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PRODUCTIVITY IN SERVICES: THREE CASE STUDIES

Retail trade, barber and beauty shops, and medical care are important and diverse areas of the Service sector. These industries are large; they account for more than one-third of total Service sector employment—and for almost one-half if government is excluded. They are also representative in several respects. Many of the problems to be discussed in connection with retailing are also found in wholesaling and banking; the discussion of medical care has important analogues in education, religious and welfare services, and other professional services; and the lessons to be drawn from the case study of barber and beauty shops could be applied profitably to the study of laundry and dry cleaning and other personal services.

In two of the case studies, medical care and retailing, the problem of measuring real output is particularly great and receives major attention. Other issues that are given careful scrutiny in one or more of the studies are the quality of labor, the role of demand, and technological change.

Retail Trade

Retail trade is one of the largest industry groups in the economy. In 1967 there were 10 million persons engaged in retailing, as many as in mining, construction, transportation, communications, and public utilities combined. The course of productivity in retail trade has a significant impact on the trend for the economy as a whole, and the problem of measuring productivity correctly in this industry group is probably second only in importance and difficulty to that encountered for government. Because the problems with respect to government are well-known many investigators confine their analysis to productivity trends in the private economy. Such analyses are heavily influenced by trends in retailing, and more

explicit attention to the conceptual and statistical problems encountered in measuring retail output is therefore desirable.

Problems of Measuring Output

The Office of Business Economics and most other investigators measure the real output of retail trade by attempting to measure the real quantity of goods sold by retailers. The usual method is to deflate current dollar sales by an index of retail prices. The deflation is done separately for each retail store "type" where type is defined primarily in terms of the kinds of goods sold, e.g., food, apparel, lumber. The output of each type, weighted by the average gross margin [1] of that type, is summed in order to obtain the output for total retail trade. This assumes that differences in gross margin among store types reflect differences in the output produced by the retail store for each dollar's worth of goods sold.

The basic underlying assumption of this method is that the quantity and quality of service supplied by retailers per constant dollar's worth of goods sold remains constant over time within each store type.[2] This assumption is open to a number of objections; there are many aspects of retailing that may vary over time or cross sectionally.

1. Terms of sale: credit, delivery, guarantees, replacement of parts, repairs and services, return privileges.
2. Amenities provided to the customer: heating, air-conditioning, lighting, music, rest rooms.
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.
6. Demands on customer: time and effort required to accomplish purchase.

The period since 1929 has witnessed many changes in retailing, most notably in food, furniture and appliances, and general merchandise stores. The advent of supermarkets, "discount" houses, and "promotional" department stores is too well-known to need recounting here. The major difference between the newer type retail operations and the older ones is that the new ones typically operate with lower gross margins. Some observers interpret the lower margin as evidence of greater efficiency;

[1] Sales minus cost of goods sold, all divided by sales.

[2] However, the method of calculating the retail price indexes does partially reflect shifts within store types. See p. 101.

others believe it indicates that the store is providing less service (and hence less output) per dollar of goods sold.

The method used by the Bureau of Labor Statistics to calculate the price indexes that are used to deflate current dollar retail sales actually results in a compromise between the two positions described above. This is because the BLS specifications for a commodity typically include the "kind" of store as well as the characteristics of the commodity itself.[3] Thus, if bread sells for thirty cents per loaf in a small grocery store, and twenty-five cents per loaf in a supermarket, the BLS price index for bread would show no change, even if there was a marked shift of purchases from one kind of store to another, as long as the price in each store remained unchanged.

The following numerical example may help to clarify this point:

Kind of Store	*Wholesale Price*	*Margin*	*Retail Price*	*Quantity*	*Sales*
		Period 1			
Small grocery	$.20	$.10	$.30	80	$24.00
Supermarket	.20	.05	.25	20	5.00
				100	$29.00
		Period 2			
Small grocery	$.20	$.10	$.30	20	$ 6.00
Supermarket	.20	.05	.25	80	20.00
				100	$26.00

According to present methods of measuring real output in retailing in the United States, the index of real output would be 89.7 (i.e., 26 ÷ 29) because the price index used to deflate sales would be unchanged from period 1 to period 2. Those economists who regard the supermarket as simply a more efficient way of providing the same retail output per loaf of bread sold would say that this output index is biased downward. They would argue that the index should be 100, on the grounds that the same quantity of real goods was sold by retailers in both periods.

Others might argue that the index is biased upward. They would say that the difference in gross margin reflects differences in the quantity and quality of service supplied per loaf of bread sold. From this point of view,

[3] The term "kind" of store is used here to denote the form of operation, e.g., high margin or low margin within a particular store type. Food stores are a "type"; supermarkets are one "kind" within that type.

the real output index should be 66.7, the result obtained if deflated sales in each kind of store is weighted by its own margin and then summed.[4]

Where does the truth lie? No precise answer is possible. The fact that there has been a dramatic shift of business to the low-margin kinds of stores lends some support to the view that they are offering the same or similar service more efficiently. On the other hand, some high-margin stores continue to flourish, and it is apparent that the credit, delivery, and other services that they offer (and the low-margin store does not) are valued by some consumers.

If, in the example given above, we were to assume that one-half of the difference in margin represents greater efficiency, and one-half represents more output per loaf of bread sold in the high-margin store, we would conclude that the index of real output should be 84.2.[5]

An additional problem arises because, although the BLS commodity specifications identify the kind of store, they do not specify the quantity or quality of retail service supplied in that store. Thus, if a particular store altered its service over time, this would not be reflected in either the price index or the index of real output.

Casual observation suggests that many of the high-margin retailers, faced with the competition of the low-margin stores, have tended to reduce service in order to hold down prices and keep business. This is evident in the trend toward self-selection in department stores and self-service in small grocery stores.

Casual observation also suggests a number of reasons why a diminution in retail service per constant dollar of sales is not always perceived as such by the consumer. Many of the services that were formerly provided by the retailer, such as product information, guarantees, return privileges, and so on, are now supplied by the manufacturer. From the point of view of the consumer, and in terms of measuring real output in the economy as a whole, there has been no change. But in terms of allocating real output between retail trade and manufacturing, this trend has probably resulted in overstating the growth of output and productivity in retailing, and understating it in manufacturing.

To be sure, there may be some respects in which retailers have generally upgraded their service over time. Most stores are now air-conditioned; they probably have better lighting; and the display fixtures are probably more attractive and more functional. On the other hand, one cannot help being impressed with the extent to which prepackaging, pre-

[4] $\frac{20\ (.10) + 80\ (.05)}{80\ (.10) + 20\ (.05)}$

[5] $\frac{20\ (.10) + 80\ (.075)}{80\ (.10) + 20\ (.075)}$

labeling, and preselling by manufacturers have relieved the retailer of many of his former chores.

In addition, it is reasonably clear that some services that were formerly supplied by the retailer are now supplied by the consumer himself. This is most apparent in the case of food supermarkets, where the consumer typically waits on himself, provides his own delivery service, and, to the extent that he shops less frequently, provides storage service as well.

Because of other changes that have occurred—in automobile ownership, in the trend toward suburban living, in the increase in the value of the consumer's time—it may suit the consumer to do these things. When interviewed, he may respond that he "prefers shopping in the supermarket," but this does not negate the fact that the supermarket is providing less service.

David Schwartzman's point that the discount house and the supermarket are *not* post-'29 technological innovations has considerable force. Long before that time, retailers knew that it was possible to reduce margins by cutting out delivery and credit service and making other cuts in overhead. The growth of low-margin retailing must be regarded, at least in part, as a movement within a known production-function frontier, resulting from many exogenous changes in the economy rather than from a breakthrough in technology and productivity.[6] To choose an analogy, if consumers should decide that they prefer compact cars to large ones (because the price of gasoline has risen, or insurance is cheaper, or parking spaces are hard to find), and there is a shift of production to the easier-to-make compacts, the output of the automobile industry should not be considered unchanged if it produces the same number of cars as it did when most of the demand was for large ones.

Another conceptual problem, which is particularly important in retail trade (but is found to some degree in every industry), is the treatment of changes in the size of transactions. Let us suppose that the number of transactions and all other aspects of retail sales remain unchanged, except that each consumer buys twice as much in each transaction as before. Should we say that real output in retailing has doubled? Some economists have argued that because an increase in the size of the transaction nor-

[6] Schwartzman also emphasizes a substitution effect. He argues that consumers have substituted goods for retail service because the price of services has risen relative to the price of goods. Some evidence to support this view is found in cross-sectional studies of differences in sales per person among standard metropolitan statistical areas. See David Schwartzman, "The Growth of Sales Per Man-hour in Retail Trade, 1929–1963," *Production and Productivity in the Service Industries,* V. R. Fuchs, ed., NBER, in press.

mally does not require a proportionate increase in inputs, the volume of real goods should not be used as the measure of real output in retailing. It has been suggested that the number of transactions be used, or at least considered, in determining real output in retailing.[7]

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 the run," i.e., in the number of transactions, holding sales constant.

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 productivity in retailing can be attributed to change in the size of transactions.

Some Empirical Estimates

Having reviewed some of the pitfalls that beset attempts to measure output and productivity in retail trade, let us look at the available figures and see what they imply about trends in this industry, in absolute terms and relative to manufacturing. Table 37 is based on OBE figures for trade and manufacturing. Trade is a reasonably good proxy for retail trade because employment in retailing is three times as large as in wholesaling, and the trends for the two trade components have not been markedly dissimilar.[8]

It should be noted that the measures of labor input and total factor input are subject to the biases discussed in Chapter 3. The differential in the rates of growth of unionization in manufacturing and retailing was particularly marked, and probably accounted for .2 percentage points per annum of the differential in compensation per man. If an adjustment is made for this bias, the differentials in output per unit of labor input, and per unit of total factor input would be −.1 and −.35 respectively.

All three measures of productivity show relatively small differentials

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

[8] The Office of Business Economics provides a breakdown of persons engaged in trade back to 1929, but a similar breakdown for real gross product is not available. The rate of growth of employment in retail trade alone, 1929–65, was 1.4 per cent per annum compared with 1.5 per cent for total trade.

TABLE 37

Trends in Output and Productivity in Trade and Manufacturing, 1929–65
(per cent per annum)

	Trade	Manufacturing	Trade Minus Manufacturing
Gross product in current dollars	5.5	5.8	–0.3
Real output	3.1	3.7	–0.6
Employment	1.5	1.6	–0.1
Real output per man	1.6	2.1	–0.5
Real output per unit of labor input	n.a.	n.a.	0.1
Real output per unit of total factor input	n.a.	n.a.	–0.2
Compensation per man	3.6	4.2	–0.6

Note: Rates have been calculated from unrounded data.
Source: Appendix Table C–4.

between trade and manufacturing. This is surprising. Manufacturing is commonly regarded as having enjoyed significant technological change, and as being in the forefront of productivity advance. Notice has often been taken of the huge expenditures for research and development in manufacturing. Trade, on the other hand, is often regarded as a relatively static industry. Table 37 can be interpreted as saying that these casual impressions are incorrect. It may be that, despite the expenditures for research and development and the upgrading of physical and human capital in manufacturing, the true productivity differentials are small. An alternative interpretation, first advanced by David Schwartzman in his NBER study, is that the real output measure for trade is biased upward relative to manufacturing.

Table 38 presents some other results that are more speculative in character. Included are estimates derived from David Schwartzman's attempt to measure output and input independently. Use is also made of Edward Denison's estimates of labor input, capital input, and total factor input for the total economy.[9]

[9] Denison's *The Sources of Economic Growth in the United States and the Alternatives Before Us*, New York, 1962, p. 265. Denison estimated the rates of change for 1929–57 as 2.16 per cent, 1.88 per cent, and 2.10 per cent for labor input, capital input, and total factor input, respectively. The rate of growth of labor input slowed down between 1957 and 1963, and capital input was somewhat faster. An estimate of 2.0 for both variables for the entire period seems warranted. This would result in a figure of 2.0 for total factor input also, regardless of the weights assigned to each factor.

TABLE 38

Some Alternative Estimates of Rates of Change of Output, Input, and Productivity in Retail Trade, 1929–63
(per cent per annum)

	(1)	(2)
Real output [a]	2.8	1.3
Employment [b]	1.6	1.6
Labor input [c]	1.5	0.5
Total factor input [d]	2.0	0.8
Output per unit of total factor input	0.8	0.5
Attributable to:		
Capacity and scale economies [b]	0.2	0.2
Transaction size [b]	0.8	0.8
Unexplained residual	−0.2	−0.5

Source: David Schwartzman, "Retail Trade in the United States, 1929–63," NBER manuscript: Denison, *Sources of Economic Growth.*

[a] Col. 1, Schwartzman's estimate of margin-weighted-constant dollar sales; col. 2, first figure adjusted for Schwartzman's estimate of a change in service per transaction of −1.5 per cent per annum.

[b] Schwartzman.

[c] Col. 1, derived from Denison's estimate of change in labor input for total economy and the difference between the change in total labor compensation in retail trade and in the total economy (−0.5 per cent per annum); col. 2, Schwartzman's estimate based on independent estimates of change in hours per man (−.5 per cent per annum) and change in labor quality (−.6 per cent per annum) in retail trade.

[d] Col. 1, equal to Denison's estimate for total economy inasmuch as rate of change of current dollar output in retail trade is equal to that for the total economy; col. 2, Schwartzman's estimate based on weighted average of capital input (1.8 per cent per annum) and labor input.

Schwartzman estimates the rate of change of deflated retail sales as 2.8 per cent per annum in 1929–63. Since the gross product in current dollars grew at the same rate in retail trade as in the total economy, we can assume that total factor input also grew at about the national rate, which Denison estimates at about 2.0 per cent per annum. This implies a rate of growth of total factor productivity of .8 per cent per annum. Schwartzman estimates that fuller use of capacity and realization of scale economies explains about .2 percentage points of the growth of retail trade output, and that increases in the average size of transactions explains about .8 percentage points.

The second column in Table 38 shows a much lower rate of change

of real output which, in Schwartzman's view, takes account of the decline in the quantity and quality of service provided by retailers. The estimate of total factor input is also very much lower, first because Schwartzman finds a decrease in the quality of labor in retail trade since 1929 and second because Schwartzman takes the decrease in hours at full value rather than allowing for an offsetting increase in output per man-hour as Denison does. Since the rates for both output and input are sharply reduced, the implied change in productivity is similar to that shown in the first column.

My own view is that the true measures of changes in real output and labor and total factor input probably fall somewhere between those shown in the columns of Table 38. I believe that there probably has been some decline in service per constant-dollar's worth of goods sold, and I believe there is some upward bias in Denison's measures of factor input. There is no reason why the residual should be negative.

Barber and Beauty Shops *

The measurement of real output in barber and beauty shops appears to be relatively straightforward. Current dollar receipts in the *Censuses of Business* are deflated by price indexes compiled by the Bureau of Labor Statistics. Trends in current dollar receipts are believed to be fairly accurate; the principal source of uncertainty is the differential coverage of very small establishments in different Census years.[10] The price indexes are based on reported prices for reasonably standard services such as haircuts and permanent waves. The growth in importance of many new services in beauty shops in the past two decades may introduce some bias into the price index for that industry.

The principal interest in this case study concerns the sources of growth of output per man, and particularly the differential trends in two apparently similar industries. Both barber and beauty shops are typically small: fewer than half of the shops in each industry have as many as one paid employee. They are also highly labor intensive; the capital investment per

* Most of this section is drawn from the work of Jean Wilburn at the National Bureau of Economic Research. Her work is reported in greater detail in Victor R. Fuchs and Jean Alexander Wilburn, *Productivity Differences Within the Service Sector,* New York, NBER, OP 102, 1967.

[10] Two issues are involved. First, the Bureau of the Census periodically changes the definition of firms considered too small to be included in the Census. Second, the "enumerator misses" of firms that should be covered probably varies from one Census to another.

worker is probably under $2,000. Together, the two industries employ over half a million persons and have receipts of over $250 million.[11]

Despite the many similarities between barber and beauty shops with respect to function and market structure, they have experienced divergent trends in output, employment, productivity, and prices, as indicated in Table 39. Productivity has risen much more rapidly in beauty shops than in barber shops, especially since 1948. Prices in beauty shops have risen much more slowly than in barber shops. The reasons for the disparate trends can be discussed under three related categories: labor, technology, and demand.

Labor

The labor force in both industries has shown a significant shift in age distribution over the last several decades. (See Table 40.) In the case of barber shops, the shift probably tended to lower productivity; in beauty shops, it had the opposite effect. Barber shops now rely heavily on older men; more than one-third of the barbers are over 55. The work is physically demanding, and some decrease in speed is to be expected with age. This is not likely to be offset by any increase in quality because maximum proficiency is reached long before the age of 55. In beauty shops, the shift in age distribution has been away from very young, inexperienced workers to persons of middle age. This is advantageous because the greater complexity of work in beauty shops provides greater opportunity for additional years of experience to be reflected in increased productivity.

The other major change in labor input that has implications for productivity is the rapid growth of part-time employment in beauty shops, but not in barber shops (see Table 41). Given the uneven flow of demand (to be discussed), the employment of part-time labor raises productivity because it is only used when demand is heavy. Most of the workers in beauty shops are female, and many of them prefer part-time employment. Barbers are almost exclusively male, and nearly all work full time.

Technology

The technological changes that have had the greatest effect on barber shops are the development of the safety razor and the electric razor. Both innovations resulted in a sharp decrease in the demand for shaves in barber shops. In the late 1920's, shaves accounted for a substantial frac-

[11] *Census of Business,* 1963.

TABLE 39

Rates of Growth of Barber and Beauty Shops, Selected Variables, 1939–63
(per cent per annum)

	1939–63			1939–48			1948–63		
	Barber Shops	Beauty Shops	Barber Minus Beauty	Barber Shops	Beauty Shops	Barber Minus Beauty	Barber Shops	Beauty Shops	Barber Minus Beauty
Current dollar output	5.7	7.8	−2.1	6.2	6.1	0.1	5.4	8.8	−3.4
Price	5.2	3.8	1.4	7.1	6.7	0.4	4.1	2.1	2.0
Real output	0.5	4.0	−3.5	−0.9	−0.6	−0.3	1.3	6.7	−5.4
Employment	−0.1	2.5	−2.6	−2.0	−1.7	−0.3	1.0	5.0	−4.0
Real output per man	0.6	1.5	−0.9	1.1	1.1	0.0	0.3	1.7	−1.4

Source: Appendix Table G-1.

TABLE 40

Percentage Distribution of Barbers and Beauticians, by Age, 1930–60

Years [a]	16–24	25–34	35–44	45–54	55–64	65+	55 Years and Over	Median Age
Barbers								
1930	11.6 [b]	26.6	29.0	19.4	9.3	2.9	12.2	37.8
1940	4.9	20.4	28.2	26.4	14.8	5.4	20.2	43.4
1950	4.8	15.1	21.9	26.6	21.6	10.1	31.7	47.6
1960	6.9	17.2	17.6	23.5	21.7	13.3	35.0	48.1
Beauticians								
1930	26.6 [b]	37.1	23.9	8.0	1.8	0.4	2.2	29.3
1940	34.5	34.2	20.6	8.3	2.0	0.4	2.4	28.5
1950	16.3	34.2	29.7	13.9	4.7	1.0	5.7	34.3
1960	15.6	20.3	33.2	20.7	7.9	2.3	10.2	38.7

Source: *Census of Population*, 1930, 1940, 1950, 1960.

[a] For 1930, the concept is "gainful workers"; for the remaining years, it is "employed persons." For 1930, 1940, and 1950, males are assumed to be barbers and females, beauticians; for 1960, the two occupations are listed separately: barbers are the sum of male and female barbers; the same is true of beauticians.

[b] 18–24 years. This row will not total 100 per cent since years 16–17 have been omitted.

TABLE 41

Percentage of Barbers and Beauticians Working Part-Time,[a] 1940, 1950, 1960

	1940	1950	1960
Barbers			
Wage and salary workers	5.1	7.6	n.a.
Employed persons	n.a.	6.4	10.7
Beauticians			
Wage and salary workers	11.1	20.2	n.a.
Employed persons	n.a.	23.4	30.1

Note: Since "barbers and beauticians" were classified as a single occupation in 1940 and 1950, a division of the occupation has been arbitrarily made here on the assumption that barbers are males and beauticians are females. In 1960 the occupations were listed separately. If the same assumption had been made in 1960 as in the previous years, the figures would have been 9.9 for barbers (instead of 10.7) and 32.8 for beauticians (instead of 30.1).

Source: *Census of Population*, 1940, pp. 171–172; 1950, pp. 18–139, 145, 151, 157; 1960, pp. 191–201.

[a] Less than 35 hours per week.

tion of the industry's output; by the 1960's, shaves were of negligible importance in most shops.

The effect of these new razors on productivity of shaving in the home was very great, but this, of course, is not reflected in the data for the barber shop industry. The effect on measured productivity was probably adverse because it cut down the flow of customers to barber shops and tended to limit the typical transaction to one service—a haircut.[12]

Two technological changes in barber shops—the electric clipper and the electric lather-making machine—apparently had only a minor impact on productivity, though no measure of it is available. A barber can cut hair more rapidly with clippers than with scissors, but there may be some decline in the quality of the service. The time required for lather making is small regardless of method.

The principal technological changes in beauty shops, in contrast, have had a significant impact on productivity through reductions in the costs of providing services, improvements in quality, and stimulation of demand.

The first big stimulus was provided by the permanent-wave machine.

[12] Specialization normally increases productivity, but this assumes no decrease in demand.

This was introduced in the beginning of this century, but did not become commercially important until the 1920's when women began to wear short hair. Given the increase in demand for permanent waves resulting from the change in fashion, research was stimulated and a number of improvements in the original heat process were introduced throughout the 1930's. In the early 1940's, the cold-wave permanent was discovered. The new process was originally much more expensive than the heat process, and the effectiveness of its results was controversial. In the past two decades, however, numerous minor technological improvements have resulted in making an improved service available at a much lower price. The reduction in price has in turn reinforced the fashion trend. The cold-wave process, which cuts labor requirements in half and reduces discomfort and risk, has completely replaced the heat process.

A similar interaction between technology, fashion, and productivity can be observed with respect to hair coloring. Tinting agents have been available since 1920. Demand was small, however, because the quality of the product was imperfect and fashion trends were not favorable. Several technological improvements introduced during the past two decades have reduced the time required for hair tinting, improved the quality of the product, and increased the range of colors available. At the same time, fashion trends have favored artificially colored hair. This service now represents a substantial fraction of total beauty shop output.

The innovations in waving and coloring hair have been the most important ones for this industry in recent decades, but there have been several other technological innovations that have contributed to increased productivity in beauty shops. Some, such as reductions in the time required to dry hair, increased productivity in much the same way that a reduction in processing time improved productivity in manufacturing, or any other industry. Other innovations, however, do not affect processing time directly, but take the form of new products and processes, or improvement in old ones, that stimulate demand. Examples include: nail enamel, facial packs, and rinses. These developments have made a favorable contribution to productivity through increased demand.

Demand

It is a well-established proposition that productivity tends to vary with the "length of the run." In retailing and personal services, such as barber and beauty shops, the "run" is the total purchase of a customer at one time. The effort required to sell a customer X dollars' worth of merchandise, or to provide X dollars' worth of service is normally less than twice that required to sell or provide one-half X dollars' worth.

The shift of shaving from barber shops to the home has adversely affected demand and productivity in barber shops in several ways. First, it has reduced the total demand for barbering services because of the almost complete elimination of shaves. Second, it has probably reduced the demand for haircuts and other barber shop services, because part of the cost of these services is the time spent going to and from the barber shop.[13] When men visited the barber shop frequently for shaves, the cost (including time) of haircuts and other services was relatively lower. Finally, the size of the average transaction was reduced.

In beauty shops the trend has been in the other direction. A single transaction now may include a haircut, a wave or set, hair coloring, manicure, facial, etc. Large transactions tend to enhance productivity because the fixed cost of the set-up time is spread over a larger number of services. Also, frequently more than one service can be performed at the same time. Finally, there is greater latitude and flexibility in planning and timing the work load.

The implications for productivity of the relatively weak demand for barbering services is reflected in the hourly earnings of barbers. According to figures derived from the 1/1,000 sample of the *1960 Census of Population,* the average hourly earnings of barbers in 1959 was $1.68 including tips.[14] A good way of determining whether this is a high or low figure is to compare it with the earnings of other workers having similar demographic characteristics. By classifying workers in all nonagricultural occupations by color, age, sex, and education, and calculating hourly earning rates for each category, it is possible to estimate what barbers would have earned if their earnings had equaled those of other workers having similar characteristics.[15] This figure, known as "expected" earnings, was $2.51 for barbers in 1951. The ratio of actual to "expected" earnings was .67, or only two-thirds of what was expected given the demographic characteristics of barbers. The low hourly earnings of barbers relative to "expected" earnings applies to wage and salary workers as well as to the self-employed, and is true regardless of nativity status, as may be seen in Table 42. This comparison is limited to white males to eliminate effects of sex and color.

Comparable figures for beauticians suggest that their time is spent much more productively. Average hourly earnings of $1.64 in 1959 were

[13] It should be noted that real output per capita of barber shops declined at the rate of 1 per cent per annum between 1939 and 1963.

[14] The accuracy of the hourly earnings figure has been investigated and substantially confirmed by earnings data from the 1958 *Census of Business.* See Fuchs and Wilburn, *Productivity Differences Within the Service Sector,* pp. 91–94.

[15] See Chapter 6 for a fuller discussion of this approach.

TABLE 42

Hourly Earnings of White Male Barbers, by Class of Worker and Nativity, Actual and Expected, 1959

	Number in Sample	Actual Hourly Earnings (dollars)	Expected Hourly Earnings (dollars)	Actual ÷ Expected
Class of Worker				
Self-employed	84	1.85 (.03)	2.63	.70
Wage and salary workers	60	1.61 (.10)	2.55	.63
Nativity				
Native, native parents	95	1.71 (.09)	2.61	.65
Native, one or both parents foreign-born	28	1.93 (.16)	2.67	.72
Foreign-born	21	1.73 (.23)	2.46	.70

Note: Numbers in parentheses indicate standard deviation. Expected earnings based on earnings in all nonagricultural occupations for comparable color, age, sex, and education.

Source: *U.S. Census of Population and Housing: 1960. 1/1,000, 1/10,000 Sample.*

close to "expected" earnings of $1.80. The ratio of actual to "expected" was .91, indicating that beauticians earned almost as much as did workers with similar demographic characteristics in other industries.

The low earnings of barbers, compared with the price of haircuts, suggests that barbers, on average, are idle more than half the time. The average price of a haircut in 1959 can conservatively be estimated at $1.50. A barber working steadily could give three haircuts in an hour, and thus gross $4.50 plus an estimated $.50 in tips. The return to labor in this industry is not less than 75 per cent (the rate paid to barbers working on a straight commission basis) and is probably over 80 per cent. Thus, a fully occupied barber would earn about $4.00 per hour. The difference between this figure and the actual earnings of only $1.68 per hour reflects the time spent in waiting for customers.

Both barber and beauty shops are subject to an uneven flow of demand. Business is likely to be brisk toward the end of each week and

before holidays. As was indicated in Table 41, beauty shops cope with this uneven flow through extensive use of part-time labor. There are very few part-time barbers. One possible explanation is that most males are looking for full-time work, and barbering has been traditionally a male occupation. The legal requirements for obtaining a license as a barber are considerable.[16] Also, the skill requirements, though not great, are sharply different from those of other occupations, Thus, barbering is not an attractive occupation for students, moonlighters, and other males who do seek part-time jobs.

The high value placed by our society on at least nominal employment also should be considered. As has been indicated, a substantial fraction of the labor force in barber shops consists of older men. These men, many of whom are paid on a commission basis, prefer to be nominally employed, even when demand is very light, than to be unemployed. Given their age, and their specialized skill, there are few good alternatives available to them. The industry appears to have low productivity, but as Jean Wilburn has pointed out, forced retirement or part-time unemployment would raise measured productivity without necessarily being socially advantageous.[17]

Medical Care

The medical care industry, defined to include the services of physicians and other health professionals plus the capital, labor, and intermediate goods used at their direction, is one of the largest and fastest growing in the entire economy. In round numbers, expenditures for medical care have risen from under $4 billion in 1929 to over $40 billion in 1965 and close to $50 billion in 1967. Even as recently as 1947, expenditures were only $10 billion.[18] The share of total spending allocated to medical care has also been rising, from under 4 per cent in 1929 to about 6 per cent

[16] Every state, except one, requires some barber school attendance; the number of hours required ranges from 900 to 2,000. Examination after graduation, before the period of apprenticeship begins, is customary; the fee for examination is as high as $50 in some states and as low as none or $5 in others. The period of apprenticeship, during which earnings are restricted by law, ranges from 6 to 36 months. Following the apprenticeship there is another examination costing from $5 to $50. A further barrier to entry is created by the refusal of some states to give credit for out-of-state experience. Formal educational requirements exist in most states and range from 8 through 12 years. Many of the requirements appear to be excessive.

[17] *Ibid.*. p. 108.

[18] Part of this increase was due to the sharp rise in medical care prices. In terms of 1967 medical care prices, the increase has been from $10 billion in 1929 to $21 billion in 1947 to $46 billion in 1965.

in recent years. Nearly all of this relative increase has occurred since 1947. The rise in spending has been accompanied by a rapid rise in employment. The average annual increase in medical care employment in the postwar period has been about 5 per cent.

Despite its size, the medical care industry has not received a great deal of attention from economists.[19] The measurement and analysis of productivity in this industry have been particularly neglected, largely because of conceptual and statistical difficulties. Undoubtedly the greatest difficulty is that of measuring the output of the industry. Traditionally, output has been measured in terms of the number of physician visits, or number of patient-days in a hospital. This approach is roughly comparable to measuring the output of the automobile industry in terms of the number of cars produced without regard to size, durability, performance characteristics, and so on. For an industry that has experienced rapid technological change, as medical care has, such an approach cannot be regarded as satisfactory and provides only a crude approximation to the desired measure.

The official data on expenditures, price, and employment yield the rates of change shown in Table 43. They imply an average rate of growth of real output per man of about 1 per cent per annum between 1929 and 1965.[20] It is of some interest to note that this rate is midway between the rate for the total economy (1.9 per cent) and zero. If medical care were provided by the government, a zero rate would be assumed just as it is for other governmental services. This points up the probable bias in this assumption.

To the extent that the price indexes for medical care fail to take account of changes in the quality and quantity of service associated with a visit to a physician, or a day spent in a hospital, the existing measures of real output may be biased upward or downward. Many observers believe the latter to be more likely because of significant advances that have been made in medical science, as evidenced by declines in mortality, and so on. Yoram Barzel has attempted to develop a price index for medical care based on changes in the price of health insurance plans.[21] He concludes

[19] For a review of the relevant literature see Herbert E. Klarman, *The Economics of Health*, New York, 1965. See also, Selma J. Mushkin, "Health as an Investment," *Journal of Political Economy*, Supplement 70, October 1962, pp. 129–157, and Martin Feldstein, *Economic Analysis for Health Service Efficiency*, Amsterdam, 1967.

[20] The dramatic differences between subperiods probably reflect offsetting biases in the price index more than real phenomena.

[21] Yoram Barzel, "Productivity and the Price of Medical Service," University of Washington, Mimeograph.

TABLE 43

Rates of Growth of Medical Care Industry, Selected Variables, 1929–65 and Subperiods
(per cent per annum)

Variables	1929–65	1929–47	1947–65	1947–56	1956–65
Current dollar output	7.0	5.8	8.1	7.7	8.5
Price	2.5	1.6	3.5	3.8	3.2
Real output	4.5	4.2	4.6	3.9	5.3
Employment	3.6	2.3	4.9	5.2	4.7
Real output per man	0.9	1.9	−0.3	−1.3	0.6

Sources

Current dollar output: **1929,** Ida C. Merriam, "Social Welfare Expenditures, 1965–66," *Social Security Bulletin,* 29, No. 12 (December, 1966); **1965,** Ruth S. Hanft, "National Health Expenditures, 1950–65," *Social Security Bulletin,* 30, No. 2 (February, 1967); **1947** estimated by assuming that the proportion of the 1945 to 1950 change which took place between 1945 and 1947 was the same for the Merriam series as for the OBE series on personal consumption expenditures for medical care published in *The National Income and Product Accounts of the United States, 1929–1965;* **1956,** Hanft series benchmarked to OBE.

Price: Medical care component of Consumer Price Index with no change assumed between 1929 and 1935.

Employment: *Census of Population, 1940, 1950, and 1960* with extrapolation and interpolation based on number of persons engaged. The rates of change of persons engaged were used for 1929–40 and 1960–65. Employment in 1947 was estimated assuming that the proportion of the 1940 to 1950 change which took place from 1940 to 1947 was the same for census employment as for persons engaged. A similar procedure was used for 1956.

that the BLS price index has a strong upward bias. On the other hand, it should be noted that the cost of treating specific episodes of illness for five fairly common conditions appears to have risen more rapidly than the BLS medical care price index between 1951 and 1965.[22] This suggests a possible downward bias in the index. Much work will have to be done before the question is resolved.

The problem of measuring changes in the real output of the medical care industry consists of three parts. First the various types of output must be defined; second, the changes in each type must be quantified; and third, the various types must be made commensurate, that is the changes must be translated into dollar equivalents.

At least three types of output are readily apparent. Probably the most

[22] See Anne A. Scitovsky, "Changes in the Cost of Treatment of Selected Illnesses, 1951–65," *American Economic Review,* December 1967, pp. 1182–1195.

important one is the contribution that medical care makes to health. This surely is uppermost in the minds of consumers when they purchase medical care. In addition, physicians frequently provide a "validation service," i.e., an evaluation of an individual's health status, that may be required by third parties. Such an evaluation represents output independent of its effect on health, as in the case of a life insurance examination. Finally, there are a number of other consumer services provided in connection with medical care, e.g., the room-and-board aspects of hospitalization.

The following discussion concentrates on the problem of putting a dollar value on the health-affecting aspects of medical care.

First we must be able to define and measure health levels, or at least changes in levels. Second, we must say what these changes are worth; and third, we must estimate what portion of the changes can be attributed to the medical care industry as distinct from genetic and environmental factors that also affect health.[23]

Measures of Health

Definitions of health abound, but agreement is hard to find.[24] A few points seem clear. First, health has many aspects—anatomical, physiological, mental, and so on. Second, the relative importance of different disabilities varies considerably, depending upon the particular culture and the role of the particular individual in that culture. Third, most attempts at measurement take the negative approach; that is, they make inferences about health by measuring the degree of ill health as indicated by mortality, morbidity, disability, etc. Finally, as in so many other cases, detecting changes in health is easier than defining or measuring absolute levels.

The most widely used indicators of health levels are those based on mortality rates, either age-specific or age-adjusted. The great virtue of death rates is that they are determined objectively, are readily available in considerable detail for most countries, and are reasonably comparable for intertemporal and interspatial comparisons.

Table 44 shows the trends in death rates and infant mortality rates in the United States since 1929. Substantial reductions have been achieved

[23] A discussion of these three questions, summarized here, can be found in V. R. Fuchs, "The Contribution of Health Services to the American Economy," *Milbank Memorial Fund Quarterly,* October 1966.

[24] Compare, for example, the World Health Organization's definition: "A state of complete physical and mental and social well being" (World Health Organization Constitution Annex 1, Geneva, 1958), with Ffrangcon Roberts' emphasis on the absence of, or the ability to resist, disease and death in *The Cost of Health,* London, 1952.

TABLE 44

U.S. Death Rates, Selected Years, 1929–65

	Crude Death Rates (per 1,000 persons)	Age-Adjusted Death Rates [a] (per 1,000 persons)	Infant Death Rates (per 1,000 live births)
1929	11.9	13.2	67.6
1935	10.9	11.6	55.7
1940	10.8	10.8	47.0
1945	10.6	9.5	38.3
1950	9.6	8.4	29.2
1955	9.3	7.7	26.4
1960	9.5	7.6	26.0
1965	9.4	7.4	24.7

Sources

Crude and infant death rates: **1929–40,** U.S. Bureau of the Census, *Vital Statistics Rates in the United States, 1900–1940* (16th Census of the U.S.: 1940), 1943, pp. 124, 573; **1945–65,** U.S. Bureau of the Census, *Statistical Abstract of the United States,* 1965, p. 47; 1967, *ibid.,* p. 56.

Age-adjusted death rates: **1929–40** and **1950–55,** U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957* (A *Statistical Abstract* Supplement), 1961, p. 27; **1945,** U.S. Department of Health, Education and Welfare, *Vital Health Statistics,* "Mortality Trends in the United States 1954–1963," National Center for Health Statistics, Series 20, Number 2, 1966, p. 7; **1960–65,** U.S. Bureau of the Census, *Statistical Abstract of the United States,* 1967, p. 56.

[a] Age-adjusted death rates are computed by the direct method, i.e., age-specific death rates for each year have been applied to the age distribution of the total population of the United States as enumerated in 1940.

since 1929, but the relative stability of these rates since 1955 also deserves notice. Some have argued that we are approaching a biological minimum, but many European countries enjoy much lower rates, and large interstate differences within the United States indicate that further declines are biologically feasible.

During this period of relative stability in death rates, the inputs into the medical care industry have increased considerably, and medical science has certainly made some progress. This has suggested to some people that there *must* have been improvement in health levels not reflected in the mortality indexes. This type of reasoning begs the question. An alternative explanation is that changes in environmental factors over the same period have had, on balance, a negative effect on health, thus offsetting the favorable effects of increases in medical care and medical

knowledge. Such changes might include increases in smoking and drinking, air pollution, lack of exercise, and the tensions of urban life.

Some suggestions have been made for indexes of health that would combine mortality and morbidity information.[25] One possibility, suggested by Sanders, would be to calculate years of "effective life expectancy," using mortality and morbidity rates to measure the number of years that a person could expect to live and be well enough to fulfill the role appropriate to his sex and age. This approach could be modified to take account of the fact that illness or disability is a matter of degree. The years deducted from life expectancy because of disability should be adjusted by some percentage factor that represents the degree of disability. The determination of these percentage weights is one of the most challenging research problems to be faced in calculating an index of health.

The Value of Changes in Health

An increase in health has two potential values for individuals—consumption and production. Good health is clearly something consumers desire for itself. In addition, better health may contribute to an individual's productive capacity. It may do this, first, by increasing the supply of potential man-hours through a reduction in mortality or in time lost because of illness and disability. Second, better health may increase production by improving productivity, i.e., increasing output per man-hour.

No measures of the value of health in consumption are available. Surprisingly, there is also a dearth of information on the relation between health and output per man-hour. The available measures of the value of changes in health deal primarily with the effect of these changes on potential man-hours of work.

One frequently used approach is to ask how many more people are available for work as a result of a decrease in death rates, and what potential or actual production can be attributed to this increased supply of manpower. The capitalized value of the increase, at a given point in time, can be obtained by summing the value of future potential earnings discounted at some appropriate rate of interest.

[25] See D. F. Sullivan, "Conceptual Problems in Developing an Index of Health," in *Vital and Health Statistics, Data Evaluation and Methods of Research,* Public Health Service Publication No. 1,000, Series 2, No. 17, Washington, D.C., May 1966, and B. S. Sanders, "Measuring Community Health Levels," *American Journal of Public Health,* July 1964, pp. 1063–1070.

The details of such calculations vary greatly from one investigator to another, but one result is common to all: the value of a man (in terms of discounted future earnings) is very different at different ages. It rises steadily from birth and reaches a peak at about age 30 or 35. Peak values may vary from two to ten times the values at birth depending upon the rate at which future earnings are discounted. After the peak, values decline steadily and approach zero at very old ages.

The principal implication of the age-value profile is that the economic return from saving a life is not the same at all ages. Different kinds of health programs, and different kinds of medical research, affect various age groups differently; in estimating the output of the medical care industry, therefore, some consideration must be given to these matters. For example, accidents accounted for only 6.6 per cent of all male deaths in the United States in 1960, but accounted for 12.8 per cent of the economic cost of these deaths as measured by 1960 earnings discounted at the rate of 7.2 per cent per annum. On the other hand, vascular lesions accounted for 9.5 per cent of all male deaths but only 5.7 per cent of the value of discounted future earnings.[26]

To obtain some notion of the economic value (in terms of discounted future earnings) of the decline in death rates between 1929 and 1960, the 1929 rates were applied to the 1960 U.S. male population and compared with the actual deaths in 1960. There would have been approximately 475,000 more male deaths at the 1929 rate, and the discounted value (at 7.2 per cent per annum) of these lives amounted to $14 billion. A similar comparison between the U.S. male deaths in 1960 and the substantially lower Swedish male death rate in 1960 shows a potential saving of 220,000 lives annually, with a discounted future earnings value of $7.5 billion if the U.S. age-specific rates could be reduced to Swedish levels. These are large sums, but the connection between death rates and medical care is not obvious and requires considerable investigation.

The Contribution of Medical Care to Health

The impact of medical care on health depends upon the answers to two questions: (1) How effective are the best known techniques of diagnosis, therapy, etc.? (2) How wide is the gap between the best known techniques ("treatment of choice") and those actually used across the country? The second question has been reviewed extensively

[26] See Victor R. Fuchs, "The Contribution of Health Services to the American Economy," *Milbank Memorial Fund Quarterly,* October 1966.

in medical literature under the heading "quality of care." [27] A useful introduction to the first question is provided by Terris.[28]

Infectious disease is an area where medical services are demonstrably effective. Although the decline of some infectious diseases (e.g., tuberculosis) can be credited in part to environmental changes, such as improved sanitation, the important role played by improvements in medical science should not be downgraded. For many infectious diseases the health service is preventive rather than curative and "one-shot" rather than continuous. Such preventive services do not occupy a large portion of total physician time, but the results should nevertheless be included in the output of the health industry.

Examples of infectious diseases controlled through immunization are diphtheria, tetanus, and poliomyelitis; chemotherapy is effective in tuberculosis and pneumonia.[29] The decline in mortality from these causes has been dramatic, and some correlation can be observed between changes in the rate of decline and the adoption of specific medical advances. For example, during the fifteen-year period, 1935 to 1950, which spanned the introduction and wide use of sulfonamides and penicillin, the United States death rate from influenza and pneumonia fell at a rate of more than 8 per cent per annum; the rate of decline was 2 per cent per annum from 1900 to 1935. In the case of tuberculosis, considerable progress was made throughout this century, but the relative rate of decline in the death rate accelerated appreciably after the adoption of penicillin, streptomycin and PAS (para-aminosalicylic acid) in the late 1940's, and of isoniazid in the early 1950's.

The situation with respect to the noninfectious diseases is more mixed. Some examples of demonstrable effectiveness are the following: replace-

[27] See Alice L. Anderson and Isidore Altman, *Methodology in Evaluating the Quality of Medical Care, An Annotated Selected Bibliography, 1955–61,* Pittsburgh, 1962.

[28] Milton Terris, "The Relevance of Medical Care to the Public Health," paper delivered before the American Public Health Association, November 13, 1963.

[29] For further information on the control of these diseases, see George Rosen, "The Bacteriological, Immunologic and Chemotherapeutic Period 1875–1960," *Bulletin of the New York Academy of Medicine,* 40, 1964, pp. 483–494; A. P. Long and P. E. Sartwell, "Tetanus in the U.S. Army in World War II," *Bulletin of the U.S. Army Medical Department,* April 1947, pp. 371–385; A. P. Long, "Immunization to Tetanus," in Army Medical Services Graduate School, *Recent Advances in Medicine and Surgery,* Walter Reed Army Institute of Research, Washington, 1955, pp. 311–313; American Medical Association, *Commission on the Cost of Medical Care Report,* Chicago, 1963–64, Volume III, Chapters 4 and 7; and Monroe Lerner and Odin W. Anderson, *Health Progress in the United States, 1900–1960: A Report of the Health Information Foundation,* Chicago, 1963, p. 43.

ment therapy has lessened the impact of diabetes, dental caries in children are reduced by fluoridation, and medical care has become increasingly successful in treating trauma.[30] The diagnostic value of the Papanicolaou test for cervical cancer is established, and the incidence of invasive cancer of this site has been reduced in the 1960's, presumably due to medical treatment during the preinvasive stage disclosed by the test. Also effective is the treatment of skin cancer.[31]

Less heartening are the reports on other cancer sites. The five-year survival rate for breast cancer (the most common single organ site of malignancy in either sex) is typically about 50 per cent.[32] Some writers stress the importance of prompt treatment for cancer; others question whether elimination of delay would dramatically alter survival rates. The problem of delay itself is complex, and not simply attributable to ignorance or lack of access to health services: "Physicians with cancer are just as likely to delay as are laymen." [33]

Heart disease is another major cause of death where the contribution of health services to health leaves much to be desired. Despite the contributions of surgery in correcting congenital and rheumatic cardiac defects and the decline in recurrence rates of rheumatic fever, apparently no curative treatment has been found for this disease.[34] The treatment

[30] Herbert H. Marks, "Longevity and Mortality of Diabetics," *American Journal of Public Health,* March 1965, pp. 416–423; World Health Organization, *Expert Committee on Water Fluoridation, First Report,* Technical Report Series, No. 146, Geneva, 1958; and A. W. Farmer and B. S. Shandling, "Review of Burn Admissions, 1956–1960—The Hospital for Sick Children," *Journal of Trauma,* September 1963, pp. 425–432.

[31] R. F. Kaiser *et al.,* "Uterine Cytology," *Public Health Reports* 75, 1960, pp. 423–427; John E. Dunn, Jr., "Cancer of the Cervix—End Results Report," in National Cancer Institute and American Cancer Society, *Fifth National Cancer Conference Proceedings,* Philadelphia, 1956, pp. 253–257; and Edward T. Krementz, "End Results in Skin Cancer," in National Cancer Institute and American Cancer Society, *Fourth National Cancer Conference Proceedings,* Philadelphia, 1961, pp. 629–637.

[32] Edwin F. Lewison, "An Appraisal of Longterm Results in Surgical Treatment of Breast Cancer," *Journal of the American Medical Association,* December 14, 1963, pp. 975–978.

[33] Robert Sutherland, *Cancer: The Significance of Delay,* London, 1960, pp. 196–202.

[34] John Stout *et al.,* "Status of Congenital Heart Disease Patients Ten to Fifteen Years After Surgery," *Public Health Reports,* 79, May 1964, pp. 377–382; May G. Wilson *et al.,* "The Decline of Rheumatic Fever—Recurrence Rates of Rheumatic Fever Among 782 Children for 21 Consecutive Calendar Years," *Journal of Chronic Diseases,* March 1958, pp. 183–197; The Rheumatic Fever Working Party of the Medical Research Council of Great Britain and The Subcommittee of Principal Investigators of the American Council on Rheumatic Fever and Congenital Heart Disease, American Heart Association, "Treatment of Acute Rheumatic

of coronary heart disease is only partially effective.[35] Definitive therapy is still not available for widespread afflictions such as cerebral vascular disease, and no cure is known for schizophrenia.[36]

Innovations in medical care are not limited to improvements in drugs, surgical techniques, or other technological changes. Research concerning the effects on health of group practice, intensive care units, and special arrangements for neonatal surgery has yielded encouraging results.[37] In other cases, results have been disappointing, e.g., multiple screening, periodic medical examination of school children, and cancer control programs differing in duration, intensity, and cost.[38]

This very brief review indicates that no simple generalization is possible about the effect of medical care on health. Although many health services definitely improve health, in other cases even the best-known techniques may have no effect. This problem of relating input to output is one of the most difficult ones facing economists who try to do research on the medical care industry. They must gain the support and advice of doctors and public health specialists if they are to make progress in this area.

Fever in Children: A Cooperative Clinical Trial of ACTH, Cortisone, and Aspirin," *British Medical Journal,* 1, 1955, pp. 555–574; and Ann G. Kutner, "Current Status of Steroid Therapy in Rheumatic Fever," *American Heart Journal,* 70, August 1965, pp. 147–149.

[35] Albert N. Brest, "Treatment of Coronary Occlusive Disease: Critical Review," *Diseases of the Chest,* 45, January 1964, pp. 40–45.

[36] Harvey D. Cain *et al.,* "Current Therapy of Cardiovascular Disease," *Geriatrics,* 18, July 1963, pp. 507–518; Milton Lowenthal *et al.,* "An Analysis of the Rehabilitation Needs and Prognoses of 232 Cases of Cerebral Vascular Accident," *Archives of Physical Medicine,* 40, 1959, pp. 183–186; and Philip R. A. May and A. Hussain Tuma, "Schizophrenia—An Experimental Study of Five Treatment Methods," *British Journal of Psychiatry,* June 1965, pp. 503–510.

[37] For a discussion of group practice, see Sam Shapiro *et al.,* "Comparisons of Prematurity and Prenatal Mortality in a General Population and in a Population of a Prepaid Group Practice," *American Journal of Public Health,* February 1958, pp. 170–187, and "Further Observations on Prematurity and Prenatal Mortality in a General Population and in the Population of a Prepaid Group Practice Medical Plan," *American Journal of Public Health,* September 1960, pp. 1304–1317. For intensive care units, see Lockwood *et al., op. cit.;* and United States Public Health Service, Coronary Care Units: *Specialized Intensive Care Units for Acute Myocardial Infarction Patients,* Washington, October 1964. For neonatal surgery, see Isabella Forshall and P. P. Rickham, "Experience of a Neonatal Surgery Unit—The First Six Years," *The Lancet,* October 1960, pp. 751–754.

[38] See C. M. Wylie, "Participation in a Multiple Screening Clinic with Five-Year Follow-Up," *Public Health Reports,* July 1961, pp. 596–602; Alfred Yankauer and Ruth A. Lawrence, "A Study of Periodic School Medical Examinations," *American Journal of Public Health,* January 1955, pp. 71–78; and N. E. McKinnon, "The Effects of Control Programs on Cancer Mortality," *Canadian Medical Association Journal,* June 25, 1960, pp. 1308–1312.

Some researchers at the National Bureau have attempted to gain insights into the contributions of medical care and environmental factors to health by examining interstate differentials in age-adjusted death rates.[39]

Two models are estimated. In the first, the quantity of medical services is measured by expenditures on medical care. In the second, expenditures are replaced by a Cobb-Douglas production function combining the factors of production: physicians, paramedical personnel, physical capital, and drugs. In this formulation a demand equation for medical services and supply curves of factors are introduced. Estimates are alternatively made by ordinary least squares and instrumental variables.[40]

Both medical services and environmental factors contribute to variations in age-adjusted death rates. The elasticity of the death rate with respect to medical services is about −.1. The most important environmental factors are income and education. States with above average education tend to have below average death rates; states with high income tend to have *high* death rates when the quantity of medical services and other factors are held constant.

This is an exploratory study and these tentative findings should be subjected to additional testing. They are, however, very suggestive. The authors note that the cost of an increase in medical service is several times the benefits of increased national output from reduced mortality. The interstate analysis indicates that almost as large a reduction in mortality is associated with an additional dollar spent on education as an additional dollar spent on medical care.

The estimates imply that the stability of the death rate in recent years should not be interpreted as a complete failure of medical care to improve health. Rather, declines in death rates that would have resulted from increases in the quantity and quality of medical care may have been offset by adverse changes in environmental factors, most notably those associated with the rise in real income. Whether the net positive relation between mortality and income is attributable to the adverse effects of earning a higher income or to the consumption effects, or to other changes in the environment that are beyond the range of individual choice remains to be explored.

[39] Richard Auster, Irving Leveson, Deborah Sarachek, "The Production of Health, an Exploratory Study," NBER manuscript. The analysis in this study is limited to whites because of sharp differences in death rates by color and the high correlation between percentage nonwhite and other variables across states.

[40] This technique involves regressing the independent variables on a set of exogenous variables and then using the predicted values (from the regressions) in the final regression instead of the observed values.

Summary

This brief and incomplete survey of productivity in three service industries serves to illustrate the heterogeneity of the sector and the complexity of problems encountered in measurement and analysis.

In the case of medical care, the very definition of output is unclear; there is as yet no agreement as to what, in principle, should be measured. The conventional measures of medical care output such as a physician-visit, or a hospital-day, are patently unacceptable to economists because they come close to measuring input instead of output. However, those economists who stress the "cure" dimension of medical care output overlook the fact that much of the service rendered by physicians is supportive or palliative and has very little connection with "cures." [41] The other major analytical problem is relating "cures" or "health" to medical care. Just as most disease is the result of a combination of causes, so are most "cures" the result of the efforts of the health industry combined with the efforts of the individual patient. As some new work on demand theory stresses, it is the individual (if anyone) who produces health, using medical care as an input.[42] A reconciliation between this realistic view of medical care and the conventional approaches to measuring output and productivity has not yet been achieved.

The problem with respect to retail trade is somewhat less severe than in health, at least at the conceptual level. There is wide agreement that the output of a retail firm should be measured by the services provided by the firm to the consumer in the distribution of goods. Most of these services can be specified: storage, information, credit, delivery, and the like. Many of them can, in principle, be quantified. In practice, no great effort has been made to do so and the conventional approach has assumed that the bundle of services associated with the sale of a given real volume of goods remains unchanged over time. For reasons mentioned in this chapter, and described more fully by David Schwartzman, this assumption probably leads to overestimating the growth of retail output and productivity between 1929 and the present.

The case of retail trade also brings to the fore the problem of inter-

[41] See Eli Ginzberg, "Medical Economics—More Than Curves and Computers," in *The Economics of Health and Medical Care,* Proceedings of the Conference on the Economics of Health and Medical Care, May 10–12, 1962, Ann Arbor, Michigan, 1964, p. 14.

[42] Kelvin J. Lancaster, "A New Approach to Consumer Theory," *The Journal of Political Economy,* April 1966, pp. 132–157, and Gary S. Becker, "A Reformulation of Consumption Theory," NBER, Mimeograph.

preting changes in the size of transactions, a problem also noted in the case of barber and beauty shops. Productivity, as conventionally measured, tends to increase with transaction size. This formulation is acceptable provided the increase from this source is sharply distinguished from productivity increases attributable to technological advance or to changes in the quality of factor inputs.

The complex interrelationship between demand, technological change, and productivity is well illustrated by the case study of beauty shops. Two of the major technological innovations in that industry, the permanent wave process and the hair coloring agents, were long available in imperfect form but were not important because the demand situation was not favorable. Changes in demand stimulated further technological improvements; these in turn stimulated demand, and the continuous interaction sparked sustained advances in productivity. In barbering, technology, demand, and productivity have all tended to be stagnant over the period studied.

Even barber shops, however, show some increase in output per man as do all the industries examined in this chapter. This result should serve as a warning that the simple assumption of no productivity increase in services [43] is unsatisfactory. At the same time, the case studies show how difficult it is to measure accurately and to determine the sources of the increases that have undoubtedly occurred.

[43] See William J. Baumol, "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crises," *American Economic Review,* June 1967.