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have little reason to fire such employees when business falls off. This group includes real estate, insurance, and security brokers, waiters and waitresses, barbers and beauticians, and most salesmen of durable goods. Because their earnings are more sensitive to cyclical fluctuations in spending than are their hours of work, we can think of these workers as having "flexible" wages.[24]

There is some "piecework" employment in manufacturing, as well as in the service sector, but the effect on measured employment is not the same because of differences in the production process. When demand falls in manufacturing, the employer will probably cut back on production, regardless of whether labor is paid on an hourly or piecework basis, and this cutback will usually result in less employment. The effect in services is different because the amount and timing of the output and employment required is not known in advance. In both situations a decrease in demand means a fall in the marginal revenue product of labor. In manufacturing, the wage per hour tends to remain the same, and there is a reduction in man-hours. In the case of waiters, barbers, salesmen, and so on, employment tends to remain unchanged, and the necessary adjustment is achieved through a fall in hourly earnings.

A second interesting point suggested by Figure 5 concerns the timing of cyclical changes in real output and man-hours. Although annual data reveal timing differences imperfectly, in manufacturing the two series tend to move together, while in trade the man-hours series appears to lag behind real output. At most upper turning points, trend-adjusted man-hours reaches a peak one year after the peak in trend-adjusted real output. The reason probably is that output in manufacturing can be planned in advance and the appropriate labor inputs scheduled accordingly. Output in trade is uncertain, and employment plans are often based on output experience of the previous year. It is relevant to note that the OBE measure of real output in trade does not make any allowance for such quality changes as delays in being waited on. It may be that when measured real output in trade rises rapidly, and man-hours do not, there is a decrease in the quality of service and therefore true output does not rise as rapidly as measured output.

To sum up, a comparison of the two sectors suggests that output in services is less sensitive to cyclical fluctuations in total demand and employment is less sensitive to fluctuations in output. Wage rates, on the other hand, are probably not as stable as in goods, because earnings frequently depend upon output. If the service sector continues to grow relative to the rest of the economy, these considerations will probably take on increased importance for questions of economic stability.

IMPLICATIONS FOR ECONOMIC ANALYSIS

In this section it is argued that the growth of the service sector has important implications for economic analysis. One line of reasoning is by analogy. In retrospect, it is apparent that the change in emphasis from primary to secondary production had considerable influence on economic analysis. Land became less important as an input in production and distribution models, and physical capital became much more important. The need for a theory of imperfect competition became more apparent. Short-run supply curves could no longer be thought of as completely inelastic, and the possibilities

[24] I am grateful to Jacob Mincer for this formulation.

of increasing returns had to be examined with greater rigor.

One could argue that all the necessary theoretical tools can be found in one form or another in the writings of the earliest economists. The development and refinement of concepts, however, are often related to changes in the economy itself. Analytical work requires frequent compromises with reality. The compromises that may be appropriate, or the second-order effects that may be neglected, in an economy dominated by agriculture and manufacturing may turn out to be inappropriate, or too important to be neglected, in an economy dominated by the service industries. I shall try to illustrate this point by reference to the analysis of productivity and growth.

THE CONSUMER AS A FACTOR IN PRODUCTION

One lesson that our study of productivity in the service industries keeps forcing upon us is the importance of the consumer as a cooperating agent in the production process. To the best of my knowledge, this point is neglected in the analysis of productivity in goods-producing industries, as well it might be. After all, productivity in the automobile industry is not affected by whether the ultimate drivers are bright or stupid, or whether they drive carefully or carelessly.

In services, however, the consumer frequently plays an important role in production. Sometimes, as in the barber's chair, the role is essentially passive. In such cases the only conceptual adjustment called for is to recognize that the time of the consumer is also a scarce resource.[25] But in the supermarket and laundromat the consumer actually works, and in the doctor's office the quality of the medical history the patient gives may influence significantly the productivity of the doctor. Productivity in banking is affected by whether the clerk or the customer makes out the deposit slip—and whether it is made out correctly or not. This, in turn, is likely to be a function of the education of the customer, among other factors. Productivity in education, as every teacher knows, is determined largely by what the student contributes, and, to take an extreme case, the performance of a string quartet can be affected by the audience's response. Thus we see that productivity in many service industries is dependent in part on the knowledge, experience, and motivation of the consumer. Consider, for instance, what would happen to service-industry productivity in the United States if technology and capital and labor inputs remained as they are, but the consumers were exchanged for 190 million consumers chosen at random from India.

In a similar vein, productivity can be and often is affected by the level of honesty of the consumer. If consumers can be trusted to refrain from stealing merchandise, to report prices and costs properly at check-out counters, to honor verbal commitments for purchases and other contracts, for example, there can be tremendous savings in personnel on the part of producers of services.[26] These savings are probably important when comparisons are made with productivity in other countries or with the same country at different points in time. It may be that qualities such as honesty are themselves functions of the general level of productivity and income. A full analysis of productivity, therefore, requires consideration of these interrelations.

[25] See Gary S. Becker, *A Theory of the Allocation of Time* (IBM Research Paper RC 1149 [New York, 1964]).

[26] Changes in the honesty of employees have implications for productivity in the goods sector as well as services; changes in the honesty of consumers have implications primarily for services.

LABOR-EMBODIED TECHNOLOGICAL CHANGE

A second example of an analytical implication of the growth of service-industry employment concerns the labor embodiment of technological change. Labor embodiment is analogous to capital embodiment; it refers to a situation where the technological change or the advance in knowledge has its effects on productivity by being embodied in new additions to the labor force. For example, if newly trained doctors, after receiving the same amount of schooling as their predecessors, now know more about disease and are more effective in treating sick people, we should attribute the increase in output to labor-embodied technological change.

Most previous discussions of embodiment have concentrated on physical capital.[27] It has typically been assumed that capital is a fixed factor and that labor is variable, as in the following statement by Salter. "By investing in fixed capital equipment an entrepreneur gives 'hostages to fortune'; a decision to employ fixed capital equipment is irrevocable in contrast to labor, which can be discharged at will."[28] This may be a reasonably satisfactory description of the situation in manufacturing, but it will not do for much of the service sector. In fact, given the growing opportunity to rent capital equipment (e.g., computers), the reverse is sometimes closer to the truth. If one argues that rented capital equipment represents an irrevocable commitment for society, if not for the particular firm or industry using it, the same can be said for the supply of labor, and the distinction loses all force.

Let us imagine, for instance, a technological change in some government activity—a change that requires new skills on the part of labor. Civil service rules may prohibit the firing of old employees, and it may be difficult to train them in the new techniques. The full benefits of the advance, therefore, will not be realized immediately. If this type of technological change occurs at an even rate, the rate of change in productivity in government will be unaffected even though the level may be less than optimal.[29] But such changes probably do not occur at a smooth rate. If the output of the government agency is accelerating rapidly, it is likely that new additions of capital and labor are being made and that they can incorporate the latest technological change, thus raising the average level of productivity. This may be one reason that changes in output and changes in productivity are sometimes found to be positively correlated.

The argument applies not only to government but to all instances in which specific individuals are attached to specific organizations for long periods of time (through contract, moral commitment, or high hiring costs) and cannot easily be replaced by others. Such long-term attachments are common in many service industries. To be sure, the existing labor force may frequently be trained or adapted to take advantage of technological change, but in many cases this is not easy to accomplish. Economics professors who lack modern mathematical

[27] See W. E. G. Salter, *Productivity and Technical Change* (Cambridge, Mass.: 1960); R. M. Solow, "Technical Progress, Capital Formation, and Economic Growth," *American Economic Review Proceedings*, LII (May 1962), 76–86; and E. F. Denison, "The Unimportance of the Embodied Question," *American Economic Review*, LIV (March, 1964), 90–93. For reference to labor embodiment see Gary S. Becker, *Human Capital* (New York: NBER, 1964), p. 143.

[28] *Productivity . . .* , p. 38.

[29] Current methods of measuring output in government *assume* no change in productivity. This discussion is concerned with the effects on true productivity.

techniques provide a good example close to home.

The question may be raised why, if technological change is embodied in new entrants to the labor force, do we usually find that older workers earn more than do new entrants with the same number of years of schooling? The answer is, of course, that employers place a value on the experience and the maturity of the older worker which more than offsets the value of the labor-embodied technological change. If one could compare two workers of equal experience and maturity, one with the education of twenty years ago and the other with the current model, there is little doubt that the latter would command higher earnings. This is particularly evident in fields experiencing rapid technological change, such as engineering, where recent graduates often earn as much as old-timers do despite the maturity and experience of the latter.

The concept of labor embodiment is likely to be most relevant when formal schooling and job security are important, as in the professional and technical occupations. Three-fourths of all professional and technical workers are employed in the service sector.

CHANGES IN DEMAND AND PRODUCTIVITY

Another area where the growth of services may require some refinement of concepts is in the analysis of the relation between changes in demand and changes in productivity. In many service industries it is not enough to know by *how much* demand has changed in order to predict the effect on productivity. At least two other dimensions of demand in addition to quantity must be specified.

One source of variation arises because output is frequently uneven, with peaks coming at particular hours of the day, particular days of the week, and even particular weeks of the month. Such fluctuations are important for retailing, banking, barber and beauty shops, places of amusement, and some local government services. During non-peak times there is usually idle capacity. An increase in demand, if it occurs at these times, may result in very substantial gains in productivity. On the other hand, an increase in demand, if it occurs at times of peak demand, will probably not result in any increase in productivity.

A second source of variation is the "size of transaction."[30] This refers to the volume of business done with a single customer at a single purchase. My colleagues David Schwartzman and Jean Wilburn have found examples of service industries where increased demand, which takes the form of increases in the average size of transaction, results in greater increases in measured productivity than does an equivalent increase in demand that takes the form of more transactions.[31] George Benston has reported a similar finding for banking, and I suspect that this is true of many service industries.[32]

THE "REAL" GROSS NATIONAL PRODUCT

My final example of how the growth of services may affect economic analysis concerns the gross national product in constant dollars. This statistic is the key-

[30] Armen Alchian has a general theoretical discussion of this concept in "Costs and Output," in *The Allocation of Economic Resources, Essays in Honor of Bernard Francis Haley* (Stanford, Calif.: Stanford University Press, 1959), but he does not apply it specifically to the service industries. See also Jack Hirschleifer, "The Firm's Cost Function: A Successful Reconstruction," *Journal of Business*, July, 1962.

[31] There is some question whether the former should be called increased output or not. Under present conventions for measuring output in many service industries, it is recorded as such.

[32] "The Cost of Bank Operations" (unpublished Ph.D. dissertation, University of Chicago, 1964).