AN ECONOMIST LOOKS AT THE ENGINEERING SHORTAGE

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Surely one of the most popular topics of recent years has been the "engineering shortage." By some accounts this shortage has been among the most serious problems facing the American people. When you try to evaluate the validity of these fears, however, you find yourself in some difficulty because there are several different kinds of shortage that the viewers with alarm have in mind, and the way you go about evaluating the existence or magnitude of the alleged shortage, much less the evaluation itself, will vary depending upon the kind of shortage you are discussing.

Value-Judgment Shortage

One very simple kind of shortage that often underlies public discussion is based upon a judgment that the United States "should", in some sense, have more engineers. The judgment is often based these days on a comparison with Russian output of engineers. Other times it is based on a view that this country should devote more resources to research and development, particularly basic research, and that a lack of engineers (and scientists) is holding this effort back.

This view of the engineering shortage is closely related to similar views held in other fields. For example, a view held by some in the housing field is that the United States "needs" two million new houses a year, almost double the rate at which we have been producing them in the last decade or so, in order to make possible the kind of upgrading of housing standards that the analyst feels ought to take place. A similar argument is often raised about the medical profession, when it is held that the output of physicians ought to be X percent higher than it is in order that some desired ratio of patients to physicians, perhaps that characteristic of New York or California, be reached.

The economist as economist can make only a limited contribution to analysis of such a view, for in essence, this view is based on a value judgment and the economist has little basis on which to argue about value judgments.

However, there are three aspects of the question which the economist can throw some light on. In the first place, he can point out that this value judgment is at variance with that of the market place. And this in itself carries certain implications.

Second, the economist can indicate what the results would be if in fact supply increased as the shortage-viewer wished, and nothing else changed. In the housing field, for example, if the two million houses per year were produced, they could not be sold unless prices were held substantially below cost, and this could not occur for any length of time without a government subsidy. And if new houses were produced and sold at this rate, it would probably result in a collapse of real estate values. To prevent this, the government would again have to provide a subsidy.

The same kind of reasoning holds for engineers. In view of the salary experience engineers have had over the last decade or two, an increase in the number of graduating engineers of the magnitude sometimes talked about in recent years would have created havoc in the profession. Presumably even the increased number of engineers would have found jobs but at what salaries and at what kind of work is another question. Indeed, one important contribution the economist can make is to point out that those who have wanted to increase substantially the number of graduating engineers ought, in all fairness, to insure that there will be means of satisfactorily employing those whom they wish to induce to enter the applied sciences. Presumably, the government is again the only hope in this direction.

A third contribution the economist can make to a discussion of this kind of shortage is an investigation of whether there are aspects of the market mechanism which are not working properly. For, to the extent that such is the case, the inducements produced by the market place may not yield a social optimum.

It is suggested by some[1/] that research and development, particularly basic research, is an activity that falls into this category. The argument is that it is almost impossible for the rewards attainable by research to be fully appropriated by the business units performing the research. Or, to put the matter in other terms, the benefits of research are received by many more than receive their direct financial returns. To the extent this is so, and there seems to be considerable merit to the argument, one can support on economic grounds substantial investment by the government in research.

Price-Control Shortage

A second kind of shortage occurs when there are restraints placed upon the operations of the market, so that price is not permitted to equate demand and supply. This sort of shortage, with which economists are most familiar, characterizes periods in which price (or wage) control is exercised by the government and prices are deliberately kept below equilibrium levels. Under such conditions, demand exceeds supply, at prices current in the market, and direct or indirect rationing of some form performs the rationing function of free market prices.

Closely allied to this kind of shortage is the market situation in which demand is characterized by monopsony, for while there is no excess demand in this situation, market prices remain below free market equilibrium levels.

Neither of these situations is of major significance in the market for engineers. There is no general control of wages in the engineering field, such as there was during World War II. Nor is there any single dominant purchaser of engineering services who could exercise substantial monopsonistic power; the largest single private employer of engineers probably does not employ more than two or three percent of the profession.

The closest we can come to the existence of wage control is the power the Defense Department possesses in the supervision of defense contracts, particularly in cost-plus-fixed-fee contracts characteristic of research and development programs. In the latter case, the Defense Department has the obligation to review all wage and salary schedules.

There is no clear evidence, indeed little evidence at all, that the power of the government over salaries of defense contractors has ever been exercised in a manner which has resulted in salaries in defense industries lagging behind salaries in other industries, or indeed, behind levels that would have been reached without such review. In fact, there is some current complaint of just the reverse, at least from universities, the complaint being that government-financed salaries are unduly high so that resources are being drained away from other, more socially valuable, activities.

But there is a serious question as to whether such control, even if effective, would really involve any generalized form of shortage. For the government, after all, supports directly or indirectly only a fraction, albeit a substantial one, of the applied scientists in the United States. If, in fact, the government had exercised its powers in a manner which seriously limited engineering wages in defense industries, defense contractors would find themselves unable to compete with other employers of engineering skills. But is such a condition a general market shortage or merely an unwillingness on the part of one employer to meet market prices? And surely the solution to this problem would be simply to permit engineering wages to rise in defense industries so that contractors could compete once again in the market place.

Domestic Servant Shortage

A third kind of complaint of shortage, and the one most often encountered in free labor markets, occurs when demand increases relative to supply, at the salaries paid in the recent past. "Then salaries will rise and activities which once were performed by (say) engineers must now be performed by a class of workers who are less well trained and less expensive".[2/]

The complaints of shortage in this situation are usually from consumers of the product or services whose demand is marginal in whole or in part, that is, who find it unprofitable or undesirable at the new higher prices to continue to purchase the commodity or service. To these consumers, a shortage has developed, and the evidence is that they are no longer purchasing the commodity or service in the amounts to which they have been accustomed. The most common example of this kind of complaint is the servant shortage about which there has been so much talk for more than half a century.

If this type of shortage has characterized the market for engineering services, one would expect to find the salaries of engineers to have risen, after adjustment for price changes. What kind of price adjustment to make in this situation is difficult to determine, but one reasonable technique is to use changes in salary levels of occupations in which there is no claim of shortage. When this is done, we find that engineering salaries in recent periods have been substantially lower, relative to salaries of other professions as well as to the labor force as a whole, than they were two or three decades ago. Even in the last decade there is little evidence of any marked improvement of engineering salaries relative to those of other occupations. There is some evidence, however, of a relative rise in engineering salaries around 1951 and 1952, when the effect of the defense program engendered by the Korean War was at its peak, and again around 1956 when the capital investment boom was at its peak.

In summary, the modest relative increases in engineering salaries since the late Forties, when the fear was that there were too many engineers, casts considerable doubt on the existence of a shortage of the magnitude that is implicit in much recent and some current discussion.

On this note, let me conclude with a brief quotation from a letter sent to me by an eminent engineering educator[3/], concerning the market for engineers. This educator stated, in part, that: "while there is a shortage in many categories of the labor force, ...[he] ...doubted that the engineering shortage was more severe than in other areas, such as skilled technicians and nurses... [He] also pointed out that approximately one-third of the young men entering college these days were heading towards engineering and science, and this was not an unreasonably small proportion, because we also need people to do other things than engineering and science... [Finally he] noted that young engineers are widely used for sales and service work, where their engineering is used only as a background. If there was really a critical shortage of engineers to do technical work, [he argued] wage rates would adjust themselves so that the technical jobs would pay more than the quasi-technical, which is not the case... [His] conclusion based on these and other similar points was that it seemed that the seriousness of the shortage of engineers and scientists was probably overrated, and that while engineering was a good career for those who like this type of work and have the necessary qualifications, young people should not rush into engineering merely because of the propaganda about a shortage, or because they think it is a short cut to riches."

1/ A. A. Alchian, K. J. Arrow and W. M. Capron, "An Economic Analysis of the Market for Scientists and Engineers", The RAND Corporation, 1958, pp. 68-71.

2/ David M. Blank and George J. Stigler, The Demand and Supply of Scientific Personnel, National Bureau of Economic Research, 1957, p. 24.

3/ F. E. Terman, Dean of the School of Engineering, Stanford University.