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Abstract

The retail trade sector has experienced dramatic changes in the types of establishments and goods and in the ways these goods are distributed and sold. We introduce new margin-based measures of output that complement existing sales-based output measures and identify what affects the differences between these measures of output, including prices, the product mixes, and industry dynamics. From 2007 to 2022, sales productivity outpaced margin productivity in most instances. We look closely at three representative industries with different trends and the role prices may play. In electronics and appliance stores, sales productivity showed robust growth while margin productivity grew more slowly. In beer, wine, and liquor stores, the two measures had similar trends. For pharmacies and drug stores, margin productivity growth was three times the rate of sales productivity. Comparing these measures gives a better understanding of the distinct effects of quantity of goods sold and changes to retail services on output and productivity.

Keywords: retail, productivity, output, sales, margin

JEL Classification: E31, J24, L81

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Introduction

The retail trade sector has experienced dramatic changes in recent years, including the rise of warehouse clubs and supercenters, increasing dominance of larger firms, the growth of e-commerce, the digital transformation of goods, increased product variety, and globalization.¹ These changes accelerated with the COVID-19 pandemic and not only impacted the retail trade sector but associated industries in wholesale, transportation, and warehousing. The retail transformation changed the way we shop and consume, and everyday experience points to improved efficiency and consumer welfare.

How are these perceived gains in efficiency translated into economic growth? Labor productivity is a measure of economic performance that compares the amount of goods and services produced (output) with the number of labor hours used to produce those goods and services. Mathematically, it is defined as real output per hour worked, and growth occurs when output increases faster (or decreases more slowly) than hours. Historically, productivity growth has led to higher wages for workers and higher profits for businesses, and our improved standard of living depends on gains in overall productivity.

Defining output for the measurement of retail productivity has frequently attracted the attention of researchers. Ratchford (2016) described the demand for retail services as a makeor-buy decision involving the consumer's time, access to transportation and storage space, and the willingness of the consumer to allow higher margins for the retailer in exchange for added convenience. He questioned whether recent economies of scale by big-box retailers, resulting in lower prices and limited services, truly represent productivity gains. Triplett and Bosworth (2004) discussed the pros and cons of defining output using deflated sales versus margins, concluding that a better taxonomy of retailing services would be required for both concepts. Timmer et al. (2005) embraced a margin output approach yet highlighted challenges in constructing experimental margin prices using double deflation, noting that all possible

¹ The <u>Committee on National Statistics Panel Study (2021)</u> highlights seven recent changes to the retail trade sector.

measurement errors in the sales and acquisition prices will show up in the margin price. Manser (2005) discussed retail output concepts from a production framework, treating goods purchased for resale as an input to the production process, and argued that purchased goods are not separable from the services provided by the retailer to the consumer. Betancourt (2016) pointed out that, in an ideal world, deflated sales would measure the quantity of goods sold and margin would measure the value of the distributive service. In reality, sales prices partially capture the distributive service while economies of scale render margins susceptible to quantity sold, thus making it difficult to disentangle the two concepts—quantity sold and distributive service—from the aggregate.

This article advances the literature in several ways. Rather than debating whether sales- or margin-based measures of output are preferred, we contend that both are valuable, especially when taken together as complementary measures for productivity analysis.² We examine these complementary measures of labor productivity for the retail sector and its major component industries and find that sales productivity outpaces margin productivity in most instances during the 2007 to 2022 period. We identify what affects the differences between sales and margin measures of output, including prices, the nature of product mixes, and industry dynamics. Finally, we look closely at three industries with different trends and the role prices may play in sales and margin productivity.

Retail Trade Sector

To measure labor productivity, we must first define real output. Goods-producing industries create a tangible and observable output while service industries provide a non-tangible output which cannot be held in inventory. Defining and measuring the output of service industries is difficult because establishing the unit for a quantity of service is not always clear. Retail trade is a service-providing sector, yet the physical products conveyed to customers are very tangible. It

² In their September 2023 article on <u>The importance of output choice: implications for productivity measurement</u>, Eldridge and Powers presented three alternative concepts of output along with an empirical comparison focusing on the U.S. manufacturing sector and selected industries in that sector.

is the fact that these goods are bundled with distribution services that generates a dilemma for defining retail output. Primarily, should retail output be defined as the isolated distribution services, the quantity of goods sold, or the bundle of goods and services that are purchased by the consumer?

The U.S. Bureau of Labor Statistics (BLS) measures labor productivity for retail industries using a deflated sales revenue measure of output as a proxy for quantity of goods sold and the value of the services rendered. Real sales output is measured as nominal sales revenue deflated by the changes in prices of products sold outside the industry. Retail sales prices are the final prices paid by consumers and reflect the entire value chain of the product sold, from concept to delivery to the final consumer.³ Alternatively, retail output can be defined as a service. Retail margins are a measure of revenue that removes the cost of goods, paid by the retailer to an upstream vendor, from the total sales revenue of retail establishments. Margin output reflects the deflated value of services provided by retail establishments that help facilitate the sale of goods to consumers, rather than the quantity of goods flowing through retail establishments. Real margin output is the nominal margin revenue deflated by the change in margin prices—sales price less acquisition price—and reflects the value of services added by retailers.⁴

Sales output bundles the goods sold with the distributive services whereas margin measures attempt to isolate the service component by removing the cost of goods sold from sales revenue. To observe this combination in practice, figure 1 breaks down the components of real sales output for the retail trade sector into the cost of goods sold, or COGS (the bundle of goods), and margins (the services provided). From 2007 to 2022, real sales output rose 2.4 percent per year with real COGS rising faster at 2.6 percent per year, resulting in a modest growth in real margins of 1.7 percent per year.

³ Primarily <u>BLS Consumer Price Indexes (CPIs)</u>

⁴ See <u>BLS Producer Price Index (PPI) Coverage of the Retail Sector</u>



Output as Sales

Retail output calculated with real sales revenue gives a broad, inclusive picture of a retailer's totality of operations and includes economies of scale, increased sales of products with existing staffing levels, the value of products sold, product variety, and services rendered to prepare items for sale.

Published BLS measures of labor productivity for retail industries use a deflated sales revenue measure of output. As such, both the quantity of goods sold by the retail establishment and the retail services that facilitate the sale of those goods to the consumer are encompassed in the output measure. Because we do not have a discrete count of items sold and cannot sum quantities of heterogeneous products in a meaningful way, we use the deflated value of sales revenue as a proxy for item quantities.

In our calculations, we use sales data from the Annual Retail Trade Survey (ARTS) conducted by the U.S. Census Bureau.⁵ The ARTS provides annual values for total sales revenue as well as its components, such as inventories, purchases, and gross margin revenue, and these data are available at varying detail between the three-digit and six-digit NAICS industry level.⁶

Total sales revenue reflects the final price paid by the consumer, excluding sales tax, and is published on a current dollar basis each year. Although classified by their primary business type, retailers by their nature sell a large variety of product lines. BLS breaks apart annual nominal sales revenue into component product lines using sales data from the Economic Census. Published every five years, Census product line sales data are less frequent but provide detailed information on the range of products being sold within each industry.

To estimate real sales revenue for the industry, we matched revenue for each individual product line with a product-specific price index from the BLS Consumer Price Index (CPI).⁷ BLS publishes a variety of consumer product groupings representing the change in price over time across the U.S. economy. The estimated annual revenue for each product line is deflated using the matching CPI and then weighted together to produce an industry output index.⁸ The industrylevel implicit price deflator (referred to in this paper as the sales output price deflator) is calculated by dividing an index of the nominal annual sales from the ARTS by the industry output index.

⁵ <u>Census Annual Retail Trade Survey (ARTS)</u>

⁶ Industry data presented in this paper are on a <u>2017 North American Industry Classification System</u> (NAICS) basis. NAICS classifies establishments based on their primary activity. The 2017 NAICS distinguishes between store and nonstore activity for retail industries.

⁷ In some instances where CPIs are not available for a given product line, commodity producer price indexes (PPIs) are used instead. See <u>BLS PPI Commodity Data</u>

⁸ Industry Productivity Measures Output Estimation

Output as Margin

Unlike sales revenue, margin measures of output do not include the value of products moving through retail stores to the customer. Rather, the retail margin isolates the service provided to the customer from the value of products being delivered. This is a valuable way to measure retail because establishments do not control the aspects of the goods themselves; rather, they guide the way those goods are curated and sold.

Retail margins are measured as sales revenues minus the cost of goods sold. In these new margin-based measures of output and productivity we use nominal margin revenue for retail industries from the ARTS.⁹ Nominal margins are influenced when consumers shift between purchasing low-service items and high-service items, consumers demand improved or expanded levels of service, and retailers exercise pricing power. To remove price changes, industry-level margin revenue from the ARTS is deflated using the corresponding industry margin PPI from the BLS Producer Price Index. The margin-based PPIs incorporate a weighted product mix within the calculation.

Price deflator data are readily available at the industry level for retail trade industries, which allows construction of measures for all but one three-digit NAICS and most four-digit NAICS retail industries. The Census Bureau publishes measures of retail margins for 33 retail industries from 2004 through 2022. We limit our comparisons between sales and margins in this paper to the 2007 through 2022 period for 19 industries and the retail sector to cover a complete business cycle and represent trends since the COVID-19 pandemic.

⁹ Two methods were examined for calculating real margin output indexes for retail trade industries. The industry-level deflation method is currently used by BLS in published measures for selected service industries. The alternate method uses 2017 Census Product Line Sales data to break apart industry-level margin revenue, deflating the individual product lines using detailed BLS industry-based Producer Price Indexes (PPIs), and aggregating the resulting product lines as a Törnqvist index. This product line sales method is similar to the method currently used for constructing deflated revenue measures of output for published retail trade industries. However, product-level PPIs are limited for most retail industries. Because of this lack of PPI coverage of detailed margin services within individual NAICS industries, and the time and complexity of applying the Törnqvist method to detailed product breakouts, this method is not pursued further.

Contrasting Margin and Sales

Figure 2 highlights the impact of different output concepts by comparing annual percent changes in margin productivity and sales productivity for the retail trade sector and its major component industries from 2007 to 2022. For each industry, the margin and sales productivity growth combine their corresponding measure of output growth with the same measure of hours worked. As for the retail sector overall, it is the case that most industries show sales productivity outpacing margin productivity during this period. (Note table 1.)



Industry	Margin productivity	Sales productivity	2022 Sales revenue (millions of current dollars)	2022 Employment (thousands of jobs)
Electronic shopping and mail-order houses	5.9	6.7	1,117,046	505
Pharmacies and drug stores	3.7	1.3	336,296	715
Sporting goods and musical instrument stores	3.3	4.4	94,022	524
Electronics and appliance stores	3.3	7.5	92,760	451
Clothing stores	3.1	4.0	210,496	844
Jewelry, luggage, and leather goods stores	2.8	4.7	52,867	141
RETAIL TRADE SECTOR	2.3	3.0	7,040,994	16,209
Shoe stores	2.2	2.4	40,050	175
Beer, wine, and liquor stores	2.0	1.3	70,409	193
Automobile dealers	1.9	1.4	1,293,076	1,297
Other general merchandise stores	1.9	2.5	727,859	2,137
Specialty food stores	0.8	1.5	28,453	237
Department stores	0.7	1.9	134,274	953
Furniture and home furnishings stores	0.6	3.4	143,646	477
Building material and supplies dealers	0.3	1.8	445,286	1,263
Lawn and garden equipment and supplies stores	0.2	1.4	66,404	203
Book stores and news dealers	0.0	-0.3	8,971	75
Auto parts, accessories, and tire stores	-0.1	0.0	123,831	584
Grocery stores	-0.4	1.2	858,323	2,771
Gasoline stations	-1.4	-0.1	736,082	970

Table 1. Sales versus margin productivity, 2007 – 2022, annual percent change

We now take a closer look at three industries that reflect different scenarios in the comparison of sales and margin productivity measures and reflect diverse trends, measurement issues, and implications for the retail transformation. In electronics and appliance stores, sales productivity showed robust growth while margin productivity grew much more slowly. In beer, wine, and liquor stores, the two measures trended closely. For pharmacies and drug stores, margin productivity growth was three times the rate of sales productivity.

Electronics and appliance stores

Electronics and appliance stores (NAICS 4431) sell new, consumer-type electronics and household appliances from point-of-sale locations, often with displays for product

demonstrations.¹⁰ In 2017, consumer electronics composed approximately 73.3 percent of sales for this industry while 18.5 percent of sales came from household appliances and the rest from services and miscellaneous goods.¹¹ Sales of electronics and appliances are increasingly moving from brick and mortar stores to e-commerce. In 2022, approximately 64 percent of sales by electronics and appliance retailers were classified in NAICS 4431 and 36 percent in NAICS 4541 (electronic shopping and mail-order houses), compared to 83 percent in NAICS 4431 and 17 percent in NAICS 4541 in 2015.¹² As in-store sales declined and the number of establishments contracted, employment dropped from 624.4 thousand jobs in 2007 to 450.5 thousand jobs in 2022 (-2.2 percent per year).

From 2007 to 2022, sales productivity soared at a rate of 7.5 percent per year, the highest of the retail industries, as these retailers improved their capacity to move larger and larger quantities of product more efficiently. The longer-term 3.3 percent per year growth in margin productivity is concentrated in the 2008-2012 period before leveling off in the years since. The strong gains in productivity for both sales and margins are due to real output growth (+4.8 percent per year for sales, +0.6 percent for margins) coupled with decreasing hours (-2.5 percent per year). (Note figures 3 and 4.)

¹⁰ According to the <u>Census 2017 NAICS definition</u>: "Industries in the Electronics and Appliance Stores subsector retail new electronics and appliances from point-of-sale locations. Establishments in this subsector often operate from locations that have special provisions for floor displays requiring special electrical capacity to accommodate the proper demonstration of the products. The staff includes sales personnel knowledgeable in the characteristics and warranties of the line of goods retailed and may also include trained repair persons to handle the maintenance and repair of the electronic equipment and appliances. The classifications within this subsector are made principally on the type of product and knowledge required to operate each type of store."

¹¹ Based on industry product breakouts from the 2017 Economic Census.

¹² According to the ARTS: "When a company has a large e-commerce segment, typically with separate warehousing facilities, ARTS considers this a separate industry from the company's brick-and-mortar NAICS classifications." Source: <u>2022 Census ARTS supplemental e-commerce table: explanatory material</u>.



Figure 3. Productivity for electronics and appliance stores, sales versus margins 2007–22

Figure 4. Output and hours worked for electronics and appliance stores, sales versus margins 2007–22



Output is affected by both the quantity of goods sold and the change in the price and quality of goods over time. The BLS makes quality adjustments to prices for rapidly changing products, such as computers and smart phones.¹³ Examining the price changes of goods helps reveal what Timmer et al. (2005) call the "inside-the-box effect." As noted by Triplett and Bosworth (2004): "Electronics stores are in the business of selling boxes (filled with computers) that they obtain from the manufacturer. The fact that the machine inside has experienced dramatic technological improvements should have few implications for efforts to measure the productivity of the workers in the retail establishment. An index that combines the improvements within the box with changes in the number of boxes bears little relationship to the actual activities of the retail store."

Sales prices fell by 5.6 percent per year because of dramatic technological improvements in electronics and price competition from shifts to online shopping, both of which influenced sales volume and sales productivity. Examining the activities of retail electronic stores separately, we observed that margin prices fell at a similar annual rate to sales prices from 2007 to 2012 (-6.0 percent for margins and -6.9 percent for sales). Yet, as sales prices continued to decline, margin prices were nearly level through 2019 before increasing at 2.3 percent annually through 2022. (Note figure 5.)

¹³ <u>A Review of Hedonic Price Adjustment Techniques for Products Experiencing Rapid and Complex Quality Change</u>



Figure 5. Price deflators for electronics and appliance stores, sales versus margins 2007–22

Since 2007, nominal sales have been declining, and the surge in real sales output occurred as prices fell rapidly. Price changes were a response to competition from e-commerce retailers and inside-the-box quality improvements from innovations in manufacturing. These effects may speak to the arguments that real sales productivity is overstated. Figure 6 illustrates nominal and price effects on real sales output, with sales prices falling every year for 14 consecutive years from 2007 to 2020. It was only during the pandemic and recovery years of 2020 and 2021 that nominal sales revenue, rather than prices, was driving real output growth.



Real margin output attempts to isolate the services provided by retailers, such as displaying and demonstrating the products for sale, and thus the modest gains in margin productivity capture a more muted increase in efficiency associated with the retail activities of selling electronic products. However, real sales output offers insight into what retailers are selling, such as higher quality products; accordingly, both sales and margin productivity complement each other for industry analysis.

Beer, wine, and liquor stores

Beer, wine, and liquor stores (NAICS 4453) sell packaged alcoholic beverages from fixed pointof-sale locations.¹⁴ Packaged alcoholic beverages composed 90 percent of sales in 2017, with spirits at 41 percent, wine at 26 percent, and beer at 23 percent. Although alcohol products are as old as humanity, the idea of retailing alcohol is relatively new.¹⁵ Unlike the continuous

¹⁴ According to the <u>Census 2017 NAICS definition</u>: The beer, wine, and liquor stores industry "comprises establishments primarily engaged in retailing packaged alcoholic beverages, such as ale, beer, wine, and liquor."

¹⁵ How liquor stores came about in the U.S. (Arthur Cantina, Oct 2020).

advancements in electronics and appliances, the products within this industry have remained relatively uniform over time. The beer, wine, and liquor stores industry is expanding with steady employment growth of 1.5 percent per year, increasing from 154.2 thousand jobs in 2007 to 193.1 thousand jobs in 2022.

Productivity in this industry has had its ups and downs, but figure 7 depicts similar trends for the sales and margin productivity measures. Margin productivity accelerated over the 2019– 2022 period at 6.4 percent per year, which outpaced a 3.1 percent annual increase in sales productivity.



Figure 7. Productivity for beer, wine, and liquor stores, sales versus margins 2007-22

Long-term trends in output and hours worked also exhibit overall growth. Over time, margin output for services provided in this industry has moved in tandem with the quantity of output, rising as the quantity of goods has increased and falling as sale of goods has lagged. Output for both measures tracked more closely when compared with the electronics and appliance stores industry. From 2007 to 2019, annual growth for real sales output (2.3 percent) and real margin output (2.4 percent) were nearly identical. From 2019 to 2022, real margin output surpassed real sales at 8.2 percent and 4.9 percent, respectively. Hours grew at a more moderate rate of 1.5 percent annually from 2007 to 2022 leading to the overall increases in productivity. (Note figure 8.)



Figure 8. Output and hours worked for beer, wine, and liquor stores, sales versus margins 2007-22

Unlike other food and beverage store industries, beer, wine, and liquor stores are less concerned with spoilage and are therefore faced with less margin volatility from product loss. They also can count on advertising from the manufacturers to drive traffic to their stores, reducing their costs. The general homogeneity of products is another factor leading to margins and sales tracking more closely. Everything being sold requires a similar set of skills from the workers and store operators.

Pharmacies and drug stores

Pharmacies and drug stores (NAICS 44611) retail prescription and nonprescription drugs and medicines.¹⁶ Although store contents have remained relatively similar over time, the prices of drugs and medicines vary widely depending on the customer, insurance coverage, and establishment size and type. Prescriptions made up approximately 76 percent of sales in 2017, nonprescription medications approximately 5 percent, and other merchandise ranging from vitamins, cosmetics, personal hygiene products, and tobacco the rest.¹⁷ Employment varied from the industry's peak employment of 752.0 thousand jobs in 2008 until 2016. Then there began a steep decline in employment, which was interrupted briefly by the pandemic recovery, reaching 715.2 thousand jobs in 2022.

Margin measures for pharmacies and drug stores tell a different story compared with sales measures. From 2007 to 2022, margin productivity increased by 3.7 percent per year, outpacing sales (1.3 percent per year). The pharmacies and drug stores industry is one of only four retail industries examined where margin productivity exceeds sales productivity. Sales and margin productivity in pharmacies and drug stores diverge after 2010. Margin productivity surpassed and consistently outpaced sales productivity starting in 2011. Over the long term, the gap between margin and sales productivity is greater than any other industry. (Note figure 9.)

¹⁶ Pharmacies and drug stores (NAICS 44611) make up the bulk of Health and personal care stores (NAICS 4461), composing 83 percent of total sales revenue of the four-digit NAICS industry <u>reported in the ARTS</u> in 2022.

¹⁷ Based on industry product breakouts from the 2017 Economic Census.



Figure 9. Productivity for pharmacies and drug stores, sales versus margins 2007-22

While hours show a slight decline over time, falling annually by 0.5 percent from 2007 to 2022, long-term trends in output are rising. Sales output was nearly flat from 2007 through 2019 while margin output grew steadily at 1.4 percent. (Note figure 10.) With the onset of the COVID-19 pandemic and thereafter, margin output accelerated to 10.3 percent annually as sales output trailed at 4.5 percent per year through 2022. Pharmacies and drug stores lead the instore retailers for margin output growth since 2019. These retailers were among the limited businesses deemed essential throughout the pandemic and convenient locations for COVID-19 tests and vaccinations.



Figure 10. Output and hours worked for pharmacies and drug stores, sales versus margins 2007-22

Although the retailing of prescriptions and nonprescription drugs is increasingly shifting online, pharmacies and drug stores is an interesting case study among retail industries for its growing services component. Retail pharmacies stepped up and served the public during the COVID-19 pandemic, administering more than 307.4 million doses of the COVID-19 vaccine through the Federal Retail Pharmacy Program (FRPP).¹⁸ Those businesses participating in FRPP essentially had no cost of goods for the tests and vaccines with 100 percent of the compensation received counting towards the margins (Wilson and Aremu, 2022). Compared with medical practices, retail pharmacies offer extended hours, including weekends, at more locations, providing wider access to vaccination services to the general public. The convenience of store hours and store locations is the hallmark of retail as a service.

¹⁸ The Federal Retail Pharmacy Program for COVID-19 Vaccination

Ladsariya et al. (2023) discuss the evolution of the retail pharmacy landscape over the past decade, including an industry-wide consolidation from 2010 to 2020. Census data corroborate increased concentration of establishments and sales among the 50 largest firms between 2007 and 2017.¹⁹ Also, Seely and Singh (2021) discuss increased vertical and horizontal integration and dissect the market share of retail prescription drug prices by pharmacy type. Seely and Singh (2021) cite a study by Luo et al. (2019) that shows independent pharmacies and small chains had the highest cash prices for generic drugs while big box pharmacies had the lowest cash prices. Vertical and horizontal integration can lead to improved economies of scale and lower prices.

Sales prices increased consistently from 2007 through 2017 at 3.7 percent annually, but price increases slowed considerably thereafter at 0.7 percent per year through 2022. Even as overall retail industry prices soared following the pandemic, pharmacies displayed sticky prices.²⁰ Margin prices, on the other hand, fluctuated in the 16-year period studied, rising and falling in three cycles. Though higher in 2022 than 2007, margin prices since 2019 declined 0.3 percent annually. (Note figure 11.)

¹⁹ The 50 largest pharmacies and drug store firms accounted for 49.8 percent of establishments and 70.6 percent of sales in 2007 expanding by 2017 to 53.1 percent of establishments and 73.8 percent of sales. Source: 2007 and 2017 Economic Censuses

²⁰ Retail industry sales price deflator grew at 5.4 percent annually from 2019 to 2022.



Figure 11. Price deflators for pharmacies and drug stores, sales versus margins 2007–22

Meaning of Retail

Regardless of which output concept is used, productivity for the retail sector overall is growing, with sales productivity outpacing margin productivity by 0.7 percentage points per year in the observed period. When we look at individual industries within the sector, the story of sales versus margin productivity growth varies quite a bit. At one end of the range, we have electronics and appliance stores, with sales productivity rising 4.2 percentage points per year faster than margin productivity. At the other end of the spectrum are pharmacies and drug stores, where sales productivity is growing at 2.4 percentage points *less* per year. Trends for beer, wine, and liquor stores lie somewhere in between. The causes of these differences also vary by industry.

Whether or not we consider the goods sold as part of the production process of retail industries, separating the margin portion of sales revenue as an alternative output concept yields a richer picture of how retail is changing and how this is affecting the seller, the consumer, and the economy. It allows us to examine whether output and productivity are changing because retailers are selling a larger quantity of goods, increasing their services to the consumer, or both, and this analysis gives an idea of the magnitude of each.

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