

This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: Productivity Differences within the Service Sector

Volume Author/Editor: Victor R. Fuchs and Jean Alexander Wilburn

Volume Publisher: NBER

Volume ISBN: 0-87014-443-X

Volume URL: <http://www.nber.org/books/fuch67-2>

Publication Date: 1967

Chapter Title: Appendix A: Problems in the Measurement of Output and Productivity in the Service Industries

Chapter Author: Victor R. Fuchs

Chapter URL: <http://www.nber.org/chapters/c1434>

Chapter pages in book: (p. 32 - 37)

APPENDIX A
PROBLEMS IN THE MEASUREMENT OF OUTPUT AND
PRODUCTIVITY IN THE SERVICE INDUSTRIES

IN APPRAISING the preceding results, it is well to recall that the measures of real output used can be considered only as approximations. Attempts to measure output and productivity in these and other service industries encounter conceptual and statistical problems which, if not unknown in the commodity-producing industries, take on a new form and increased importance that warrant some discussion.

RETAIL TRADES

The procedure followed in this paper and elsewhere of using the real volume of goods sold as a measure of retail trade output is open to a number of objections; there are many aspects of retailing that may vary over time or cross-sectionally. These include the following:

1. Terms of sale: credit, delivery, guarantees, replacement of parts, repairs and services, return privileges, etc.
2. Amenities provided to the customer: heating, air-conditioning, lighting, music, rest rooms, etc.
3. Convenience: location with respect to homes, places of work, and other stores, availability of parking facilities, store hours
4. Aids to customer choice: variety of merchandise, displays, "test drives," "home demonstrations," "try-on" privileges
5. Sales personnel: intelligence, information, courtesy, attention, etc.
6. Demands on customer: time and effort required to accomplish purchase
7. Size of transaction

One important source of difficulty is that shifts in the sales of the identical commodity from one type of retailer to another will affect the measure of productivity in different ways depending upon what assumptions are made. The problem may be seen clearly by means of a numerical example. In the

example that follows, store type A represents an "old-style" full-line retailer, and type B a modern supermarket or low-markup retailer.

Store Type	Wholesale Price	Margin	Retail Price	Quantity	Sales
PERIOD 1					
A	\$1.00	\$.50	\$1.50	80	120
B	1.00	.30	1.30	20	26
				100	146
PERIOD 2					
A	1.00	.50	1.50	20	30
B	1.00	.30	1.30	80	104
				100	134

According to present methods of measuring real output in retailing in the United States, the index of real output would be 91.8 (i.e., $134 \div 146$) because the price index used to deflate sales would be unchanged from period 1 to period 2. Some economists would regard this as an overstatement of the change in real output in retailing. If the gross margins of the two store types can be regarded as measuring real differences in the services rendered by the two types of retailers, then the real output index should be 73.9 (i.e., $34 \div 46$). Others would argue that the index should be 100, on the grounds that the same quantity of goods is being sold by retailers and that the lower margin represents a more efficient way of providing the same function. As can be seen, the present technique provides a result which is intermediate between the two extreme positions.

Change in the size of transaction is another difficult item to deal with conceptually. Suppose that all other aspects of the sale remain unchanged, but the customer now buys in each transaction twice as much as before. Shall we say that real output in retailing is twice as great as before? Some have argued that because an increase in the size of the transaction normally does not require a proportionate increase in inputs, the volume of real goods should not be used as the measure of real output. It has been suggested that the number of transactions be used, or at least considered, in determining real output in retailing.¹⁴

One difficulty with this line of reasoning is that it is not applied in measuring real output in other industries, such as manufacturing. Businessmen and economists have known for a long time that productivity is often positively related to the "length of the run." But rarely, if ever, does anyone adjust a manufacturing output index based on volume of goods produced in order to allow for changes in the "length of run."

¹⁴ See Margaret Hall and Don Knapp, "Productivity in Distribution with Particular Reference to the Measurement of Output," *Productivity Measurement Review*, February 1957.

In retailing, the size of the transaction corresponds to the "length of the run," and there would seem to be little reason for treating this industry differently from others. Unless output is redefined in all industries, it seems more reasonable to try to identify what portion of the observed change in output per man in retailing can be attributed to change in the size of transaction.

My colleague, David Schwartzman, believes that differences in transaction size in food stores (and possibly other retail trades) explain a large part of differences in output per man. Margaret Hall appears to have reached the same conclusion. One test of this hypothesis would be to determine whether stores attempt to raise the average size of transaction through price concessions or other inducements.

The following notes on some of the individual retail trades provide some rough alternative measures of real output and compare them with the deflated sales indexes that have been used in this paper. Some of these alternatives serve as a check on the quality of the data; others involve a different concept of real output.

AUTOMOBILE DEALERS

A typical transaction in this industry consists of the sale of one car or one truck. The number of such sales may change radically from the deflated value of sales, as shown in the following figures.¹⁵ The explanation for the differ-

<i>1958 = 100</i>	<i>Deflated Sales</i>	<i>Number of New Cars and Trucks Sold^a</i>
1939	39.5	69.9
1948	77.8	102.9
1954	103.8	128.5
1958	100.0	100.0
1963	133.3	177.2

ences probably lies in changes in the proportion of low-priced, medium-priced, and expensive cars sold. One way of approaching this problem of measurement would be to look at the retail margins realized on cars in different price ranges. If the percentage margins are typically the same, regardless of price range, then the use of deflated sales as a measure of real output without regard to the number of cars sold would seem to be justified.

DRUG STORES

There seems to be a very close correspondence between deflated sales of drug stores and the total number of prescriptions filled. The index for indus-

¹⁵ Sources for all of the series presented in this section are given in footnote 16.

trial production of drugs, soap, and toiletries seems to rise more rapidly than either of the other series. It may be that sales of these commodities have been increasing at a rapid rate in retail stores other than drug stores.

<i>1958 = 100</i>	<i>Deflated Sales</i>	<i>Number of Prescriptions^b</i>	<i>Industrial Production of Drugs, Soap, and Toiletries^c</i>
1939	37.9	32.3	n.a.
1948	71.2	69.8	45.2
1954	84.5	80.4	68.9
1958	100.0	100.0	100.0
1963	121.3	122.5	141.2

FOOD STORES

Changes in deflated sales of food stores have closely paralleled changes in industrial production of food in the postwar period. The average size of transaction has apparently been rising markedly as people tend to shop less frequently. There would be some increase attributable to higher incomes even if the frequency of shopping was unchanged.

<i>1954 = 100</i>	<i>Deflated Sales</i>	<i>Industrial Production of Food^c</i>	<i>Number of Transactions^d</i>
1948	77.8	86.4	n.a.
1954	100.0	100.0	100.0
1958	115.2	110.4	n.a.
1963	132.8	129.8	87.0

GASOLINE STATIONS

Gas stations are another type of retail outlet where the size of transaction may be of considerable importance. Casual observation suggests that productivity is much greater when pumping fifteen gallons into one tank than when servicing three cars for five gallons each. Transaction size has probably increased over time as gas tanks have become larger and incomes have risen. The following data seem relevant.

<i>1958 = 100</i>	<i>Deflated Sales</i>	<i>Number of Privately Owned Cars, Trucks, and Buses^a</i>	<i>Number of Vehicle Miles Traveled^a</i>	<i>Gallons of Motor Fuel Consumed^a</i>	<i>Size of Gasoline Tank (Ford)^a</i>	<i>Replacement Production of Tires and Batteries^a</i>
1939	35.0	45.4	42.8	38.8	70.0	53.8
1948	57.5	60.2	59.8	57.1	85.0	83.1
1954	81.8	85.7	84.4	83.1	n.a.	85.2
1958	100.0	100.0	100.0	100.0	100.0	100.0
1963	120.3	121.0	120.0	114.0	100.0	126.7

GENERAL MERCHANDISE STORES

The average size of transactions has apparently risen in general merchandise stores also.

<i>1958 = 100</i>	<i>Deflated Sales</i>	<i>Number of Transactions (3 ÷ 4)</i>	<i>Receipts in Current \$²</i>	<i>Average Sale in Department Stores in Current \$²</i>
	(1)	(2)	(3)	(4)
1939	53.9	61.7	27.4	44.4
1948	74.4	78.5	72.4	92.3
1954	83.2	89.1	81.3	91.3
1958	100.0	100.0	100.0	100.0
1963	131.3	117.7	135.0	114.7

LUMBER DEALERS, ETC.

The following figures suggest either that lumber dealers are losing out to other forms of distribution or that the deflated sales figures for 1963 understate the real amount of goods passing through this type of retail outlet.

<i>1958 = 100</i>	<i>Deflated Sales</i>	<i>INDUSTRIAL PRODUCTION OF</i>		
		<i>Lumber and Products^c</i>	<i>Construction Materials^c</i>	<i>Farm Equipment^c</i>
1948	95.2	96.0	79.3	143.5
1954	98.6	104.2	92.5	107.3
1958	100.0	100.0	100.0	100.0
1963	97.4	113.9	123.1	128.0

SERVICES

Many of the general points that were made concerning output in retail trades also apply to the services. The attitude and skills of the person supplying the service, the amenities provided to the customer, and the demand made upon the customer's time are clearly factors that should be considered in measuring real output. The principal question in the case of services seems to be: How well does the price index capture the quality dimensions of output? Shifts in the composition of output within a census industry can also present problems, as indicated in the following two examples.

HOTELS AND MOTELS

The postwar period has witnessed a marked shift in the composition of this industry from hotels to motels. In 1948, motels accounted for less than 10 per cent of total industry employment. By 1963 the share in motels was one-third. Receipts per worker have typically been about 5 to 10 per cent higher in motels than in hotels; this shift therefore would tend to raise the rate of change of output per man as currently measured. A factor that prob-

ably has considerable effect on output per man is the occupancy rate. Between 1939 and 1948 this rate rose markedly, but since then it has declined. By 1963 it was almost down to the 1939 level.

1958 = 100	Deflated Sales	Occupancy Rate ^h
1939	63.2	87.0
1948	103.2	123.2
1954	92.7	n.a.
1958	100.0	100.0
1963	117.4	91.3

MOTION PICTURE THEATERS

One of the factors tending to raise measured output per man in motion picture theaters has been a shift from regular movie houses to drive-ins. In 1948 the latter accounted for only 3 per cent of the industry's employment, but by 1963 this percentage had grown to over 20 per cent. Receipts per worker have typically been 10 to 20 per cent higher in drive-ins than in regular theaters.¹⁶

¹⁶ Sources for series presented in this section are:

^a Automobile Manufacturers' Association, *Automobile Facts and Figures*, various issues.

^b Number of prescriptions per store from Eli Lilly and Company, *The Lilly Digest*, 1961, 1963, multiplied by the number of establishments from the *Census of Business*.

^c Board of Governors of the Federal Reserve System, *Industrial Production Indexes*, 1961-63, and *Industrial Production, 1957-1959 Base*.

^d 1963, *Progressive Grocer*, *Progressive Grocer*; 1954, Cox, Reavis, et al., *Distribution in a High Level Economy*, Englewood Cliffs, N.J., 1965.

^e Ford Motor Company dealer.

^f U.S. Bureau of the Census, *Census of Business*.

^g National Retail Merchants Association, *Merchandising and Operating Results*, various issues. Department and specialty stores until 1948, department stores only subsequently. 1954 data estimated by assuming the 1954-56 change in the average sale of "owned" departments applied to all departments.

^h Harris, Kerr, and Foster, *Trends in the Hotel-Motel Business, 1963*. Rate refers to both hotels and motels.