

PRCR
7/17/06
2:30 PM

Distributive Services in the U.S. Economic Accounts

Robert E. Yuskavage

U.S. Department of Commerce
Bureau of Economic Analysis

Washington DC

Paper prepared for the
National Bureau of Economic Research
Conference on Research in Income and Wealth
Summer Institute 2006
July 17, 2006
Cambridge, MA

Distributive Services in the U.S. Economic Accounts¹

Distributive services industries such as wholesale trade and retail trade have contributed significantly to productivity growth in the U.S. nonfarm business sector during the past decade. Bosworth and Triplett found that retail trade alone contributed nearly one-half to the acceleration of multifactor productivity growth in the late 1990's. At the same time, they expressed concern that productivity growth for these industries may be overstated because of the way real output is measured, especially for retail stores that sell computers and electronic devices whose quality continues to improve while prices fall. Different output concepts, data sources, and methodologies have led researchers to reach different conclusions about the sources of productivity growth and its attribution among industries. Questions have also been raised about whether the current treatment of trade industries could lead to an overstatement of overall economic growth.

Distributive services play an important role in the U.S. economy by bringing together buyers and sellers and by facilitating the movement of domestic and imported goods from producers to consumers. The industries that provide these services--wholesale trade, retail trade, and transportation and warehousing--account for about 15 percent of gross domestic product (GDP), 18 percent of total employment, and, in 2004, contributed nearly 20 percent to real GDP growth. Despite recent improvements in the overall accuracy and consistency of data in BEA's integrated annual industry accounts, interpreting the contributions of these industries to output and productivity growth is difficult because of a lack of consensus on output concepts for both nominal and real output, limitations in the source data used for measuring price indexes, and some uncertainty among researchers about how margin-type activities are treated in the U.S. economic accounts. Finally, the composition of these industries has changed as a result of the recent conversion of industry data to the North American Industry Classification System (NAICS), which affects the consistency of time series data.

This paper sheds some light on these issues by focusing on the largest and the most visible of the three sectors--retail trade--to identify and address the key measurement issues and to explain the treatment of margin activities in the economic accounts. The first part of the paper

¹ The author thanks Felicia Candela, Anna Jacobson, Paul Kern, Mark Planting, and Tony Troy of BEA for helpful comments. Special thanks go to Anna Jacobson and Gabriel Medeiros for providing unpublished data from BEA's Annual Industry Accounts.

provides an overview of how margin-type industries are defined and classified under NAICS and it also discusses alternative output measures for these industries, such as sales, gross margin, and value added. The second part focuses on the retail trade industry to address key measurement issues, including the source data and adjustments used to measure nominal gross output and the calculation of the price indexes used to estimate real gross output. The third part describes the treatment of margin in the accounts, how this treatment affects the valuation of final and intermediate expenditures, and its implications for further integration of BEA's national and industry economic accounts. The last section is a summary and conclusion.

I. Overview of Margin Industries

Trade and transportation industries in BEA's national and industry accounts are defined and classified according to the 1997 version of NAICS.² Industries are collections of establishments, such as stores and offices rather than companies or enterprises, and these establishments are classified by industry according to their primary product sold or primary activity. Establishment-based industry data are better than company-based data for studying output trends and productivity growth because establishment data are not affected by mergers, acquisitions, and other changes in corporate organization. On an establishment basis, for example, all department stores are classified in one industry and all grocery stores are classified in another industry, regardless of the classification of the company that owns them.

In BEA's industry accounts, the services provided by trade and transportation establishments include both margin and non-margin activities. Margins, which are the primary product of trade industries, represent the difference between what a consumer pays for a product and what the producer (or importer) receives for it. Trade margins include the mark-ups on goods sold by wholesalers and retailers and sales and excise taxes. Non-margin activities are the other services provided by trade establishments, such as repair and installation services. Transport costs, which are also a type of margin, are the amounts paid for a product to be shipped from the producer to the consumer

BEA defines the gross output of trade industries as gross margin rather than sales because it believes that gross margin best represents the services that a wholesale trade or retail trade establishment provides, and that merchandise purchased for resale (or merchandise transported,

² BEA's 2002 benchmark input-output accounts, which are scheduled to be released next year, will be based on the 2002 version of NAICS. Subsequently, revised estimates from the national income and product accounts and the annual industry accounts will also be presented on the 2002 NAICS basis.

in the case of transportation industries) should not be treated as an intermediate input in the production process.³ Retailers, for example, provide services that are valued by consumers in addition to the merchandise, such as convenient hours and locations, a selection of different types of merchandise, speedy or efficient check-out, and information about products. The margin definition of gross output also allows the input-output (I-O) accounts to be presented in both purchasers' prices and producers' prices. Producers' price valuation allows the I-O accounts to be used for economic impact analysis. Rather than treat goods purchased by trade industries as inputs to production, the I-O accounts depict them as if they were acquired by their ultimate users. Otherwise, these accounts would portray an economy in which nearly all final expenditures for goods originate in the trade sectors.

A. Industry Definitions

This section provides a brief description of the coverage and content of the retail trade, wholesale trade, and transportation and warehousing sectors under NAICS. It highlights some of the factors that distinguish these sectors from one another and identifies the major changes in content from the Standard Industrial Classification (SIC) system.

Retail Trade (NAICS 44-45). The retail trade sector⁴, which is the largest of the three distributive services sectors, consists of establishments that primarily sell merchandise, generally without transformation, to the general public and that provide services incidental to the sale of merchandise. It includes both store retailers and non-store retailers such as electronic shopping and mail-order houses. Compared with the 1987 SIC, the NAICS retail trade sector is significantly smaller because it no longer includes eating and drinking places, which accounted for about 35 percent of retail trade employment on the SIC basis in 1997. On the other hand, wholesale trade establishments that accounted for about 15 percent of wholesale trade employment on the SIC basis were reclassified as retail trade. Retail trade can be further disaggregated into 12 three-digit sub-sectors. Each of these sub-sectors includes more detailed industries at the four-, five-, and six-digit NAICS level.

³ This treatment, which is recommended by the 1993 System of National Accounts (SNA), is followed by most national statistical agencies.

⁴ The 2002 version of NAICS did not change the content of the retail trade sector and only slightly modified its structure. A distinction was made between discount department stores and non-discount department stores, and electronic shopping and mail order houses were split into electronic shopping, electronic auctions (Internet auctions), and mail-order houses.

Wholesale trade (NAICS 42). The wholesale trade sector consists of establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. These establishments typically sell merchandise to other businesses, such as other wholesalers and retailers, rather than to the general public, and they normally operate from a warehouse or an office. Certain types of wholesalers also sell capital goods and intermediate materials and supplies used in production by other businesses. A distinction is made in wholesale trade between establishments that sell goods on their own account and those that arrange sales or purchases for others for a commission or fee. This distinction is important in the industry accounts for determining whether output is margin or non-margin. Wholesale trade is smaller under NAICS than it was under the SIC because establishments that sell at retail to both households and businesses, such as building materials dealers and office supply stores, were reclassified as retail trade.

Establishments that sell goods on their own account include merchant wholesalers and manufacturers' sales branches and sales offices. Merchant wholesale establishments maintain their own warehouses, take title to the goods that they resell, and are typically independent of the companies whose products they sell. According to the 1997 and 2002 Censuses of Wholesale Trade, merchant wholesalers accounted for 56 percent of wholesale trade sales in 1997 and 61 percent in 2002. Manufacturers' sales branches (which maintain inventory) and sales offices (which do not maintain inventory) are establishments that are maintained by manufacturing and mining enterprises apart from their plants or mines for the purpose of marketing the company's products. They accounted for 31 percent of wholesale trade sales in 1997 and 28 percent in 2002.

Establishments that arrange for the purchase or sale of goods owned by others on a commission or fee basis are known as agents and brokers, commission merchants, import/export agents and brokers, auction companies, business to business electronic markets, and manufacturers' representatives. These establishments typically operate from offices and generally do not own or handle the goods that they sell. They accounted for about 13 percent of total wholesale trade sales in 1997 and about 10 percent in 2002. In the 2002 version of NAICS, these types of wholesale trade establishments are classified separately from merchant wholesalers and from manufacturers' sales branches and offices.

Transportation and Warehousing (NAICS 48-49). This sector includes establishments that provide transport of passengers and freight, warehousing and storage of goods, scenic and sightseeing transportation, and support activities related to the various modes of transportation. The modes of transportation are air, rail, water, road, and pipeline. Margin output in this sector is produced in connection with the transport of freight by one of the five modal transportation industry groups. Many of the establishments in this sector often operate on networks that are spread over an extensive geographic area. Warehousing establishments in this sector do not sell the goods stored on their premises, which distinguishes them from wholesale trade.

Total employment in the transportation and warehousing sector for 1997 was about the same as it was on the 1987 SIC basis, but NAICS resulted in some significant changes in the sector's composition. It now includes natural gas pipelines, selected amusement and recreation services that involve transportation, and captive establishments (auxiliaries) that provide transportation and warehousing services primarily to other establishments of the same company. Excluded from this sector under NAICS are ambulance services, marinas, waste collection, and travel agencies and tour operators. Both the SIC and NAICS exclude the rental and leasing of transportation equipment without operators. NAICS sectors 48-49 include sub-sectors for each of the five transport modes and sub-sectors for warehousing and storage, transportation support activities, scenic and sightseeing activities, and courier services.

B. Output Measures

Several output concepts are used to measure the activities of distributive services industries in BEA's economic accounts. This section briefly describes these output concepts, their relationship to one another, and reasons for having different output measures for these industries. The output measures include sales and receipts, gross margin, gross output, and value added.

Sales and receipts. This measure is common to each of the three distributive services industry groups and is the broadest indicator of nominal (current-dollar) output available for each group. Sales apply to the trade industries and receipts apply to transportation and warehousing industries. Sales are defined as the total dollar amount received in a given period from the sale of goods and the provision of services. Receipts represent the total dollar value of services provided on an accrual basis. Sales or receipts is the measure that is typically available in the

source data that BEA uses for the national and industry accounts, and it is the starting point for other calculations for most industries.

According to the Census Bureau, which is the source for BEA's sales data, sales include merchandise sold for cash or credit and receipts from customers for delivery, installation, alteration, maintenance, repair, storage, and other services. Sales are net after deductions for refunds and allowances for merchandise returned by customers. Revenue from investments and interest receipts from extending credit are not included. Sales and receipts exclude sales taxes and excise taxes collected directly from customers and paid directly to a local, state, or federal tax agency.⁵

One of the difficulties with using sales as a measure of gross output for trade industries is the potential for counting the value of merchandise purchased for resale multiple times. It will be counted when it is first imported or produced by domestic manufacturers and, depending on the distribution network, it will be counted again when it is sold by wholesalers to other wholesalers, when it is sold by wholesalers to retailers, and finally when it is sold by retailers to consumers. With this treatment, properly measuring GDP by industry in the industry accounts requires treating merchandise purchased for resale without further processing as an intermediate input to the production process for both wholesale trade and retail trade industries. In BEA's view, this treatment distorts the measurement of the production process for these industries and it reduces the usefulness of the I-O accounts for economic impact analysis.

Problems also arise with this treatment of trade industries for the attribution of productivity growth to industries based on their relative size and for the aggregation of multifactor productivity (MFP) growth using the Domar method, in which an industry's MFP growth is weighted by the ratio of its gross output to aggregate value added. Sales give a much higher weight to the MFP growth of the trade industries than does gross output. Some researchers, however, prefer sales as the measure of output, especially for productivity measurement, because they do not believe that merchandise purchased for resale can be separated from the other inputs, at least for some of the retail trade industries.

⁵ In BEA's industry accounts, however, these sales and excise taxes are included in the measure of gross output.

Gross margin. Gross margin is defined and measured as sales less the cost of goods sold.⁶ Sales data are available from the Census Bureau and are the starting point for calculating gross margin. Cost of goods sold is measured as the value of merchandise purchased for resale less the change in the value of merchandise inventories. Data on purchases of merchandise during the year and inventories at the start and end of the year are also provided by the Census Bureau. Inventory values are converted from book values to replacement cost by BEA for the national accounts. Gross margin replaces sales as the primary concept of gross output for the wholesale and retail trade industries in BEA's industry accounts for the reasons described above.

Gross output. This measure is defined for use in BEA's industry accounts as the market value of goods and services produced by an industry in a given period. It differs from sales and gross margin by the inclusion of adjustments to compensate for limitations in the source data and to match the definitions of concepts used for the national and industry accounts. For most industries, gross output is measured by summing the value of the industry's sales or receipts, other operating income, inventory change, and sales and excise taxes. Inventories are valued at replacement cost and adjustments are made for misreporting and coverage shortfalls in the basic source data. Gross output also includes imputations for the value of own-account construction and capitalized software.

For most industries, the gross output concept differs significantly from sales or receipts. For wholesale trade and retail trade, as described above, the primary concept is gross margin, which represents the difference between sales and the cost of goods sold. For non-profit organizations, the concept is operating expense because the operating receipts of these establishments normally do not cover their expenses, and thus are not a good measure of the market value of the services they provide. Operating expense is also the concept of gross output for manufacturers' sales branches and sales offices in wholesale trade. For wholesale trade agents and brokers, gross commission is the concept of gross output.

Value added. Value added represents the returns to labor and capital used by an industry, and is a concept of output that is used for all of the industries in BEA's industry accounts. It is measured as the value of an industry's gross output less the value of the intermediate inputs that the industry consumes in producing its gross output. Intermediate inputs are the energy,

⁶ In BEA's industry accounts, the term used is cost of re-sales. Cost of goods sold is used in this paper because it is the more familiar term used to describe the cost of resold merchandise.

materials, and services that an industry acquires from other domestic industries or imports for producing its gross output.⁷ Value added can also be measured as the sum of the industry's return to labor (compensation of employees) and gross return to capital (gross operating surplus plus taxes on production and imports less subsidies). Nominal value added summed over all industries (including government) equals nominal GDP. It can also be viewed as an industry's contribution to GDP.

Table 1 presents selected alternative output measures for the distributive services industries for the year 2002. These estimates highlight some of the differences in the output concepts described above. Based on sales or receipts, wholesale trade was clearly the largest of the three industry groups. However, as described above, this industry's sales include the sales of

Table 1.--Alternative Output Measures for Distributive Services Industries, 2002
(Billions of dollars)

| <u>Output Measure</u> | <u>Retail Trade</u> | <u>Wholesale Trade</u> | <u>Transportation and Warehousing</u> |
|-----------------------|---------------------|------------------------|---------------------------------------|
| Sales/receipts | 3134.3 | 4634.8 | 499.0 |
| Gross margin | 877.2 | 586.2 | NA |
| Gross output | 1080.4 | 874.0 | 576.1 |
| Value added | 719.6 | 615.4 | 304.6 |

Sources: Sales and receipts are from the 2002 economic census, except for air transportation and railroad transportation, which are from Bureau of Transportation Statistics data. Gross margin is from Census annual trade surveys. Gross output and value added data are from BEA.

manufacturers' sales branches and offices, whose gross output is measured by their operating expenses, and the sales of agents and brokers, whose gross output is measured by their commissions.⁸ Adjusted for these differences, wholesale trade gross output is significantly less than retail trade gross output, largely reflecting the difference in gross margins but also other factors. Similarly, value added for wholesale trade exceeds wholesale trade gross margin because the gross margin is only for the merchant wholesaler type of operation. Gross output for transportation and warehousing is larger than receipts because of the adjustments that are made to the basic source data.

⁷ Merchandise purchased for resale by trade industries is not included in intermediate inputs for these industries.

⁸ These two types of wholesale trade establishments account for about 13 percent of wholesale trade gross output.

II. Measurement Issues in Retail Trade

This section focuses on the retail trade industry to address key measurement issues that are common to the distributive services industries, including the source data and the adjustments that are made to measure nominal gross output and the calculation of the price indexes that are used to estimate real gross output.

A. Nominal Gross Output

In BEA's industry accounts, an industry's nominal gross output represents the market value of goods produced and services provided in the current period. Gross output is valued in producers' prices, which are defined as the amount received by producing establishments plus sales and excise taxes collected by the producer. As with all industries in BEA's annual industry accounts, gross output for the distributive services industries is consistent with the estimates from BEA's most recent benchmark input-output (I-O) accounts, which are for 1997.⁹ Annual estimates for non-benchmark years are developed primarily by extrapolating detailed components of benchmark gross output with annual indicator series that BEA believes provide the best measure of year-to-year change for those components. For example, the sales component of gross output for retail trade is extrapolated using the most recent data from the Census Bureau's annual retail trade survey.

Table 2 provides sales, gross margin, and gross margin as a percent of sales for the 12 retail trade sub-sectors for 2004. The largest sub-sector based on both sales and gross margin is motor vehicle and parts dealers, which accounted for nearly one-fourth of retail trade sales in 2004. The next two largest sub-sectors were food and beverage stores and general merchandise stores, each of which accounted for about 14 percent of retail trade sales. These three sectors combined account for slightly more than half of total retail trade sales each year. The distribution of gross margin by sub-sector is similar to the sales distribution but there are some important differences, as reflected in the column for gross margin as a percent of sales. Motor vehicle and parts dealers, food and beverage stores, and general merchandise stores account for slightly less than half of gross margin in most years because their gross margin rates are either less than or about the same as for all of retail trade. The sub-sectors with the highest gross

⁹ BEA's benchmark I-O accounts for 2002 are scheduled to be released in summer 2007. Afterwards, industry gross output estimates from the annual industry accounts will be revised to be consistent with the 2002 I-O benchmark levels of industry gross output.

Table 2.-- Sales and Gross Margin by Retail Trade Sub-sector, 2004
(Sales and gross margin are in billions of dollars)

| NAICS 97 | Industry | Sales | Gross margin | Gross margin as a percent of sales |
|----------|--|--------|--------------|------------------------------------|
| 44-45 | Retail trade | 3477.3 | 1009.5 | 29.0 |
| 441 | Motor vehicle and parts dealers | 864.8 | 181.7 | 21.0 |
| 442 | Furniture and home furnishings stores | 105.5 | 48.1 | 45.6 |
| 443 | Electronics and appliances stores | 95.0 | 28.3 | 29.7 |
| 444 | Building material and garden equipment dealers | 298.9 | 94.1 | 31.5 |
| 445 | Food and beverage stores | 495.7 | 144.4 | 29.1 |
| 446 | Health and personal care stores | 198.6 | 61.0 | 30.7 |
| 447 | Gasoline stations | 320.8 | 61.5 | 19.2 |
| 448 | Clothing and clothing accessories stores | 190.2 | 86.8 | 45.6 |
| 451 | Sporting goods, hobby, book, and music stores | 80.2 | 31.1 | 38.8 |
| 452 | General merchandise stores | 497.2 | 132.5 | 26.7 |
| 453 | Miscellaneous store retailers | 105.6 | 46.0 | 43.6 |
| 454 | Non-store retailers | 224.7 | 93.9 | 41.8 |

Source: Census Bureau's Annual Retail Trade Survey (ARTS). Excludes sales and excise taxes.

margin rate were furniture and home furnishings stores and clothing and clothing accessory stores (45.6 percent). Gasoline stations (19.2 percent) had the lowest gross margin rate.

For the published retail trade sector in the annual industry accounts, BEA develops unpublished gross output estimates for 62 detailed retail trade industries at approximately the 4- and 5-digit NAICS level. The source data for the major components of gross output are provided by the Census Bureau and are organized around a Census "kind-of-business" (KB) classification for retail trade. Retail trade KBs usually correspond to 5-digit or 6-digit NAICS industries, and they represent the most detailed industry level at which most of the gross output components can be reliably estimated. Appendix A shows the 62 detailed retail trade industries for which BEA develops unpublished gross output estimates. Source data are compiled and adjustments to source data are made for each of these detailed industries.

BEA makes several adjustments to the basic source data in order to overcome limitations in the data, to match the definitions and conventions used for the industry and national economic accounts, and to insure consistency between the estimates of final expenditures in the NIPAs and in the annual industry accounts. For retail trade, the concept of gross output is gross margin on sales of merchandise plus receipts for non-margin services. Adjustments are made to convert sales to gross margin with inventories valued at replacement cost, to add BEA's estimates of

sales and excise taxes collected at the retail level, and to include the value of other services produced.

Table 3: Derivation of Retail Trade Gross Output for BEA's Annual Industry Accounts, 1997-2004
(Billions of dollars)

| Line No. | Gross Output Component | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|-----------------|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 | Sales and receipts | 2520.7 | 2645.3 | 2879.1 | 3072.7 | 3159.1 | 3232.5 | 3369.9 | 3624.5 |
| 2 | Less: Cost of goods sold | 1823.3 | 1907.2 | 2072.5 | 2218.9 | 2313.4 | 2327.8 | 2403.4 | 2582.0 |
| 3 | Equals: Gross margin (Census basis) | 697.4 | 738.1 | 806.6 | 853.7 | 845.8 | 904.7 | 966.5 | 1042.5 |
| 4 | Plus: Inventory valuation adjustment | 5.0 | 2.2 | -1.8 | -2.7 | 0.9 | 0.9 | 0.2 | -6.4 |
| 5 | Plus: Sales and excise taxes | 98.1 | 103.3 | 112.1 | 119.0 | 122.5 | 125.5 | 130.3 | 139.9 |
| 6 | Plus: Misreporting adjustments | 12.6 | 13.2 | 14.1 | 15.0 | 15.2 | 15.9 | 16.5 | 17.9 |
| 7 | Plus: Own-account production | 2.6 | 2.8 | 3.3 | 3.8 | 3.8 | 3.4 | 3.7 | 4.1 |
| 8 | Plus: Other adjustments | 14.3 | 14.9 | 16.5 | 22.3 | 32.9 | 30.0 | 33.5 | 33.3 |
| 9 | Equals: BEA gross output | 830.1 | 874.5 | 950.7 | 1011.1 | 1021.0 | 1080.4 | 1150.8 | 1231.4 |

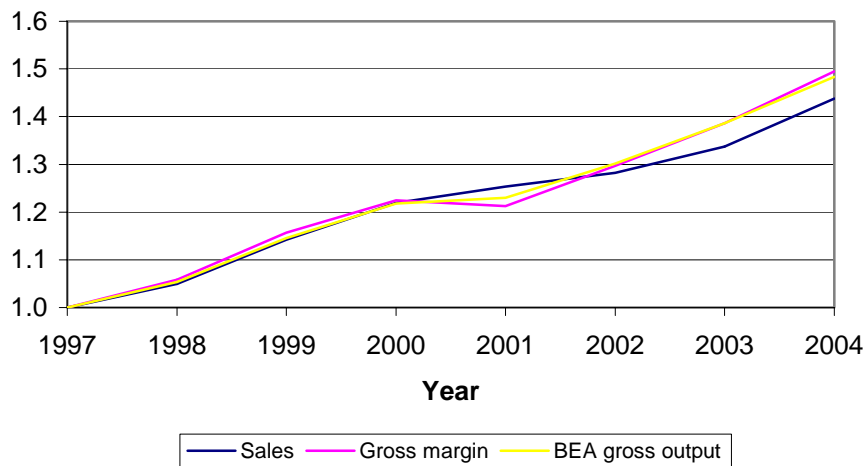
Source: Unpublished estimates from BEA's Annual Industry Accounts.

Table 3 provides the derivation of gross output for the retail trade industry for 1997-2004 in terms of the source data that are used and adjustments to the source data. This methodology is used for each of the 62 detailed retail trade industries. BEA starts with the ARTS total sales as reported to the Census Bureau. In order to calculate gross margin, BEA subtracts the cost-of-goods sold, which is calculated as merchandise purchased for resale less the change in merchandise inventories. The result equals gross margin on a Census basis, before adjustments for inventory valuation. Data for purchases and inventories are obtained from the ARTS, except for the most recent year, for which BEA assumes that the gross margin rate for the detailed KB does not change from the prior year. An adjustment is then made (line 4) to convert the book value of retail inventories to the current replacement cost for consistency with the national accounts.

BEA adds its own estimates of sales and excise taxes, which are prepared by the Regional Economic Analysis Division for use in calculating gross state product by industry. These taxes are consistent with the estimates of taxes on production and imports that appear in the NIPAs. Adjustments are made to correct for misreporting on the business tax returns that are used for the

economic census and annual surveys. The value of own-account production of new construction and capitalized software is also included, as it is for all industries. Finally, adjustments are made to eliminate double-counting of non-merchandise (services) receipts in other industries, to insure that the deduction for cost-of-goods sold does not include material inputs for service work, and to insure consistency with NIPA final expenditures.

**Chart 1.--Nominal Output Growth for Retail Trade, 1997-2004
Alternative Output Measures (1997 = 1.0)**



Although the adjustments that are made to the Census-based gross margin to obtain BEA gross output are fairly large, they do not significantly affect the growth of nominal gross output for the retail trade industry. Chart 1 shows the growth of sales, gross margin, and BEA gross output for 1997-2004. Each of the measures grew at nearly the same rate through 2000. In 2001, as sales growth slowed, gross margin declined slightly and BEA gross output increased less than sales. Since 2001, both gross margin and BEA gross output have increased faster than sales, reflecting an increase in the overall gross margin rate from 27 percent to 29 percent during this period.

B. Price Indexes and Real Output

This section discusses the measurement of real output for the retail trade industry, focusing on the price indexes that are used to deflate sales and gross margin. For most services industries, BEA's real output measures (quantity indexes) are computed using sales price indexes that match the nominal output concept very closely, such as consumer price indexes (CPIs) or producer price indexes (PPIs) from the Bureau of Labor Statistics (BLS). PPIs are used to

deflate the nominal gross output of several industries in the transportation and warehousing sector, and separate price indexes are available for freight and passenger service for some of these industries.

For trade industries, direct price indexes for the deflation of gross margin are available for only a limited number of trade industries and years.¹⁰ Because direct sales price indexes are not available for trade industries, BEA calculates indirect sales price indexes. Price indexes for gross margin are more complicated because, in principle, they should be calculated using a double-deflation method that takes into account the difference between sales prices and purchase prices and changes in the relationship between real gross margin and real sales. Unfortunately, purchase price indexes are not readily available for the many types of merchandise purchased by trade industries, and reliable data are not available at a detailed level to measure the shares of goods that are distributed through wholesale trade and retail trade channels.

1. Sales Price Indexes

BEA's National Income and Wealth Division (NIWD) prepares sales price indexes for 83 retail trade industry groups. These groups include the 62 detailed industries for which nominal gross output estimates and price indexes are prepared for use in the annual industry accounts. NIWD prepares these sales price indexes in order to calculate real inventory-sales (I-S) ratios for wholesale trade and retail trade industries. NIWD's nominal sales estimates, which are used to prepare estimates of personal consumption expenditures (PCE) for goods in the NIPAs, are obtained from the Census Bureau's monthly and annual retail trade surveys, and they include BEA's estimates of sales and excise taxes.

Each detailed trade industry's sales price index is calculated as an implicit price deflator, with the industry's nominal (current-dollar) sales divided by the industry's constant-dollar sales. Constant-dollar sales are calculated by summing deflated sales and receipts for a variety of merchandise and non-merchandise lines sold by an industry. The price indexes used for deflation are either BLS CPIs or PCE price indexes from the national accounts. These price indexes are matched with the detailed merchandise lines, which are updated every five years as part of the economic census. Merchandise lines are aggregated from potentially more than 400 to about 80 broad groups to match the level of detail needed for PCE estimation and the available

¹⁰ BLS started to provide direct retail trade margin price indexes in 2000. These price indexes are discussed later in the paper.

price indexes. Merchandise line sales are typically concentrated in the kinds of products that characterize the retail trade kind-of-business. For example, shoe stores sell mostly shoes, but department stores sell a wide variety of merchandise.

Current-dollar sales (S^V) for each retail trade industry (i) in the current year (t) is the sum of the nominal receipts for each merchandise line (m) sold by the industry, where q_m is the quantity or volume of a merchandise line and p_m is the merchandise line's sales price:

$$S^V_{it} = \sum_m (p_{mit} \cdot q_{mit}).$$

Constant-dollar sales (S^Q), which represents the aggregation of current-period merchandise line quantities valued in the prices of the base year (b), are obtained as:

$$\begin{aligned} S^Q_{it} &= \sum_m [(p_{mit} \cdot q_{mit}) / (p_{mit} / p_{mib})] \text{ or} \\ S^Q_{it} &= \sum_m (p_{mib} \cdot q_{mit}). \end{aligned}$$

The sales price index (S^P) is an implicit price deflator (IPD) calculated as:

$$S^P_{it} = (S^V_{it} / S^Q_{it}) = \sum_m (p_{mit} \cdot q_{mit}) / \sum_m (p_{mib} \cdot q_{mit}).$$

These equations show that retail trade IPDs are Paasche price indexes in which the weights are the current-period quantities for each merchandise line sold. Price relatives for merchandise line sales (p_{mt} / p_{mb}) are available for each year, but nominal merchandise line sales ($p_{mt} \cdot q_{mt}$) are only observed every five years in the most recent economic census year, which is the base year (b) for these calculations. For a retail trade KB, the distribution of nominal sales across merchandise lines is assumed to not change from the base year. Because relative prices can change, this procedure effectively assumes that the mix of merchandise line quantities for an industry does not change from the base year. Sales price indexes could thus be overstated if the sales mix shifts towards merchandise lines with slower-growing or declining prices.

2. Margin Price Indexes

a. Margin Price Concept

In BEA's industry accounts, as explained above, the primary concept of gross output for trade industries is gross margin, which is defined and measured as total sales less the cost of goods sold. Total sales consist of receipts from the sale of merchandise plus non-merchandise receipts. Cost of goods sold is defined and measured as the value of merchandise purchased for resale, less the change in inventories of such merchandise, with inventories valued at replacement cost. Gross margin on merchandise sales is a measure of the implicit (un-priced)

services provided by trade establishments for distributing merchandise. Non-merchandise receipts are a measure of directly-priced services provided by the trade establishment, usually in connection with the sale of merchandise.

In order to illustrate the concept of the margin price and its relationship to sales and purchase prices, it is useful to start with a derivation of the nominal values. The equations below provide the derivation of gross margin in current prices. As described above, S^V_{it} represents total sales for retail trade industry i in year t . S^{MD}_{it} represents revenue from sales of merchandise and S^{NM}_{it} represents non-merchandise receipts. C^{MD}_{it} represents the cost of goods (merchandise) sold, and M^{MD}_{it} represents the gross margin on merchandise sales:

$$S^V_{it} = S^{MD}_{it} + S^{NM}_{it} \quad \text{and}$$

$$S^{MD}_{it} = C^{MD}_{it} + M^{MD}_{it} \quad \text{so}$$

$$S^V_{it} = C^{MD}_{it} + M^{MD}_{it} + S^{NM}_{it}.$$

If we assume for simplicity that non-merchandise receipts are zero, then using the notation from the previous section, merchandise sales for a retail trade industry can be expressed as:

$$S^{MD}_{it} = \sum_m p^S_{mit} \cdot q^S_{mit} \quad \text{and}$$

$$\sum_m p^S_{mit} \cdot q^S_{mit} = \sum_m p^C_{mit} \cdot q^C_{mit} + \sum_m p^M_{mit} \cdot q^M_{mit} \quad \text{so}$$

$$\sum_m p^M_{mit} \cdot q^M_{mit} = \sum_m p^S_{mit} \cdot q^S_{mit} - \sum_m p^C_{mit} \cdot q^C_{mit},$$

where the superscripts S, C, and M refer to sales, cost-of-goods sold, and margin, respectively.

For the purpose of calculating gross margin quantity and price indexes, BEA also assumes that the quantity or volume of retail trade sales q^S is some function (f) of the quantity of the resold merchandise *and* the volume of the un-priced trade services provided:

$$q^S = f(q^C, q^M) \quad \text{and}$$

$$q^M = q^S - q^C.$$

q^S does not necessarily equal q^C because retailers can provide services (q^M) such as convenient hours and locations, efficient check-out, merchandise varieties, and informative displays that are valued by consumers and that are largely independent of the merchandise sold. q^M is a function of the quantities of labor, capital services, energy, non-merchandise materials, and purchased services used in production by trade establishments. This representation of the quantity of trade

services is consistent with the gross margin concept of nominal gross output, but some would argue that it is fairly restrictive because it does not allow for substitution possibilities between intermediate inputs and other inputs, including merchandise purchased for resale. For example, the BLS productivity program treats sales, rather than gross margin, as the output measure of trade industries for calculating labor productivity because sales allows for a less restrictive model of real output.¹¹

For a single merchandise line m sold by industry i in year t :

$$p_{mt}^M \cdot q_{mt}^M = p_{mt}^S \cdot q_{mt}^S - p_{mt}^C \cdot q_{mt}^C \quad \text{so}$$

$$p_{mt}^M = (p_{mt}^S \cdot q_{mt}^S - p_{mt}^C \cdot q_{mt}^C) / q_{mt}^M \quad \text{and}$$

$$p_{mt}^M = p_{mt}^S \cdot (q_{mt}^S / q_{mt}^M) - p_{mt}^C \cdot (q_{mt}^C / q_{mt}^M).$$

These equations indicate that the implied price of margin services depends not only on sales prices and purchase prices, but also on the quantities or volumes of sales, purchases, and margin. The sales price is weighted by real sales relative to real margin and the purchase price is weighted by real purchases relative to real margin. Changes in real margin services per unit of real sales (the real margin rate) can thus affect the calculation of implicit margin prices.

b. Margin Price Measurement

Implied gross margin quantities and prices can be estimated using a double-deflation method that is conceptually and statistically equivalent to the double-deflation method used to measure value added quantities and prices. This method is used for value added because value added quantities and prices cannot be directly observed and measured. With a double-deflation method, the quantity index of gross margin would be calculated as the difference between the quantity index of sales and the quantity index of purchases, and the price index for gross margin would be calculated as the difference between the sales price index and the purchases price index. With double deflation, few (if any) assumptions are required about the relationships between sales quantities and margin quantities and between sales prices and margin prices.

For addressing issues in the measurement of gross output for trade industries, including the application of double-deflation methods, the margin rate (r) is a useful construct. It is defined for a merchandise line m sold by a specific trade industry i as follows:

¹¹ Manser discusses the BLS rationale for this treatment. Triplett and Bosworth (ch. 8) discuss the same issues in more detail and provide additional references on the topic.

$$r_{mit} = [(p_{mit}^S \cdot q_{mit}^S) - (p_{mit}^C \cdot q_{mit}^C)] / (p_{mit}^S \cdot q_{mit}^S).$$

Because margins and margin rates are observed only for industries and not for merchandise lines sold by an industry, upper-case P and Q are used to represent average industry prices and quantities aggregated over all merchandise lines sold by an industry. Given the prior-period (t-1) nominal margin rate, the sales price relative for an industry can be expressed as a weighted-average of the implicit margin price relative and the (potentially) observed purchase price relative, as follows¹²:

$$P_{it}^S / P_{i,t-1}^S = r_{t-1} \cdot (P_{it}^M / P_{i,t-1}^M) + (1 - r_{t-1}) \cdot (P_{it}^C / P_{i,t-1}^C).$$

The gross margin price relative can then be obtained using a double-deflation method from the estimates of sales prices, purchase prices, and the industry margin rate as follows:

$$P_{it}^M / P_{i,t-1}^M = (1 / r_{t-1}) \cdot [(P_{it}^S / P_{i,t-1}^S) - (1 - r_{t-1}) \cdot (P_{it}^C / P_{i,t-1}^C)].$$

In practice, this procedure is difficult to implement because purchase prices for merchandise lines sold by trade industries are not readily available and the composition of merchandise line sales cannot be updated annually. Timmer, Inklaar, and van Ark prepared experimental margin price indexes for selected retail trade industries using a double-deflation method similar to the one described above. They discuss some of the problems that statistical agencies would encounter using this method, including the assumptions that were required and the limitations of the estimates. One important issue is the reliability of gross margin price indexes that are obtained as a weighted-average residual when gross margins account for only a small share of sales.

c. Alternative Methods for Margin Prices

In calculating its retail trade gross margin price indexes, BEA attempts to approximate the results that would be obtained from the double-deflation method by making assumptions about the relationship either between implicit gross margin prices and actual sales prices, or between implicit margin quantities and actual sales quantities. Alternative methods can be used that assume either that the margin price index does not change relative to the sales price index (a constant mark-up rate assumption) or that the margin quantity index does not change relative to

¹² This is a Laspeyres-type price index because the margin rate is from period t-1. A Paasche-type price index could also be calculated using the real (constant-price) margin rate from period t. BEA's featured measure of quantity and price change is the Fisher index, which is the geometric mean of the Laspeyres and Paasche indexes. The double-deflation method described above can be used to compute both the Laspeyres and Paasche indexes.

the sales quantity index (a constant real margin rate assumption). Such assumptions are not required when using a double-deflation method.

BEA's current procedure assumes that the real margin per unit of real sales at the detailed industry level does not change from the previous year (constant real margin rate). The gross margin price index is calculated as the product of the industry sales price index and the industry margin rate index. The resulting price index is used to deflate nominal gross margin. In effect, retail trade sales quantities in the current year t are valued at the sales prices and the margin rate of year t-1.¹³

The BEA margin price relative for a detailed industry is calculated as follows:

$$P_{it}^M / P_{i,t-1}^M = (P_{it}^S / P_{i,t-1}^S) \cdot (r_t / r_{t-1}).$$

Because nominal gross margin for industry i in period t equals $r_{it} \cdot (P_{it}^S \cdot Q_{it}^S)$, where P and Q represent average industry sales prices and quantities aggregated over all merchandise lines, dividing the nominal gross margin $r_{it} \cdot (P_{it}^S \cdot Q_{it}^S)$ by the industry margin price relative ($P_{it}^M / P_{i,t-1}^M$) yields the following constant-price gross margin estimate in year t for industry i:

$$P_{i,t-1}^M \cdot Q_{it}^M = r_{it} \cdot (P_{it}^S \cdot Q_{it}^S) \cdot (P_{i,t-1}^S / P_{it}^S) \cdot (r_{i,t-1} / r_{it}) \text{ and}$$

$$P_{i,t-1}^M \cdot Q_{it}^M = r_{i,t-1} \cdot (P_{i,t-1}^S \cdot Q_{it}^S).$$

The last equation indicates that deflation with the BEA margin price index yields a constant-price margin value in which the current period sales quantities are valued at the prior period's sales prices and margin rate. This procedure effectively assumes that real margin services per unit of real sales do not change from the previous year (constant real margin rate). Another interpretation of this method is that it assumes that the change in the nominal margin rate (r) from year t-1 to t is entirely due to margin prices (the mark-up rate) with no contribution from real margin services per unit of real sales.

Another alternative to double deflation would be to deflate nominal gross margin with just the sales price index, which yields an estimate of constant-price margin as shown below:

$$P_{i,t-1}^M \cdot Q_{it}^M = r_{it} \cdot (P_{it}^S \cdot Q_{it}^S) \cdot (P_{i,t-1}^S / P_{it}^S) \text{ and}$$

$$P_{i,t-1}^M \cdot Q_{it}^M = r_{it} \cdot (P_{i,t-1}^S \cdot Q_{it}^S).$$

The last equation indicates that the constant-price margin value consists of current-period sales quantities valued at the prior period's sales prices and the current-period industry margin rate.

¹³The same procedure is used by BEA to estimate constant-price ad valorem sales and excise taxes by valuing current-period quantities at the sales prices and tax rates of the prior period. Constant-price specific (unit) taxes are estimated by extrapolation with constant-price sales (quantity extrapolation).

This procedure effectively assumes that sales prices change at the same rate as purchase prices (constant mark-up rate), which implies that the change in the nominal margin rate is entirely due to real margin services per unit of real sales, with no contribution from the margin price.

Both of the alternatives to the double-deflation method described above value current period merchandise sales quantities at the prior period's sales prices, but they differ in their assumptions about relative margin prices and relative margin quantities. The double-deflation method does not require any of these assumptions.

d. Empirical Results

Table 4 compares average annual growth rates for the BEA sales price index and the BEA gross margin price index for the 12 major retail trade industry groups. For the period 1997-2004, the sales price index for retail trade was nearly unchanged, declining at an average annual rate of 0.1 percent per year. This period was also one with relatively strong real output and productivity growth for the retail trade industry. Real sales for retail trade increased at an average annual rate of 5.4 percent, real gross output increased 5.3 percent, and real value added increased 4.9 percent. Real gross output per full-time equivalent employee increased at an average annual rate of 3.8 percent from 1998-2004, much faster than for all private industries.

Table 4.--BEA's Price Indexes for Retail Trade, 1997-2004
Average annual percent change

| <u>NAICS 97</u> | <u>Industry</u> | <u>Sales</u> | <u>Margin</u> | <u>Margin less Sales</u> |
|-----------------|--|--------------|---------------|----------------------------------|
| 44-45 | Retail trade | -0.1 | 0.4 | 0.4 |
| 441 | Motor vehicle and parts dealers | -0.5 | 0.0 | 0.5 |
| 442 | Furniture and home furnishings stores | -1.1 | -0.3 | 0.7 |
| 443 | Electronics and appliances stores | -12.0 | -10.5 | 1.5 |
| 444 | Building material and garden equipment dealers | 0.4 | 1.8 | 1.4 |
| 445 | Food and beverage stores | 2.3 | 3.9 | 1.6 |
| 446 | Health and personal care stores | 3.1 | 2.4 | -0.7 |
| 447 | Gasoline stations | 5.4 | 3.9 | -1.5 |
| 448 | Clothing and clothing accessories stores | -1.8 | -0.7 | 1.0 |
| 451 | Sporting goods, hobby, book, and music stores | -2.0 | -2.4 | -0.3 |
| 452 | General merchandise stores | -0.6 | -0.6 | 0.0 |
| 453 | Miscellaneous store retailers | -1.4 | -1.1 | 0.2 |
| 454 | Nonstore retailers | -3.6 | -5.3 | -1.6 |

Source: Sales price indexes are from NIPA underlying detail tables. Margin price indexes are unpublished estimates from BEA's Annual Industry Accounts.

Sales prices declined over this period for eight of the twelve retail trade industry groups. Average sales price growth rates varied by industry group, ranging from a high of 5.4 percent for gasoline stations to a low of -12.0 percent for electronics and appliances stores. Sales price indexes for gasoline stations are, of course, dominated by the sale of refined petroleum products, such as motor gasoline and diesel fuel. Sales price indexes for electronics and appliance stores are heavily influenced by computers and other electronic products, whose prices have continued to decline due to quality improvement.

BEA's margin price index for retail trade increased slightly faster than its sales price index, increasing at an average annual rate of 0.4 percent, about the same as the overall gross output price index for retail trade (0.5 percent).¹⁴ The value added price index for retail trade declined 0.2 percent over this period. The margin price index increased slightly faster than the sales price index because of a slight increase in the retail trade gross margin rate, from 27.6 percent to 29.0 percent. The pattern of margin price growth across industries is similar to that for sales price growth, but some differences arise. Gasoline stations and food and beverage stores had the fastest growth in margin prices (3.9 percent) and electronics and appliance stores had the slowest growth (-10.5 percent). The contributions of the margin rate index varied by industry, reflecting differences in gross margin growth rates. The contribution of the margin rate index was largest in the food and beverage stores industry and in the non-store retailers industry. For food and beverage stores, increases in the gross margin rate amplified increases in sales prices. For non-store retailers, declines in the gross margin rate amplified decreases in sales prices.

e. Other Estimates

Gross margin price indexes were calculated by Timmer, Inklaar, and van Ark (TIV) using a double-deflation method. The sales price indexes used for their calculations were obtained from the BLS industry productivity program for retail trade. The authors developed a model for calculating purchase price indexes based on BLS PPIs and international price indexes (IPIs) that accounted for the shares of purchased merchandise that were imported, purchased from wholesalers, and purchased directly from domestic manufacturers. Table 5 compares the growth

¹⁴ The gross output price index for retail trade is a Fisher aggregate that uses gross margin price indexes for most of the components of retail trade gross output but also uses the corresponding sales price indexes for some of the non-margin components of gross output.

in the margin price indexes for 1993-2002 calculated using the BEA methodology with the margin price indexes that were calculated by TIV using the double-deflation method.

For all of retail trade, the gross margin price index developed by TIV increased slightly faster than the BEA gross margin price index (0.6 percent vs. 0.3 percent). The largest difference was found in electronics and appliances stores, for which the TIV index decreased at

Table 5.--Price Indexes for Retail Trade, 1993-2002
Average annual percent change

| <u>NAICS 97</u> | <u>Industry</u> | <u>BEA Sales</u> | <u>BEA Margin</u> | <u>TIV Margin</u> |
|-----------------|--|------------------|-------------------|-------------------|
| 44-45 | Retail trade | 0.3 | 0.3 | 0.6 |
| 441 | Motor vehicle and parts dealers | 1.1 | 0.8 | 0.4 |
| 442 | Furniture and home furnishings stores | 0.0 | 0.5 | -1.1 |
| 443 | Electronics and appliances stores | -10.3 | -10.6 | -4.3 |
| 444 | Building material and garden equipment dealers | 0.3 | 0.9 | -0.6 |
| 445 | Food and beverage stores | 2.2 | 3.8 | 5.5 |
| 446 | Health and personal care stores | 2.4 | 2.1 | 4.3 |
| 447 | Gasoline stations | 2.4 | 1.4 | 0.6 |
| 448 | Clothing and clothing accessories stores | -1.7 | -1.1 | -4.7 |
| 451 | Sporting goods, hobby, book, and music stores | -1.2 | -1.5 | -1.5 |
| 452 | General merchandise stores | -0.2 | -1.7 | -1.7 |
| 453 | Miscellaneous store retailers | -0.1 | -0.5 | -1.8 |
| 454 | Nonstore retailers | -2.4 | -4.1 | -2.1 |

Sources: BEA sales price indexes are from NIPA underlying detail tables. BEA margin price indexes are unpublished estimates from BEA's Annual Industry Accounts. TIV margin prices are from table 1 in their article.

an average annual rate of 4.3 percent, compared with the decline in the BEA gross margin price index of 10.6 percent. TIV found that although sales prices for these stores declined 10.6 percent, purchase prices declined even faster at 12.7 percent, implying much smaller price declines for the residual gross margin. This difference has important implications for the measurement of real output and productivity for electronics and appliances store and other types of retailers whose sales and purchase prices may sharply diverge.

The differences between the BEA and TIV gross margin price indexes may also have important implications for the measurement of real gross output for the retail trade sector as a whole. In their study, TIV compared the growth of real gross margins deflated with their estimated gross margin price indexes with the growth of real sales deflated with the BLS sales price indexes. Some fairly large differences in real growth rates were found among the 12

industry groups, especially for electronics and appliances stores. Because of offsetting positive and negative differences, however, TIV found no difference overall for total retail trade for the period 1993-2002. This is consistent with another one of their findings that the overall implicit margin price index for retail trade increased at nearly the same rate as the overall sales price index (0.6 percent vs. 0.5 percent). TIV's results thus suggest that the assumption of a constant real margin rate may be appropriate for total retail trade, at least over multi-year periods. This assumption may not be appropriate, however, for individual retail trade industries or for shorter periods.

BLS recently initiated a program to directly measure gross margin price indexes for selected retail trade industries and for the wholesale trade durable goods and nondurable goods sub-sectors.¹⁵ The BLS margin price is found by taking the selling price of an individual product and subtracting the purchase price of the last shipment received for the same product. These margin prices are calculated for several types of items within a product class sold by a retailer. BLS computes an average margin price for the product class by summing the margins for items within the class. Margin price indexes are supplemented with direct sales price indexes for selected items to obtain an overall PPI for a retail trade industry.

Comparisons of sales price indexes with direct margin price indexes are difficult because of the limited period the margin price indexes are available and because of limited industry coverage. Manser compared the BLS indirect sales price indexes with the BLS margin price indexes and found, for the 39 observations on annual price changes where both price measures are available, that the margin price index increases faster (or falls more slowly) in 30 cases. The margin price indexes also tend to be more volatile than the sales price indexes. These results suggest that the use of sales prices indexes for deflating gross margins tends to overstate the growth of real gross margins.

An updated comparison conducted for this paper found similar results. Average annual price index growth rates were calculated for 2001-2004 for 18 retail trade industries, at various levels of aggregation, where direct comparisons could be made. As shown in table 6, the BEA margin price index often differed significantly from the BLS PPI, both in direction and magnitude. On average, the BEA margin price index was slightly closer to the BLS PPI than was the BEA sales price index, but the mean absolute difference was about the same for both

¹⁵ See Manser for background on the BLS program.

BEA price indexes. Because of offsetting positive and negative differences, however, the mean difference (where the sign matters) was much closer to zero for the BEA margin price index than for the BEA sales price index (-0.8 vs.-2.3 percentage points). This result is consistent with the finding noted above that the BEA methodology for deflating gross margins may provide accurate measures for total retail trade, but not necessarily for detailed retail trade industries. BEA continues to study the possible use of BLS margin price indexes for deflating gross margins in the annual industry accounts.

Table 6.-- BEA and BLS Price Indexes for Retail Trade, 2001-2004
Average annual percent change

| <u>NAICS 97</u> | <u>Industry</u> | <u>BEA Sales</u> | <u>BEA Margin</u> | <u>BLS PPI</u> |
|-----------------|---|----------------------|-----------------------|--------------------|
| 441110 | New car dealers | -1.8 | 6.8 | 3.3 |
| 443130 | Camera and photographic supplies stores | -2.6 | 4.2 | -0.2 |
| 445000 | Food and beverage stores | 1.9 | 2.7 | 4.0 |
| 445110 | Grocery stores | 1.9 | 2.4 | 4.0 |
| 445310 | Beer, wine, and liquor stores | 1.8 | 2.3 | 2.5 |
| 446110 | Pharmacies and drug stores | 3.5 | 3.8 | 5.4 |
| 446130 | Optical goods stores | 1.1 | 1.7 | 1.9 |
| 448310 | Jewelry stores | -2.1 | -0.2 | 2.3 |
| 448320 | Luggage and leather goods stores | -3.8 | -3.6 | -1.7 |
| 451110 | Sporting goods stores | -1.4 | -1.9 | -1.5 |
| 451120 | Hobby, toy and game stores | -5.2 | -5.9 | 2.2 |
| 451130 | Sewing, needlework, and piece good stores | -0.8 | 0.2 | -0.3 |
| 451211 | Book stores and news dealers | 0.1 | -2.3 | 3.1 |
| 453110 | Florists | 0.5 | 2.3 | 0.1 |
| 453210 | Office supplies and stationery stores | -6.6 | -3.9 | 5.8 |
| 453220 | Gift, novelty, and souvenir stores | -3.4 | -0.6 | -0.9 |
| 454210 | Vending machine operators | 2.2 | 3.0 | 2.3 |
| 454310 | Fuel dealers | 7.5 | 10.4 | 2.4 |

Sources: BEA sales price indexes are from NIPA underlying detail tables. BEA margin price indexes are unpublished estimates from BEA's Annual Industry Accounts. BLS PPIs are annual averages of monthly indexes from the BLS web site.

III. Margins and Valuation

Although the margin concept of gross output makes the calculation of real gross output for trade industries more difficult, it plays an important role in the valuation of commodities in BEA's industry accounts and in the depiction of the flows of goods and services throughout the economy. The margin concept is also very useful for clarifying relationships in the input-output (I-O) accounts between producers and importers and intermediate and final users. This part of

the paper describes the valuation concepts and conventions used in BEA's industry accounts, presents some results on the distribution of margin services in the accounts, and briefly discusses the significance of the treatment of margins in BEA's efforts to develop more highly integrated national and industry economic accounts.

A. Valuation Conventions

In the I-O accounts, transactions are valued in producers' prices, which represent amounts received by producers for commodities, plus excise and sales taxes collected by the producer and forwarded to taxing authorities. Trade margins, which include sales and excise taxes collected at the wholesale and retail level, and transport costs are shown as though they were purchased separately by the users of the commodities. This valuation convention is described as unbundling and forward shifting. Unbundling indicates that the value of the trade margin (or transport cost) is recorded separately rather than incorporated in the value of the merchandise. Forward shifting indicates that the incidence of the trade margin or transport cost falls on the user of the merchandise, regardless of who actually pays the cost.

In the I-O use table, these margin "commodities" are shown separately in the wholesale trade, retail trade, and transportation rows when the valuation is in producers' prices. The margins are included in the commodity rows for goods when the valuation is in purchasers' prices. Rather than treat goods purchased for resale by wholesalers and by retailers as intermediate inputs, the I-O accounts depict these goods as though they were acquired directly by their ultimate users. Otherwise, the I-O accounts would portray an economy in which nearly all final expenditures for goods originate in the trade sector. This representation would significantly reduce the usefulness of the I-O accounts for studying the impact on industries of changes in final demand.

In the NIPAs, final expenditures for goods are valued in purchasers' prices. This valuation is consistent with the retail sales data that are used for the current estimates of personal consumption expenditures and with the consumer price indexes (CPIs) that are used for the deflation of final expenditures. Purchasers' prices are the equivalent of "market prices" and are defined in the 1993 System of National Accounts as the amount paid by the purchaser for delivery of a good or service at a time and place required by the purchaser.¹⁶ These prices

¹⁶ See Guo, Planting, Mortensen, and Pho for a discussion of the issues related to following the SNA recommendation of providing supply and use tables in basic prices rather than producer prices.

include the amounts received by the producer or the importer (producers' prices) plus trade margins, transport costs, and sales and excise taxes. Final prices paid by ultimate consumers, whether at retail trade establishments or other distribution points, include some or all of these cost elements. This valuation convention means that real GDP based on final expenditures is not much affected by the use of the gross margin concept for trade industries because margins are embedded in both nominal expenditures and the price indexes used to deflate them.

Transactions in the I-O use table can also be valued in purchasers' prices by summing together (bundling) the producers' prices, trade margins, and transport costs for a specific commodity. This valuation is useful for comparing estimates of final expenditures from the I-O accounts with those obtained from the NIPAs.¹⁷ Valuation of intermediate inputs in purchasers' prices is also needed to calculate the materials (goods) share of intermediate purchases by industry. Producers' price valuation, however, is also useful because producer price indexes are used to deflate intermediate purchases of materials. (The deflation of margins is still problematic for both final and intermediate uses.)

B. Distribution of Margins

Each trade industry's gross output is allocated between margin output and non-margin output. Margins can also be produced in non-margin industries as secondary products, such as the margin on auto parts sold directly to customers by motor vehicle repair establishments and the resale of goods without further processing by some manufacturing industries. Margins from all sources (primary and secondary products) are combined for distribution among the commodities, including imported commodities, that move through wholesale trade and retail trade channels.

Gross margin data can be disaggregated by detailed wholesale trade and retail trade kinds-of-business, but not by individual types of merchandise or products sold. In calculating wholesale trade and retail trade margins for commodities, BEA assumes that the gross margin rate for a particular product is the same as that for the trade kind-of-business that primarily sells the product. For example, the retail margin rate for shoes is assumed to be the gross margin rate for retail trade shoe stores, even though these stores sell other products whose margin rates may differ from shoes. Transport cost margins are calculated by distributing each transportation

¹⁷ See Steindel and also Yuskavage and Pho (pp. 38-39) for discussions of the issues associated with comparing manufacturing output with GDP final expenditures for goods when valuation conventions differ.

industry's freight receipts among the types of products transported by those industries. Data from several sources, including the Census Bureau, the Bureau of Transportation Statistics, and trade associations are used to allocate freight revenue among commodities.

Table 7 shows the value of the domestic output of all commodities (goods and services) by valuation component and by type of use for 2004. The purchasers' (market) value of all transactions was \$21.3 trillion. This included \$2.3 trillion of margin, nearly half of which was retail trade margin (\$1.1 trillion). Final uses of goods and services (GDP) amounted to \$11.7 trillion, which included \$1.6 trillion in margin value. Most of the retail trade margin (88 percent)

Table 7.-- Valuation of Commodity Output by Type of Use, 2004
(Billions of dollars)

| <u>Valuation</u> | <u>Commodity Output</u> | <u>Final Use</u> | <u>Intermediate Use</u> |
|------------------------|-------------------------|------------------|-------------------------|
| Producers' value | 19049.1 | 10136.9 | 8912.2 |
| Retail trade margin | 1138.7 | 1005.2 | 133.4 |
| Wholesale trade margin | 885.9 | 505.0 | 380.9 |
| Transport costs | 272.4 | 87.2 | 185.2 |
| Total margin | 2297.0 | 1597.4 | 699.6 |
| Purchasers' value | 21346.0 | 11734.3 | 9611.8 |

Source: Unpublished data from BEA's Annual Industry Accounts.

was included in the market value of final expenditures rather than intermediate uses because only a small portion of business purchases are made through retail trade channels. About 57 percent of wholesale trade margin and 32 percent of transport costs were included in final expenditures.

Table 8 shows each of the valuation components from table 7 as a share of the purchasers' value for total commodity output, final uses, and intermediate uses. Margins overall accounted for nearly 11 percent of the purchasers' value of all commodities, leaving 89 percent accruing to producers and importers. Retail trade margin accounted for about five percent, wholesale trade margin accounted for about four percent, and transport costs were about one percent. Total margin as a share of purchasers' value was nearly twice as large for final uses as for intermediate uses, reflecting the much more important role that the retail trade sector plays in distributing goods to final users, especially to households for personal consumption. In 2004, retail trade margins alone accounted for about one-third of the purchasers' value of personal

consumption expenditures for durable and nondurable goods. All margins combined accounted for about 45 percent of the purchasers' value of PCE for goods.¹⁸

Table 8.--Commodity Valuation as a Share of Purchasers' Value, 2004
(in percent)

| <u>Valuation</u> | <u>Commodity Output</u> | <u>Final Use</u> | <u>Intermediate Use</u> |
|------------------------|-------------------------|------------------|-------------------------|
| Producers' value | 89.2 | 86.4 | 92.7 |
| Retail trade margin | 5.3 | 8.6 | 1.4 |
| Wholesale trade margin | 4.2 | 4.3 | 4.0 |
| Transport costs | 1.3 | 0.7 | 1.9 |
| Total margin | 10.8 | 13.6 | 7.3 |
| Purchasers' value | 100.0 | 100.0 | 100.0 |

Source: Author's calculations using unpublished data from BEA's Annual Industry Accounts.

C. Integration of Accounts

One of the high-priority items on BEA's strategic planning agenda is to develop more highly integrated industry and national economic accounts. For example, research is underway to develop flexible annual revisions and "feedback loops" between the annual NIPA final expenditures estimates and the final use estimates in BEA's annual industry accounts, which are based on the benchmark and annual I-O accounts.¹⁹ While many challenges lie ahead for those efforts, it is clear that the allocation of margins among the various categories of final expenditures for goods in the industry accounts is one of the key steps in reconciling the different approaches to measuring nominal GDP.

Margins also play an important role in attempts to reconcile aggregate estimates of real GDP using different approaches (Moyer, Reinsdorf, and Yuskavage). For example, estimates of real value added by industry calculated using the double-deflation method require estimates of real intermediate inputs by industry. To obtain these measures, BEA calculates constant-price estimates for each of the components of the purchasers' value of inputs: Producers' value,

¹⁸ These shares of margin included in PCE, which are not shown in the paper, are based on unpublished estimates from BEA's Annual Industry Accounts.

¹⁹ See Smith for more information about this research.

wholesale trade margins, retail trade margins, and transport costs. Margin price indexes are prepared for each of the seven types of margin (including the detailed transport cost margins) and are used to calculate constant-price estimates by industry and by type of margin. Sales price indexes are used to deflate the “directly allocated” non-margin intermediate inputs.

The allocation of nominal margin among commodities is largely based on the assumption that the overall margin rate for a detailed product class applies to each industry and each final user that purchases the product. Some exceptions are made for industries that are known to purchase little if any of a commodity through certain trade channels, but these exceptions are rare. Because margin rates are assumed to not vary by consuming industry or by final user, and because producer prices are generally not available by using industry, the distribution of both producers’ and purchasers’ values among users may not reflect differences in the actual prices paid by consumers and received by producers. These limitations in the source data for intermediate purchases can affect the quantity and price indexes calculated for intermediate inputs and value added by industry.²⁰

IV. Summary and Conclusion

Distributive services industries, which include wholesale trade, retail trade, and transportation and warehousing, account for about 15 percent of GDP and have contributed significantly to aggregate nonfarm business productivity growth during the past decade. The conversion to NAICS from the SIC system led to some significant changes in the content and structure of these industries, but broad trends that were observed based on SIC data have remained largely intact. These industries are often described as “margin” industries because much their output represents the difference, or margin, between what consumers pay for goods and what producers and importers receive for them. For the wholesale trade and retail trade industries, most of the output is margin and is measured as the difference between sales and the cost of goods sold. For transportation industries, receipts for transporting freight to the ultimate consumer are also treated as margin.

Several different output concepts apply to the distributive services industries, including sales, gross margin, gross output, and value added. BEA defines the gross output of trade industries as gross margin rather than sales, because gross margin best represents the services

²⁰ See Diewert for a full discussion of this issue in the context of reconciling different approaches to measuring real GDP.

that these establishments provide. BEA does not view merchandise purchased for resale as an intermediate input in the production process for these industries. Most of the source data for developing output measures comes from the Census Bureau, but BEA makes adjustments for limitations in the source data and to insure consistency with the concepts and definitions used for both the national and industry economic accounts. Sales and excise taxes collected by these industries and forwarded to taxing authorities are included in their output. For some of these industries, different output concepts are used for different parts of the industry depending on the nature of the operation or the type of activity. For wholesale trade, about 13 percent of the gross output is measured either as operating expenses or as commissions, rather than gross margin. Differences between sales, gross margin, and gross output are substantial for the retail trade industry, but growth trends for these three nominal output measures are similar.

Because direct sales price indexes are not available for trade industries, BEA develops indirect sales price indexes for detailed retail trade industries by aggregating CPIs and PCE price indexes over the merchandise lines sold by these industries. These price indexes assume that the distribution of merchandise line sales for a retail trade industry has not changed since the most recent economic census year. This assumption could have a significant impact for some of the detailed industries. Until recently, gross margin price indexes were not available so BEA calculates indirect gross margin price indexes to deflate nominal gross margin in the industry accounts. Ideally these price indexes would be calculated using a double-deflation method that takes into account differences between sales prices and purchase prices, but data on purchase prices for trade industries are not readily available.

BEA's gross margin price indexes for retail trade industries are the product of the industry's sales price index and an index of its gross margin rate. This procedure effectively assumes that the constant-price or real margin rate does not change from the prior year. Changes in nominal margin rates are treated as changes in margin prices. Comparisons of the BEA gross margin price indexes with direct gross margin price indexes now available from BLS and with experimental "double-deflated" gross margin price indexes reveal large differences in growth rates for some detailed industries, but close agreement overall for the retail trade sector. BEA will continue to study the use of the BLS margin PPIs in the annual industry accounts, and may also consider investigating possibilities for developing double-deflated margin price indexes.

In the I-O accounts, which are estimated initially in producers' prices, trade margins and transport costs are shown as though they were purchased separately by consumers of the products. This valuation convention is described as unbundling and forward shifting. Otherwise, the I-O accounts would depict an economy in which nearly all final expenditures for goods originate in the trade sector. Trade margins and transport costs account for about 14 percent of the market value of final expenditures and about seven percent of the market value of intermediate purchases. Retail trade margins are the largest type of margin and account for about one-third of the market value of personal consumption expenditures for durable and nondurable goods. BEA continues to study its methods for improving the distribution of margins among products and consumers. The treatment of margins is an important part of BEA's efforts to better integrate its estimates of final expenditures from the NIPAs and from the I-O accounts.

References

Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and the World Bank, *System of National Accounts 1993*, (Brussels/Luxembourg, New York, Paris, and Washington, DC), 1993.

Diewert, Erwin W. 2006. "Comment: Aggregation Issues in Integrating and Accelerating the BEA's Accounts." *A New Architecture for the U.S. National Accounts*, NBER Studies in Income and Wealth, edited by Dale W. Jorgenson, J. Steven Landefeld and William D. Nordhaus. University of Chicago Press.

Guo, Jiemin, Mark A. Planting, Mikael Mortensen, and Yvon Pho. 2005. "Integrating U.S. Input-Output Tables with SNA93: An Assessment Study." Paper presented at the 15th International Conference on Input-Output Techniques. Beijing, China. June 2005.

Lawson, Ann M., Kurt S. Bersani, Mahnaz Fahim-Nader, and Jiemin Guo. 2002. "Benchmark Input-Output Accounts of the United States, 1999." *Survey of Current Business* 82 (12): 19-109.

Manser, Marilyn E. 2005. "Productivity measures for retail trade: data and issues." *Monthly Labor Review* 128 (7): 30-38.

Moyer, Brian C., Marshall B. Reinsdorf, and Robert E. Yuskavage. 2006. "Aggregation Issues in Integrating and Accelerating the BEA's Accounts." *A New Architecture for the U.S. National Accounts*, NBER Studies in Income and Wealth, edited by Dale W. Jorgenson, J. Steven Landefeld and William D. Nordhaus. University of Chicago Press.

Smith, George M., "Next Steps in Internal Integration: Flexible Annual Revisions, NIPA Feedback Loop, and Improved Value Added Reconciliation." Presentation at the BEA Advisory Committee Meeting. Washington, DC. May 2006.
<http://bea.gov/bea/about/advisory.htm#BEAACM>

Steindel, Charles. 2004. "The Relationship between Manufacturing Production and Goods Output." *Current Issues in Economics and Finance* 10 (9). Federal Reserve Bank of New York.

Timmer, Marcel P., Robert Inklaar, and Bart van Ark. 2005. "Alternative output measures for the U.S. retail trade sector." *Monthly Labor Review* 128 (7): 39-45.

Triplett, Jack E. and Barry P. Bosworth. 2004. *Productivity in the U.S. Services Sector: New Sources of Economic Growth*. Brookings Institution Press: Washington, DC.

Appendix A.-- Detailed Retail Trade Industries for BEA Gross Output Estimates

| <u>NAICS Code</u> | <u>Industry Description</u> | <u>NAICS Code</u> | <u>Industry Description</u> |
|-------------------|---|-------------------|---|
| 441110 | New car dealers | 446190 | Other health and personal care stores |
| 441120 | Used car dealers | 447100 | Gasoline stations |
| 441210 | Recreational vehicle dealers | 448110 | Men's clothing stores |
| 441221 | Motorcycle dealers | 448120 | Women's clothing stores |
| 441222 | Boat dealers | 448130 | Children's and infants' clothing stores |
| 441229 | All other motor vehicle dealers | 448140 | Family clothing stores |
| 441310 | Automotive parts and accessories stores | 448159 | All other clothing stores |
| 441320 | Tire dealers | 448210 | Shoe stores |
| 442110 | Furniture stores | 448310 | Jewelry stores |
| 442210 | Floor covering stores | 448320 | Luggage and leather goods stores |
| 442290 | Other home furnishings stores | 451110 | Sporting goods stores |
| 443111 | Household appliance stores | 451120 | Hobby, toy and game stores |
| 443112 | Radio, TV, and other electronics stores | 451130 | Sewing, needlework, and piece good stores |
| 443120 | Computer and software stores | 451140 | Musical instrument and supply stores |
| 443130 | Camera and photographic supplies stores | 451210 | Book stores and news dealers |
| 444110 | Home centers | 451220 | Prerecorded tape, CD and record stores |
| 444120 | Paint and wallpaper stores | 452110 | Department stores |
| 444130 | Hardware stores | 452910 | Warehouse clubs and superstores |
| 444190 | Other building material dealers | 452990 | All other general merchandise stores |
| 444200 | Lawn and garden equipment and supplies stores | 453110 | Florists |
| 445100 | Grocery stores | 453210 | Office supplies and stationery stores |
| 445210 | Meat markets | 453220 | Gift, novelty, and souvenir stores |
| 445220 | Fish and seafood markets | 453310 | Used merchandise stores |
| 445230 | Fruit and vegetable markets | 453910 | Pet and pet supply stores |
| 445291 | Baked goods stores | 453920 | Art dealers |
| 445292 | Confectionery and nut stores | 453930 | Mobile home dealers |
| 445299 | All other specialty food stores | 453990 | All other miscellaneous store retailers |
| 445310 | Beer, wine, and liquor stores | 454110 | Electronic shopping and mail order houses |
| 446110 | Pharmacies and drug stores | 454210 | Vending machine operators |
| 446120 | Cosmetic, beauty supplies, and perfume stores | 454310 | Fuel dealers |
| 446130 | Optical goods stores | 454390 | Other direct selling establishments |