the price index should be “adjusted” or corrected *in some fashion* for improvements in medical efficacy. Because medical economists generally believe that progress has been made in medical technology--better prognoses, less time spent in the hospital for any given condition, less painful and onerous conditions during treatment, and so forth--they believe that inadequate adjustment for changes in medical technology creates upward biases in price indexes for medical care.

There is less universal agreement, however, on the basis for adjustment. In the PPI, the BLS looks for information on the change in costs that are associated with improvements in medical efficacy. Some economists would go considerable further, and ask for information about the medical outcome and the value to the patient of changes in medical outcomes. Research on cataract surgery by Shapiro and Wilcox (1996) serves to illustrate the issues.

At one time, cataract surgery involved a lengthy hospital stay, a week or ten days in intensive care. Now, it is mostly an outpatient procedure, often performed in a doctor’s office or clinic. Put another way, the number of days in the hospital has dropped from 10 or more to zero. If one were to ask, in the usual “cost-based” formulation, how much more costly was the improved procedure, the answer is negative. If the price index were based, as the CPI was formerly, on the cost of a day in the hospital, there is no reasonable way to “adjust” the price index for the value of an improvement that reduced the number of days to zero.

But from the patient’s point of view, the modern operation is surely better. The operation once required that the patient be immobilized for a lengthy period. Given the choice between immobilization

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<sup>18</sup> A comprehensive discussion of price indexes for medical care is Berndt et al (1998). See also Triplett and Berndt, 1999.

and the far less unpleasant recovery period associated with the modern operation, patients would undoubtedly be willing to pay more for the modern operation. Not only is it less costly *in terms of what is paid for* (hospital care, for example), it is also far less unpleasant for the patient. The operation also has fewer adverse side-effects, does not require wearing thick corrective lenses, and is in many other ways improved from the patient's point of view.

A medical outcome measure would take into account all the ways in which the improvement in cataract surgery was beneficial to the patient. But some of those improvements discussed in the previous paragraph go outside the traditional "market boundary" of national accounts. The patient might well be *willing* to pay for the improved technology, but in fact the technology comes to him (or to his insurance company) for less monetary cost or expenditure of market resources than the old treatment cost.

But should these improvements be credited to the productivity of the medical care industry, or to its output in national accounts? Or should improvements that are not explicitly paid for, and for which the value of a transaction cannot be directly inferred, be ruled out of national accounts (or out of national health accounts) on the grounds that they fall outside the market boundary that has been traditional for measuring GDP?

For example, the time spent in recovery from cataract surgery is part of the cost to the patient—even leaving aside the disutility of immobilization—but this time cost is not traditionally considered in national accounts, nor is the value of the reduction in time in recovery from surgery, or the reduced disutility of reduced time spent immobilized, directly valued. The time cost of the patient, the greater utility to the patient of less unpleasant treatments, and the value to the patient of reductions in unwanted side effects are all elements that would go into a measure of medical outcomes (see Gold et al, 1996). But should they go into an economic accounting for medical care? That remains somewhat controversial among economists.<sup>19</sup> Many of these issues were discussed in the conference papers contained in Triplett (1999a).

Stating the problem this way underscores the difficulties that statistical agencies face in producing price indexes for medical care. Calculating the change in costs for treating an episode of an illness requires not only the traditional statistical agency skills in gathering prices, but also a great deal of medical knowledge about changes in the efficacy of medical treatments (knowledge which, in many cases, is scientifically uncertain, or in contention). It also requires knowledge about patient valuations of changes in treatments, particularly when treatments change in dimensions that involve the patient's time, tolerance for pain, and valuation of the disutility of side effects, or of the onerous implications of treatments (such as, for example, a frequent treatment regimen for a pharmaceutical).

Additionally, some changes in medical treatment cause shifts in expenditures among PPI index categories; the PPI methodology contains no obvious way to take these cost savings into account. As an example, consider increased use of drugs that permit treatment of mental conditions on an outpatient basis, rather than in a mental hospital. Substitution of drugs (and clinical visits) for hospital care will reduce the cost of treatment, but this cost reduction will be reflected inadequately in the PPI because the PPI holds the weights for the various expenditure categories (hospitals, doctors offices, pharmaceuticals, and so forth) constant.

New research price indexes for medical treatments that adjust for changes in the effectiveness of medical treatments are Cutler et al (1996, 1999), Frank, Berndt and Busch (1998; forthcoming) and, as already noted, Shapiro and Wilcox (1996). These new price indexes confirm that the historical CPI

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<sup>19</sup> We leave aside here problems with measuring medical outcomes, which are formidable. The question is what one wants to do with medical outcomes measures, if perfected or improved.

medical care component was upward biased as a deflator for medical care industry output, as does comparison of the new PPI indexes with movements of the CPI. How much do medical care productivity measures that use the historical CPI as output deflators understate the amount of productivity growth in medical care?

To provide an evaluation of the bias in existing measures, Triplett (1999b) “backcasts” an estimate for a mental health care price index. One part of the backcast is an estimate formed by matching, for the period following 1992, PPI and CPI components and using the differences in trends as an adjustment factor for the CPI for the earlier period. He weights these indexes according to costs for treatment of mental health and makes an additional correction based on the research of Frank, Berndt, and Busch (forthcoming). The adjusted mental health care price index shows essentially no medical inflation during the 1985-95 interval.

He then uses the adjusted price index to estimate the growth in the quantity of per capita mental health care services (or real expenditure growth).<sup>20</sup> For the 1985-95 period, the unadjusted real output growth rate is negative, at about - 1.5 percent per year, which is very roughly consistent with the negative 1987-97 productivity trend for health care, shown in table 3, of - 2.6 per cent annually. Adjusted, real output growth is substantially positive, at about 6.6 per cent for 1985-95, or nearly 8 percentage points higher than the unadjusted estimates. The implications for medical care productivity are obvious.

Mental health may not be representative of the rest of medical care. Improved price indexes for other diseases might not make so much difference to output trends as in the case of mental health. However, the heart attack price index of Cutler et al, 1996, or the cataract surgery price index in Shapiro and Wilcox (1996) suggest that revisions to real expenditure trends for these disease categories might be similar to the revisions for mental health.

As an exercise, however, Triplett (1999b) assumes that the correction applied to the mental health price and output measures applies to the entire medical care sector. This would raise medical care productivity from -2.6 per cent per year in table 3 to 5.6 per cent per year. This is clearly a major impact.

It is important to emphasize limitations of this backcast. It is unlikely that the backcast is exactly valid, but neither is the historical CPI. Improvement of productivity in medical care seems more likely than the deterioration that present measures of medical care output show.

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<sup>20</sup> Treatments for mental disorders account for over eight per cent of total U.S. health care expenditures, about a tenth (9.5%) of all allocable U.S. personal health care expenditures and just over one per cent of gross domestic product (GDP).

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Table 1

**U.S. Labor and Multifactor Productivity, Average Annual Rates of Change,  
1949-96 and Selected Subperiods**

	<u>Non-Farm Business</u>	<u>Manufacturing</u>	<u>Estimated Non-Manufacturing</u>
<u>Output per Hour</u>			
1949-73	2.8	2.6	3.0
1973-96	1.5 <sup>r</sup>	2.7	1.0 <sup>r</sup>
1973-79	1.3 <sup>r</sup>	2.1	1.0 <sup>r</sup>
1979-96	1.5 <sup>r</sup>	2.9	1.1 <sup>r</sup>
	<u>Non-Farm Business</u>	<u>Manufacturing</u>	<u>Estimated Non-Manufacturing</u>
<u>Multifactor Productivity</u>			
1949-73	1.9	1.5	2.1
1973-96	0.2	0.8	0.0
1973-79	0.4	- 0.6	0.8
1979-96	0.1	1.3	- 0.3

<sup>r</sup> indicates that numbers incorporate the revised October, 1999 GDP data.

sources: output per hour: U.S. Department of Labor, Bureau of Labor Statistics, 1999a; multifactor productivity: U.S. Department of Labor, Bureau of Labor Statistics, 1999b.

**Table 2. Labor Productivity by Industry, 1960-97**

Annual percentage rate of change

Industry	Percentage		Growth Rate			Change (4)-(2)
	Share (1992) (1)	1992 Level (2)	1960-73 (3)	1973-97 (4)	1987-97 (5)	
		Thousands				
<b>Nonfarm business hours</b>	<b>87</b>		<b>3.0</b>	<b>1.1</b>	<b>1.0</b>	<b>-2.0</b>
<b>Nonfarm business persons</b>	<b>87</b>		<b>2.6</b>	<b>0.9</b>	<b>1.1</b>	<b>-1.5</b>
<b>Total Private - A (Aggregates)</b>	<b>100.0</b>		<b>2.7</b>	<b>0.9</b>	<b>1.1</b>	<b>-1.7</b>
<b>Total Private Sector</b>	<b>100.0</b>	<b>56</b>	<b>2.5</b>	<b>0.9</b>	<b>1.1</b>	<b>-1.4</b>
Agriculture	2.1	37	3.9	3.8	2.2	-1.7
Mining	1.7	142	3.6	1.2	4.4	0.7
Construction	4.3	39	-2.1	-0.7	-0.1	2.0
<b>Manufacturing</b>	<b>19.8</b>	<b>59</b>	<b>3.3</b>	<b>2.7</b>	<b>2.9</b>	<b>-0.4</b>
Durables (ex elect.)	7.8	53	3.7	2.4	2.5	-1.2
Electronics	2.8	63	0.2	5.8	8.7	8.6
Nondurables	9.1	64	3.6	2.1	1.3	-2.2
<b>Services</b>	<b>71.3</b>	<b>57</b>	<b>2.2</b>	<b>0.4</b>	<b>0.7</b>	<b>-1.5</b>
Transportation	3.6	54	3.2	0.9	0.8	-2.4
Communications	3.0	138	5.0	3.9	2.9	-2.1
Public Utilities	3.3	184	4.8	1.5	3.8	-0.9
Wholesale Trade	7.6	65	3.2	2.9	4.0	0.7
Retail Trade	10.1	31	2.0	0.8	1.6	-0.3
Finance	21.4	164	1.3	0.5	1.6	0.4
Other Services	22.4	39	1.3	-0.5	-0.7	-2.0
<b>Finance, Insurance and Real Estate</b>	<b>21.4</b>	<b>164</b>	<b>1.3</b>	<b>0.5</b>	<b>1.6</b>	<b>0.4</b>
Depository and Nondepository Inst.	4.3	95	0.2	-0.3	-0.3	-0.4
Security and Commodity Brokers	0.9	97	0.0	4.0	8.8	8.9
Insurance Carriers	1.6	57	1.9	-0.1	4.6	2.6
Insurance Agents	0.7	48	0.2	-0.8	-0.3	-0.5
Real estate	13.7					
Nonfarm housing	10.3					
Other	3.4	116	1.0	0.5	1.5	0.5
Holding and Investment Offices	0.2	53	0.1	-0.3	0.0	-0.1
<i>Finance less nonfarm housing</i>	<i>11.1</i>	<i>85</i>	<i>1.0</i>	<i>0.5</i>	<i>1.9</i>	<i>0.9</i>
<b>Other Services</b>	<b>22.4</b>	<b>39</b>	<b>1.3</b>	<b>-0.5</b>	<b>-0.7</b>	<b>-2.0</b>
Hotels and other lodging	0.9	34	0.7	0.0	2.9	2.2
Personal services	0.2	24	1.7	-0.9	-0.3	-2.0
Business and professional	0.8	44	-0.2	-0.4	0.0	0.2
Auto repair	1.0	40	2.9	-0.8	0.1	-2.8
Miscellaneous repair	0.3	32	0.0	-1.6	-3.0	-3.0
Motion pictures	0.4	43	0.7	1.0	-1.0	-1.7
Amusement and recreation	0.9	44	-0.8	0.2	-0.8	0.0
Health services	6.9	45	0.6	-1.5	-2.2	-2.8
Legal services	1.7	79	0.9	-2.5	-0.8	-1.7
Educational services	0.9	26	0.0	-0.5	-0.9	-0.8
Social services and membership org.	1.4	19	0.1	-0.3	-0.5	-0.6
Private Households	0.2	12	..	..	..	..

Source: Bureau of Economic Analysis data. Pre-1977 output data are estimated using the 1982-base industry data as extrapolators, except for those sectors whose output can be derived from other tables of the revised national accounts. Gross product is gross output minus intermediate inputs, and the aggregates are constructed as Fisher aggregates of component industries.

Persons engaged in production are defined as full-time equivalents plus the self-employed (Table 6.8).

The productivity slowdown is measured as the difference in the growth rate between 1987-97 and 1960-73.

**Table 3. Multifactor Productivity by Industry, 1960-97**

Annual percentage rate of change

Industry	Percentage	Growth Rate			Change
	Share (1992) (1)	1960-73 (2)	1973-97 (3)	1987-97 (4)	(4)-(2) (5)
<b>Total Private Sector</b>	<b>100.0</b>	<b>1.7</b>	<b>0.5</b>	<b>0.9</b>	<b>-0.8</b>
Agriculture	2.1	0.4	3.5	2.7	2.2
Mining	1.7	1.4	-0.2	4.0	2.5
Construction	4.3	-2.4	-0.5	0.1	2.5
Manufacturing	<b>19.8</b>	<b>2.5</b>	<b>2.0</b>	<b>2.4</b>	<b>-0.1</b>
Durables (ex elect.)	7.8	3.1	2.0	2.4	-0.6
Electronics	2.8	-0.9	4.6	7.3	8.2
Nondurables	9.1	2.6	1.2	0.5	-2.0
<b>Services</b>	<b>71.3</b>	<b>1.6</b>	<b>0.2</b>	<b>0.5</b>	<b>-1.1</b>
Transportation	3.6	3.3	1.3	1.4	-1.9
Communications	3.0	2.7	1.8	1.4	-1.3
Public Utilities	3.3	3.1	0.4	2.4	-0.7
Wholesale Trade	7.6	0.4	1.0	2.7	2.3
Retail Trade	10.1	1.2	0.4	1.0	-0.2
Finance	21.4	-0.6	-0.9	-0.5	0.1
Other Services	22.4	0.3	-0.6	-0.8	-1.2
<b>Finance, Insurance and Real Estate</b>	21.4	<b>-0.6</b>	<b>-0.9</b>	<b>-0.5</b>	<b>0.1</b>
Depository and Nondepository Inst.	4.3	-1.4	-3.2	-3.7	-2.3
Security and Commodity Brokers	0.9	-0.6	3.6	9.0	9.5
Insurance Carriers	1.6	0.6	-2.3	2.1	1.5
Insurance Agents	0.7	-0.9	-0.7	0.0	0.9
Real estate	13.7	..	..	..	..
Nonfarm housing	10.3	..	..	..	..
Other	3.4	-0.7	0.1	0.4	1.1
Holding and Investment Offices	0.2	-3.5	-0.9	2.2	5.6
<i>Finance less nonfarm housing</i>	<i>11.1</i>	<i>-0.9</i>	<i>-0.9</i>	<i>-0.3</i>	<i>0.6</i>
<b>Other Services</b>	22.4	<b>0.3</b>	<b>-0.6</b>	<b>-0.8</b>	<b>-1.2</b>
Hotels and other lodging	0.9	0.3	-0.1	2.6	2.3
Personal services	0.2	0.7	-0.8	-0.4	-1.1
Business and professional	0.8	-1.3	0.0	-0.2	1.1
Auto repair	1.0	1.5	-1.3	-1.0	-2.6
Miscellaneous repair	0.3	-0.1	-1.7	-3.2	-3.1
Motion pictures	0.4	-0.2	0.5	-1.6	-1.4
Amusement and recreation	0.9	-0.7	0.9	0.0	0.7
Health services	6.9	-0.3	-1.8	-2.6	-2.3
Legal services	1.7	0.5	-2.6	-1.0	-1.5
Educational services	0.9	0.0	-0.4	-0.9	-0.9
Social services and membership org.	1.4	0.1	-0.3	-0.6	-0.8
Private Households	0.2	..	..	..	..

Source: table 2 plus capital stock data of the Bureau of Economic Analysis and authors' estimates as described in the text.

**Table 4. Output Versus Product and the Proportion of Output Directed to Final Demand**

Industry	Gross Product Share (1992) (1)	Output/Product Ratio Annual Percent Change (2)	Final Demand Share (percent) (3)	Methodology (4)
<b>Total Private Sector</b>	<b>100.0</b>	..	..	..
Agriculture	2.1	-2.1	21.0	dd
Mining	1.7	-1.5	4.2	dd
Construction	4.3	-0.6	76.5	dd
Manufacturing	<b>19.8</b>	<b>-0.4</b>	<b>51.4</b>	<b>dd</b>
Durables (ex elect.)	7.8	-0.2	51.6	dd
Electronics	2.8	0.0	58.9	dd
Nondurables	9.1	-0.5	49.2	dd
<b>Services</b>	<b>71.3</b>	..	<b>63.9</b>	..
Transportation	3.6	..	43.9	dd
Communications	3.0	..	54.0	dd
Public Utilities	3.3	0.6	45.2	dd
Wholesale Trade	7.6	-2.8	49.0	dd
Retail Trade	10.1	-1.0	89.9	dd
Finance	21.4	0.0	64.4	..
Other Services	22.4	..	64.7	..
<b>Finance, Insurance and Real Estate</b>	<b>21.4</b>	..	<b>64.4</b>	
Depository and Nondepository Inst.	4.3	..	63.0	x
Security and Commodity Brokers	0.9	2.3	41.7	dd
Insurance Carriers	1.6	1.4	83.7	dd
Insurance Agents	0.7	-0.5	0.4	dd
Real estate	13.7	..	..	
Nonfarm housing	10.3	..	..	
Other	3.4	..	41.0	dd
Holding and Investment Offices	0.2	..	41.7	x
<i>Finance less nonfarm housing</i>	<i>11.1</i>	..	50.6	
<b>Other Services</b>	<b>22.4</b>	..	<b>64.7</b>	
Hotels and other lodging	0.9	0.9	53.7	dd
Personal services	0.2	0.9	74.4	dd
Business and professional	0.8	..	20.7	x
Auto repair	1.0	1.0	57.4	dd
Miscellaneous repair	0.3	3.0	74.4	dd
Motion pictures	0.4	1.5	66.0	dd
Amusement and recreation	0.9	..	66.0	dd
Health services	6.9	1.9	97.6	dd
Legal services	1.7	1.1	29.3	dd
Educational services	0.9	..	92.8	dd
Social services and membership org.	1.4	..	92.8	x
Private Households	0.2	..	92.4	dd

For the methodology, dd represents double-deflation, and x represents extrapolation with employment or wage deflation