Productivity measures for retail trade: data and issues

Alternative concepts for the output of retail trade industries have been proposed and implemented, but the conclusion of strong labor productivity growth in this sector is robust to the choice of measure

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The retail trade industry is a major component of the U.S. economy, with employment exceeding that in manufacturing. Yet only recently has the strong productivity performance of the retail sector been widely noted. Analysis of productivity growth in retail trade is especially challenging because it involves defining what output is for the industry, and different concepts can be used.

This article discusses conceptual and other issues in measuring productivity for retail trade industries, and presents current information on productivity in these industries in the United States. First it discusses the classification of retail trade activities. Second, it focuses on issues in defining the output concept for retail trade and in obtaining operational measures. Third, it presents data and comparisons for various measures and fourth, it addresses issues in comparing changes in retail trade productivity across countries.

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Classification of retail trade

Recently, U.S. data have been converted to the new North American Industry Classification System (NAICS). NAICS retail trade (industries 44–45) includes stores and nonstore retailers and excludes food services and drinking places (NAICS 722). Both NAICS and the earlier Standard Industrial Classification (SIC) system classify retail stores according to the types of goods that are being moved to the consumer. Eating and drinking places were classified as part of the retail trade division under the SIC (industries 52–59).

Two other major differences between NAICS and SIC also affect the classification of retail trade. Under NAICS, unlike SIC, auxiliary units involved in management or support activities such as transportation, warehousing, accounting and related services, and repair and maintenance are classified into specialized industries rather than including them in the industries they support, including retail trade. In addition, NAICS considers the method of selling when classifying establishments into wholesale versus retail trade, whereas the SIC system focused on the class of customer. This latter change caused a noticeable increase in the size of the retail trade sector, with a corresponding decrease in wholesale trade.

All of the changes previously described were introduced with the initial 1997 version of NAICS and continue under the 2002 NAICS revision. There were no changes at the three-digit level for retail trade between 1997 and 2002, but additional detail is provided for two retail trade industries under NAICS 2002. This article uses the NAICS 2002 definition of retail trade, unless otherwise noted.

Output concepts and issues

Industry output and productivity concepts. The broadest measure of productivity is multifactor productivity, which relates output to an index of all the inputs used in its production. Multifactor productivity (MFP) change measures the joint influences on economic growth of technological change, efficiency improvements, returns to scale, and other factors. The most commonly

used measure of productivity is labor productivity, which is defined simply as output per hour. Labor productivity measures are produced and used more widely than multifactor measures because data needed for inputs other than labor are not available on a quarterly basis, are not as timely, and are not available or not measured precisely for many industries. Besides measuring the joint influences of the factors noted, labor productivity change also reflects the substitution of other inputs for labor in the production process.

To measure either labor or multifactor productivity for industries, we must define output. The Bureau of Labor Statistics (BLS) prefers the *sectoral output* concept for measuring industry output and productivity growth in the United States. Sectoral output is defined as gross output of the industry less intraindustry transfers.[1] This choice arises from the recommendation of the U.S. National Academy of Sciences that manufacturing industry multifactor productivity measures include intermediate inputs along with capital and labor inputs, as well as from subsequent research. An alternative output measure is *value-added output*, which is equal to sectoral output minus all intermediate inputs.

For retail trade, there are additional considerations. Another output measure, uniquely used for the distributive trades, is *gross margins*, which equals sectoral output less the cost of goods sold. It equals the sum of operating costs including other intermediate goods, other inputs, and residual profits.

In general, a retail trade industry produces sectoral output using labor hours, capital services, goods purchased for resale, and (other) intermediate inputs. The most general representation of the production process is:

$$f(O, M, I, K, L) = 0.$$

Often, we write:

$$O = g(M, I, K, L),$$

where:

O is the quantity of sectoral output;
M is the amount of goods purchased for resale;
I is the amount of intermediates;
K is the input of capital services
L is the input of labor hours
p_i is the price of i, $i = O, M, I, K, L$.

Thus, gross-margin based output (GMO) is $O - M$, and value-added output (VA) is $O - M - I$.[2]

It is often noted in studies of production and productivity that use of a value-added measure assumes a type of separability between intermediate and other inputs, and does not allow for substitution possibilities between I, K, and L. In effect, beginning a study with gross-margin-based output does the same, allowing for no substitution among the types of goods purchased and other inputs. Ideally, one would like to have data on all the components of the model to test which is the appropriate approach. Unfortunately, sufficient information for these purposes is not available at present. In the absence of complete information on all the inputs identified, which is needed to produce a multifactor productivity measure, it is worthwhile considering merits and availability of alternative output measures for use in productivity studies.

There are a variety of conceptual issues affecting retail trade output, and various researchers have favored one or the other of the alternative concepts for output of this sector. Walter Oi argues that "The principal function of a retailer is to transfer possession of its merchandise lines to the ultimate consumer.[3] It assembles a product line, displays it at a convenient place and time, and provides ancillary services...." Generally, a retailer takes ownership of the products until they are sold to consumers. Thus, sales (sectoral output) is a commonly used measure of output for this industry sector. On balance, Oi prefers the sectoral output approach, rather than the gross margins approach, for measuring retail sector output for two primary reasons.[4] First, as already noted, "[t]he principal 'product' is a flow of transactions that transfers possession to material goods." Second, gross margins are the sum of value added (payments to labor and capital) plus monopoly rents. Changes in gross margins, like changes in sales, appropriately will reflect changes in efficiencies in store operations. But as Oi notes, gross margins also can increase as a result of businesses securing market power.[5] Increased monopolization, however, does not reflect increased output provided to consumers.[6] In contrast, sales as a measure of output does not have this problem, because monopolization reduces sales. Other researchers have favored gross margins.[7]

If a retailer switches from purchasing products from a supplier whose products require more effort at the store to assemble or display (or both) to one whose products can be much more readily transferred to consumers, yet which are the same from the viewpoint of the consumer, that switch will show up as no change in sectoral output for retail trade. In this case, gross margins will fall (assuming the supplier provides more services and charges more for the latter product).[8] But the output to consumers will be unaffected.[9]

It can be argued that the gross margins concept is preferable, at least for some types of retail establishments, because the merchant just buys a product and does not transform it in any way before the consumer takes it home and, further, the purchased good does not substitute for any other factor input. But even for a basic product, such as a can of beans sold by a grocery store, there must be a minimal amount of transformation just from changing the location of the good to make it more accessible to the consumer. The way the cans of beans are packaged together may directly affect the amount of labor required to display them. Further, different packaging characteristics may affect the amount of spoilage, breakage, or pilfering. Most products require more transformation than

does a can of beans. Thus, the purchased goods are not separable from the services being delivered to the customer, which argues that gross output is the preferable measure of output.

Our preference would be to construct MFP measures for retail trade, defining output as sectoral output and treating goods purchased for resale as an input along with other inputs (capital and labor services and other intermediate goods and services). In the absence of data to do this, we examine labor productivity based on existing measures of both the quantity of sectoral output (*O*) and gross-margin based output (GMO).

Measurement issues. As noted earlier, BLS uses the sectoral output concept for purposes of measuring U.S. productivity growth. U.S. data on the value of sales of retail trade industries are available from the Census Bureau in its *Annual Benchmark Report for Retail Trade and Food Services*.[10] The annual report benchmarks monthly collected data to the Annual Retail Trade Survey. The retail sales data are further benchmarked in the annual report to data available from the quinquennial censuses. To measure output for a given industry at the most detailed level, BLS starts with the value of goods sold by item type *j*, deflates it by a retail selling price p_j, usually a Consumer Price Index (CPI), then combines all *j* products in the industry using Törnqvist aggregation.[11] The only exception among retail industries occurs for new car dealers (NAICS 441110). Output for this industry is constructed based on counts of vehicles sold by these dealers and current dollar sales of their service departments.[12]

In producing the National Accounts, the Bureau of Economic Analysis (BEA) produces output series for trade industries that, in concept, are gross margins, in accord with the approach taken by the international System of National Accounts.[13] The Census Bureau data include information on the nominal value of gross margins. BEA's measure of nominal gross margins is based on those data, but is larger than the census estimate because BEA makes several adjustments to it.[14] BEA assumes that, at the detailed industry level, the real gross margin rates do not change from the benchmark values. Nominal gross margin rates are allowed to change, however, depending on the availability of annual census data. In calculating real gross margins, BEA must use the same available price indexes that BLS uses to calculate sectoral output, generally CPIs. Thus, in practice, the BEA and BLS measures are constructed in a much more similar fashion than the concepts would imply.

In concept, it would be appropriate to measure gross margin output starting with the value of gross margins for item *k*, then deflating by the price of gross margins, p_{Mk}, which would be collected directly. In practice, this was not possible in the past. Recently, the BLS Producer Price Index (PPI) program has begun developing price indexes designed to measure gross margins. BEA is not yet using the new retail PPIs that have been developed to date, but will begin evaluating them for future use. In the following section, which describes the data, we provide information on the retail trade PPIs that are available now and we compare them with the industry implicit price deflators (largely based on CPIs) from the BLS industry productivity database. As PPIs become available for additional industries, and the time series lengthen, it will be important, for research purposes, to continue to compare them. Future BEA and BLS data comparisons could assess the implication of use of alternative price measures as well as other differences for the various output series for retail trade.

Another approach to developing price measures for gross margins is to calculate them from other information using "double deflation." As already noted, BEA does not calculate margin price indexes using double deflation. This approach has not been adopted by statistical agencies, probably primarily because all of the error resulting from the numerous assumptions that need to be made would be reflected in the estimated margin price measures and the resulting real gross margin output measures. Marcel P. Timmer, Robert Inklaar, and Bart van Ark have constructed this type of measure for the United States, which is of interest for research purposes.[15]

The ability to produce high-quality measures of intermediate inputs, whether for use together with sectoral output in measuring multifactor productivity or for use in constructing value added, depends on available data. In general, direct information on the current-dollar value of intermediate purchases is somewhat limited for the United States. Construction of the real value of intermediates is made more problematic in some cases by the absence of fully suitable deflators. Some goods and services are imported, so both PPIs and import price deflators are needed. In sum, intermediates are a weak area in the U.S. data.

In constructing value-added measures, current-dollar value added can be constructed from the income side of the national income accounts, rather than by subtracting intermediate inputs from gross output. BEA recently completed a partial integration of the national income accounts. The input-output accounts and the value added by industry measures have been integrated. Now the current-dollar value-added levels are based on information from both sources. Issues about deflation remain.

Data and comparisons

Trends in labor productivity growth in retail trade. Business sector productivity growth was strong over the 1990–2003 period. Productivity growth in retail trade also was strong, at 3.4 percent per year, on average. (See table 1.)[16] Retail trade productivity growth was slightly below that in manufacturing for this entire period and for each subperiod considered. The *acceleration* in labor productivity growth between the first half and latter half of the long business cycle of

Table 1. Labor productivity in the United States, 1990–2003, average annual rates of change

[In percent]

Sector	2003 employment (in thousands)	1990–2003	1990–1995	1995–2000	2000–2003
Business sector[1]	111,747	2.5	1.5	2.7	3.7
Manufacturing	14,807	4.0	3.4	4.1	4.9
Retail trade	15,866	3.4	2.6	3.9	4.1
Food services and drinking places	8,791	.4	–.5	.6	1.4

[1] The business sector measure, produced using a value-added output concept, is not directly comparable to the industry measures, for which the output concept is sectoral output.

1990–2000, however, was greater in retail trade than in manufacturing: an increase of 1.3 percent per year for the former, compared with 0.7 percent per year for the latter. Productivity growth is typically strong in the first 3 years after a business cycle peak. For example, after the peak in 2000, the business sector as a whole and both the manufacturing and retail trade sectors experienced strong productivity growth in 2000–03. For the business sector as a whole, productivity growth from the first quarter of 2001 to the first quarter of 2004 was the highest for any 12-quarter period following a peak in the last 50 years.

Almost certainly, the factor related to the U.S. productivity speedup of the 1990s which has received the most attention is the rapid growth in the high-tech (information processing equipment and software) sector. Our data show that the combination of two effects, the use of high-tech capital services throughout the economy and the multifactor productivity improvements in the industries that produce high-tech capital, accounted for more than two-thirds of the speedup in labor productivity growth in 1995–2000, compared with the growth during 1990–95. This result is consistent, however, with a strong role for productivity growth in certain other sectors such as retail. First, industries producing high-tech capital equipment had by far the strongest productivity growth rates among manufacturing industries, but growth in many other manufacturing industries was weak. Some industries both within and outside of manufacturing experienced *negative* multifactor productivity growth. Second, some of the labor productivity growth in retail trade can be attributed to the effects of using high-tech capital.

Also included in table 1 are figures for productivity change in food services and drinking places. Notice that although this industry did experience an acceleration of productivity growth in the latter half of the 1990s, the growth rate was low in each of the subperiods considered. In earlier studies of U.S. productivity growth in retail trade, SIC-based data for retail trade, which include eating and drinking places, would have been used. Productivity in retail trade on an SIC basis grew at an annual average rate of 2.4 percent over the 1990–2000 period, compared with 3.2 percent on a NAICS basis.[17]

Comparison of alternative output series. As noted earlier, BEA and BLS utilize different concepts of "gross" output; BLS uses sectoral output, whereas BEA uses gross margins. Table 2 reports output change in retail trade for both of these measures, as well as for BEA's value-added output measure, over the 1990–2003 period.[18] Although changes in the three measures differ somewhat over this period, all show a strong increase in retail trade output growth in the latter half of the 1990s compared with growth over the 1990–95 period. In addition, all show at least some decrease in the rate of growth of output for 2000–2003 compared with 1995–2000, but the difference between the size of the output increase for value-added output compared with the other two measures is particularly striking.

The differences between the three alternative measures are somewhat larger than those shown by the earlier comparisons of output change in retail trade using SIC-based data reported by Jack E. Triplett and Barry P. Bosworth.[19] They noted that the data showed a close correspondence in the growth of output over the period they considered, 1987–2001. Since that time, BEA revised their SIC-based data and both agencies converted their output data to NAICS.

BEA and BLS are in the process of comparing and assessing their various output measures, with the long-term goal of removing arbitrary differences and explaining any differences that remain for program-related reasons. Preliminary comparisons of output change for some detailed retail industries show some significant differences over the periods compared, 1990–95 and 1995–2000, but additional work is needed on those comparisons.

Productivity results for retail trade industries. Table 3 presents average annual rates of change in labor productivity for the three-digit NAICS industries that comprise retail trade.[20] All 12 of these industries experienced productivity growth over the 1990–2003 period. The productivity speedup of the late 1990s was widespread among these industries; all but gasoline stations (NAICS 447) and miscellaneous store retailers (NAICS 953) experienced productivity accelerations in 1995–2000, as compared with 1990–95. Notable trends that occurred

Table 2. Output in retail trade, 1990–2003 average annual rates of change

[In percent]

Output measure	1990–2003	1990–1995	1995–2000	2000–2003
Sectoral output (BLS)[1]	4.2	3.4	5.4	3.5
Gross output (gross margins) (BEA)[2]	4.8	4.1	6.0	4.0
Value-added output (BEA)[2]	5.4	4.1	6.5	6.0

[1] Bureau of Labor Statistics data classified according to NAICS 2002.

[2] Bureau of Economic Analysis data classified according to NAICS 1997.

in U.S. retailing during the 1990s were increased concentration and growth in investment in information technologies.[21] Electronics and appliance stores (NAICS 443) and nonstore retailers (NAICS 454) experienced the strongest growth rates among these industries over the 1990–2003 period. Nonstore retailers consist of electronic shopping and mail-order houses (40.3 percent of nonstore retail employment in 2003), vending machine operators (10.4 percent of nonstore retail employment), and direct selling establishments (49.3 percent of nonstore retail employment). Productivity growth was especially high in electronic shopping and mail-order houses; 14.0 percent per year on average over the 1990–2003 period, with a particularly strong acceleration in the 1995–2000 period.

High-tech goods represent a significant share of the goods sold by retailers in both electronics and appliance stores (NAICS 443) and nonstore retailers (NAICS 454).[22] It has been argued that these are industries in which the sectoral output concept is undesirable because the output gains and declining output prices arise from the manufacture of the goods sold, not from the activities of the retailers, which simply sell the computers (or other goods) incorporating the high-tech components. Under this view, that productivity gains in these retail industries reflect the pass-through of productivity gains from manufacturing, measured productivity in these retail industries is biased upward because of the use of this concept.[23] One way to get a rough estimate of the maximum amount of possible overstatement in retail trade productivity due to the sale of these high-tech goods is to look at productivity in retail trade excluding electronics and appliance stores and nonstore retailers.[24] The conclusion about the strong productivity growth and the productivity speedup in retail trade remains if these industries are excluded. Labor productivity in retail trade excluding electronics and appliance stores and nonstore retailers grew at an annual average rate of 2.1 percent in 1990–95, sped up to 3.1 percent per year in 1995–2000, and continued to grow strongly at 3.3 percent from 2000 to 2003. Some of the productivity gains in electronics and appliance stores and nonstore retailers are likely to arise from sources other than simply a pass-through of productivity gains in the production of goods sold, and some of the gains arise from the sale of goods other than high-tech goods. Therefore, the difference between productivity growth for all of retail trade and for retail trade excluding these two industries, 0.7 percent per year on average for 1990–2003, is likely to be an overstatement of any effect from the pass-through of gains from manufacture of high-tech goods.

Productivity growth among retail trade industries was lowest in food and beverage stores (NAICS 445), at 0.5 percent, and for motor vehicle and parts dealers (NAICS 441), at 1.7 percent, over the 1990–2003 period. The food and beverage store industry experienced the lowest growth in output, 0.4 percent, of the 12 retail industries.[25] It has experienced notable changes of various types over this period. One change was a movement toward superstores (some of which are classified as part of NAICS 452, general merchandise stores) and toward convenience stores (some of which are operated in combination with gasoline stations and are classified in NAICS 447). There has been growth of specialized retailers that carry extensive lines of organic products or various high-end products (or both), but do not stock many standard food and beverage products, along with growth of specialized services in these and other stores. Certain measurement issues that Oi discusses arise for these industries, but it is unknown to what extent they trade off against each other.[26] For instance, on the one hand, if there is more in-store labor used to produce high-quality specialty products such as fresh prepared foods, measured productivity might decline. On the other hand, new, lower cost retailers may provide lower quality services (such as not packing up the purchases or having longer waits for check-out) in ways that are not captured in the output measures.

Motor vehicle and parts dealers experienced the third lowest output growth of the retail industries over the study period, 3.1 percent per year on average. Over this period, automobiles became more highly computerized, and reliability generally improved. In addition, service departments increasingly used computer diagnostic equipment to detect needed repairs.

Comparison of alternative price deflators for retail trade. Beginning in 2000, BLS began introducing monthly PPIs for various retail trade industries. For products for which the PPI program determines that margin prices exist and are meaningful,

Table 3. Output per hour in retail trade industries, average annual rates of change, 1990–2003

[In percent]

NAICS	Industry	2003 employment (in thousands)	1990–2003	1990–1995	1995–2000	2000–2003
44, 45	Retail trade	15,866	3.4	2.6	3.9	4.1
441	Motor vehicle and parts dealers	1,975	1.7	1.6	2.0	1.4
442	Furniture and home furnishings stores	597	3.9	3.1	4.2	4.8
443	Electronics and appliance stores	544	15.6	14.2	14.9	19.1
444	Building material and garden equipment and supplies dealers	1,242	3.6	2.7	4.2	4.1
445	Food and beverage stores	2,953	.5	–.9	.4	2.8
446	Health and personal care stores	981	2.6	–.1	3.8	5.1
447	Gasoline stations	905	2.6	3.3	1.4	3.6
448	Clothing and clothing accessories stores	1,391	5.3	5.6	5.7	4.4
451	Sporting goods, hobby, book, and music stores	727	3.7	2.9	5.4	2.0
452	General merchandise stores	2,827	4.7	4.2	5.4	4.2
453	Miscellaneous store retailers	1,112	4.1	4.8	4.3	2.5
454	Nonstore retailers	613	10.4	7.5	13.2	10.3

the retail trade output concept is margins.[27] The approach taken is to capture the margin price of an individual product. The margin price is found by taking the selling price and subtracting the purchase price of the last shipment received (less all rebates and allowances) for the specific good.[28]

As an example of procedures, consider food stores, a very large industry and one of the first retail industries for which PPIs were published. Development of PPIs requires specific decisions on the underlying output concept. The PPI views food stores as providing all of the marketing functions necessary to allow customers to make unit purchases of items rather than being required to buy in bulk. Typically, consumers cannot gain access to these products directly from manufacturers or wholesalers. Basic functions of retailers involve standardizing or grading, storing and transporting, buying, risk bearing, financing, selling, and product planning. Storage functions include displaying inventory in the store for customers to purchase. Storage functions also include maintaining supplies housed elsewhere or obtaining a constant flow from suppliers (or both). The PPI program identified a minority of items within this industry as cases in which retail priced items, not margin prices, are measured because further processing is performed by the seller. A baked good that is made on the premises is an example of an item that does not have a margin price. The PPI program, based on its investigation of the industry, recognized that the CPI is measuring something quite different than the margin price and did not expect that PPIs and CPIs would move together.

CPIs are not developed for specific retail trade industries, but rather for products. Implicit price deflators for various retail trade industries based primarily on CPIs are available from the BLS industry productivity program, however. These deflators are derived by dividing current dollar sales in the industry by the industry output index, and they represent selling prices in the industry. Table 4 presents these implicit price deflators along with annual average PPIs for retail industries where PPIs are published. Of the 39 observations on annual price changes where both price measures are available, the PPI increases faster (or falls less) than the implicit price deflator in 30 cases (77 percent). Both series demonstrate volatility, although volatility of the PPIs seems somewhat greater. The different behavior of the two price series implies that application of selling prices to deflate gross margins is not appropriate. It is not possible to assess how a completely margin-based output measure would compare with the sectoral output measure without taking the next step, which is to develop an actual data series on gross margins and deflate it, using the new PPIs. BEA had asked for margin-based PPIs and, as noted earlier, they will be exploring their use for the national accounts.

International comparisons

International comparisons of industry labor productivity involve issues such as classifying industries, measuring output, and measuring labor input. The exclusion of eating and drinking places from retail trade makes the NAICS definition more similar to retail trade as defined by the International Standard Industrial Classification (ISIC) system, in which retail trade (division 52), excludes restaurants. Under ISIC, however, retail trade includes repair of personal and household goods, which is excluded from the NAICS and SIC definitions of retail trade. The other classification changes from NAICS to SIC may work in the direction of making the U.S. system and ISIC more dissimilar.

Although alternative conceptual definitions of output were discussed earlier, there are other issues that affect the comparability of real output measures for various countries, even when the concept is the same. They include valuation, that is the

Table 4. Annual percent changes in retail trade Producer Price Indexes and Implicit Price Deflators, 2000–03

NAICS	Industry	Producer Price Index			Implicit Price Deflator		
		2000–2001	2001–2002	2002–2003	2000–2001	2001–2002	2002–2003
44111	New car dealers	3.4	5.4	2.6	–0.1	1.5	4.0
44121	Recreational vehicles dealers	–	–	–2.2	.8	–1.5	–2.2
441222	Boat dealers	–	–	5.5	–	–	–
4413	Automotive parts, accessories and tire stores	–	–	3.3	3.0	1.8	1.2
443130	Camera and photographic supply stores	–	–6.1	21.3	–	–	–
445	Food and beverage stores	5.6	3.5	3.7	2.9	1.6	1.7
445110	Grocery stores	5.5	3.4	3.8	2.9	1.6	1.7
4453	Beer, wine, and liquor stores	–	.6	3.3	2.6	2.1	1.3
44611	Pharmacies and drug stores	–	9.8	3.7	3.8	3.3	1.8
446130	Optical goods stores	–	4.9	4.2	3.2	.6	.2
446191	Food supplement stores	20.7	5.7	6.5	1.4	.4	1.3
447	Gasoline stations	–	–	–19.0	–1.5	–4.1	11.6
448310	Jewelry stores	–	3.7	.6	.0	–2.8	[1]–3.2
448320	Luggage and leather goods stores	–	–9.7	1.2	–	–	–
451110	Sporting goods stores	–	3.5	–2.6	–1.6	–2.0	–1.2
451120	Hobby, toy, and game shops	–	–7.9	9.1	–4.1	–5.3	–6.1
451130	Sewing, needlework, and piece goods	–	–4.2	.3	–.2	–.4	–2.4
451211	Book stores	–	–1.0	6.4	–	–	–
453110	Florists	–	2.2	.8	2.9	.0	–.9
453210	Stationery stores	–	7.0	8.3	–3.1	–3.8	–4.6
453220	Gift, novelty, and souvenir shops	–	–.7	–1.0	.5	–1.0	–2.4
454113	Catalog and mail-order houses	–	2.9	–.7	–	–	–
454210	Automatic merchandising machine operators	–	1.0	3.9	3.3	1.9	2.2
45431	Fuel dealers	–	–5.6	7.8	1.1	–8.9	18.4

[1] The implicit deflator is for NAICS 4483, jewelry, luggage and leather goods stores; jewelry stores account for about 94 percent of industry sales.

NOTE: All industries in the retail trade sector for which Producer Price Indexes are published for the time period are included. Dash indicates data not available.

use of basic prices versus market prices.[29] They also include the use of base-year versus chained price index formulas. Another important issue is the extent of quality adjustment, particularly the use of hedonic techniques. To the extent that hedonic or other quality adjustment procedures used by one country capture more of the quality improvement in an industry's output than do the procedures used for another country to which it is being compared, some of the difference in measured productivity may be due to measurement procedures. Robert Gordon made this point in assessing the higher measured productivity growth for the United States than for European countries since 1995.[30] In sum, though, he concluded that the main source of the relatively strong U.S. performance has been the information and communication technology-using industries of wholesale and retail trade, and he discussed various characteristics of the U.S. economy that contributed to that strong performance.

In assessing industry productivity change for the United States, we prefer the sectoral output concept, as noted earlier for the case of retail trade. For a number of years, BLS has regularly published comparisons of manufacturing labor productivity change across countries, and for that series we use value-added output (from BEA). A practical reason is that these data are more readily available. In addition, there are considerations, such as differences among countries in the extent of vertical integration of industries, that may make value added a better concept for international comparisons of labor productivity, at least for some industries such as manufacturing. For international comparisons of productivity, comparable measures of hours changes also are needed.[31]

BLS currently is investigating the possibility of developing international comparative series on productivity change for selected service sector industries. Retail trade is a likely candidate.

All of the differences in concepts and methods that affect comparisons of productivity change across countries would affect comparisons of productivity levels. In fact, the differences discussed in this study are likely to be much more significant for comparisons of levels. In addition, as each country measures industry output in its own currency units, a common unit of measure is needed in order to make comparisons among countries. Market exchange rates are not suitable. What is needed are purchasing power parities, which are the number of foreign currency units required to buy goods and services for the foreign country equivalent to what can be bought with one unit of

currency of the base country. Although purchasing power parities are available for gross domestic product from the Organisation for Economic Co-operation and Development (OECD), these parities are developed for comparing expenditures made by consumers, business, and government for goods and services, not for comparing value added by industry. Parities have not been developed for the purpose of comparing value added by industry. We have not explored options for constructing a common unit of measure specifically for any industry, including retail trade.

There are other reasons as well to be very cautious in making levels comparisons of labor productivity. One concerns interpretation of the results. As an extreme example, consider the validity of comparing output per hour in an automobile assembly plant with output per hour in a corner bakery. Of course, the former would have far higher output per hour due to far higher capital services inputs, but what does that mean? It would largely reflect differing use of capital services and intermediate inputs. Comparisons of output per hour across countries have the same problem, because countries differ greatly in their industry composition. Although comparisons of multifactor productivity levels would not have this particular problem, there are likely to be measurement issues affecting comparability of capital services measures, where they exist. And measures of hours levels also suffer from comparability issues. Because there is considerable interest in international hours comparisons, BLS is studying the comparability of hours measures for various countries.

ALTHOUGH RETAIL TRADE is an industry that generally is viewed as more amenable to measurement than are many service sector industries, there are major conceptual challenges. Issues concerning what is meant by output in this industry are noted throughout the article. From the discussion on alternative output concepts, this article concludes that sectoral output is, in theory, the desirable concept for measuring productivity change for retail trade. Because of various data limitations, it seems useful to analyze the various U.S. measures that are available, however. U.S. productivity trends for the retail trade sector and its component industries are presented and discussed. For purposes of comparing productivity trends across countries, the use of value-added output measures may be preferable. □

Notes

[1] For trade and most other service sector industries, gross output is measured as total shipments. For manufacturing and a few other industries, gross output is measured as total shipments to other industries less inventory change. For a few industries, output is a physical quantity measure.

[2] The value of sectoral output is $p_O O$, and so forth. In practice, output quantities generally are constructed from values and prices.

[3] Walter Oi, "Retail Trade in a Dynamic Economy," unpublished paper presented at the Brookings Institution Workshop on productivity measurement in the services sector, September 2000, p. 15.

[4] Oi, "Retail Trade in a Dynamic Economy," p. 4.

[5] According to Oi, "Retail Trade in a Dynamic Economy," the gap between estimates of gross margin and value added for retail trade widened slightly over the 1983–97 period.

[6] Oi, "Retail Trade in a Dynamic Economy," also argues that data should be disaggregated by store format, at least chain versus independent, and by breadth of output line.

[7] Jack E. Triplett and Barry P. Bosworth, *Productivity in the U.S. Services Sector: New Sources of Economic Growth* (Washington, DC, The Brookings Institution, 2004), ch. 8, discuss the pros and cons of use of sales versus gross margins, and provide additional references.

[8] In this case, labor productivity would be expected to rise using the sectoral output concept and might either rise or fall using the gross margins concept.

[9] For additional discussion, see Oi, "Retail Trade in a Dynamic Economy."

[10] *Annual Benchmark Report for Retail Trade and Food Services*: January 1992 Through February 2004 *Current Business Reports*, BR/03-A (U.S. Census Bureau, March 2004), on the Internet at **www.census.gov/prod/2004pubs/br03-a.pdf** (visited July 13, 2005).

[11] In general, the historical consumer price data used are research series CPIs.

[12] Counts of new vehicles sold are based on Ward's Automotive data. Counts of used cars sold in new car dealer industries (NAICS 441110) are from National Automobile Dealers Association (NADA) data. The service and parts segment of the industry measure is based on detailed service department current dollar sales from NADA, deflated using CPIs. Indexes for the three industry segments are aggregated into an output index for new car dealer industries using base year employment weights based on NADA data.

Beginning with release of data for 2004, BLS will revise its procedures to construct output data for new car dealers based on the same data sources and methodology used for the other retail trade industries.

[13] BEA calls this series "gross output;" a term which we do not use in this article in order to avoid confusion.

[14] First, sales of services and parts installed (for example, services provided on new cars by car dealers) are included in output. Second, BEA adds its own estimates of retail sales taxes and excise taxes, rather than use the Census Bureau estimates of taxes. Third, own account software and own account construction are added. Fourth, BEA makes adjustments for misreporting, misfiling, and nonemployers.

Figures reported in this article are based on data available as of June 2, 2005.

[15] Marcel P. Timmer, Robert Inklaar, and Bart van Ark, "Alternative output measurement for the U.S. retail trade sector," *Monthly Labor Review*, July 2005, pp. 39–45.

[16] Figures reported in this article are based on data available as of June 2, 2005.

[17] For an analysis of the NAICS reclassification and of industry productivity trends under NAICS, see Lisa Usher, Matthew Russell, and

Paul Takac, "Industry productivity trends under the North American Industry Classification system," *Monthly Labor Review*, November 2004, pp. 31–42.

[18] As noted earlier in the article, the BLS sectoral output data are on a NAICS 2002 basis. The BEA NAICS data are on a NAICS 1997 basis.

[19] See for instance, Triplett and Bosworth, *Productivity in the U.S. Services Sector.*

[20] BLS also produces productivity and related measures for all four-digit industries in retail trade and, where possible, for five- and six-digit industries. Those data are available upon request by contacting the Division of Industry Productivity Studies by e-mail: dipsweb@bls.gov or by calling 202-691-5618.

[21] For additional discussion of trends in retailing, see Mark Seiling, Brian Friedman, and Mark Dumas, "Labor productivity in retail trade," *Monthly Labor Review*, December 2001, pp. 3–14. This article presents productivity trends from 1987–99 using SIC-based data.

[22] Computer hardware, software, and supplies accounted for 42.0 percent of sales in the electronics and appliance stores industry (NAICS 443) and for 19.0 percent of industry sales in the nonstore retailers industry (NAICS 454) in 1997. Together, sales in these two industries accounted for 92.2 percent of all retail sales of this merchandise line.

[23] See, for instance, Triplett and Bosworth, *Productivity in the U.S. Services Sector*. Or see Timmer and others, "Alternative Output Measurement."

[24] BLS does not have productivity data for all the components of electronics and appliance stores (NAICS 443) that would be needed to undertake this exercise at a lower level of detail.

[25] Output data are available on the Internet at **ftp://ftp.bls.gov/pub/special.requests/opt/dipts/outin.txt** (visited June 2, 2005).

[26] Oi, "Retail Trade in a Dynamic Economy."

[27] This discussion of PPI procedures is based largely on an unpublished "Industry Synopsis" prepared prior to beginning pricing of the industry. A shorter discussion, "Retail Trade Industries in the PPI," was published in the *PPI Detailed Report* (Bureau of Labor Statistics, July 2000). If a meaningful margin price does not exist, such as for some deli items or baked goods made on the premises, the net sales price is captured.

PPI uses the term "margin prices;" these prices are appropriate for deflating what we have termed, "the value of gross margin output," that is, sales minus the cost of goods purchased for resale.

[28] Although it was recognized that the national accounts define the margin price as the selling price of a good in the retail market less the cost of replacing the good in the store's stock, it was determined to be infeasible to operationalize that definition.

Also, discounts are taken into account and quality adjustment procedures are used.

[29] Basic price is what the producer actually receives. Therefore, it excludes indirect business taxes and transportation costs, which are included in the market price.

[30] Robert Gordon, "Why Was Europe Left at the Station When America's Productivity Locomotive Departed?" NBER Working Paper 10661 (Cambridge, MA, National Bureau of Economic Research, August 2004).

[31] For a discussion of issues in measuring hours, see Lucy P. Eldridge, "Hours Measures for Productivity Measurement and National Accounting," paper prepared for the Paris group, September 2004, available on the Internet at **www.insee.fr/en/nom_def_met/colloques/citygroup/2004_meeting_papers.htm**, item d. "Substantive papers for session 3," United States (visited July 13, 2005).