

Technological Unemployment¹

Measurement of Elasticity of Demand as a Basis
for Prediction of Labor Displacement

By PAUL H. DOUGLAS
Professor of Economics, University of Chicago

THE chief aim of management and of production engineers is to increase the number of units of goods which can be produced with a given amount of capital and of labor. Along that line lie both greater profits to the producer and lower prices to the consumer. Up to a few years ago, such managers and engineers had an unflinching answer to all those critics who urged that by increasing the output per worker they were in effect reducing the number who needed to be employed and hence increasing unemployment. This was to assert that the lowered price of each article, which through competition would come in the wake of the improvement in production, would call forth such a great increase in the quantity demanded that in the end more workers would be needed in the industry than at the beginning. And to support this assertion, it was apparently only necessary to point to the experience of the preceding century. With every decade, manufacturing efficiency had increased and with it the numbers employed in the factories had also increased, not only absolutely but in proportion to the population as a whole.

It was, of course, true that in agriculture events were taking a different course. There, smaller improvements in efficiency than were occurring in manufacturing were nevertheless causing an even smaller proportion of the population to be employed. Whereas in 1870, 47 per cent of the working population were agriculturists, only slightly over 25 per cent were farmers in 1920. In other words, in 1920 it required but one man out of every four to feed the population, instead of the two who had been needed a half century before. But this was thought to be a unique situation which existed

¹Paper presented before a meeting of the Taylor Society, New York, December 5, 1930.

solely because of the fact that people's desires for additional food were rather sharply limited, and fell off rapidly once a physical basis for life had been obtained. Such, it was thought, could not be the case in manufacturing for whose products, it was urged, there was a voracious and unappeased demand which would express itself in a great rush if only the prices of the commodities were reduced.

But during the last decade some very unfamiliar changes have been occurring. The output per worker in manufacturing, thanks to the moving assembly and to the teachings of Frederick W. Taylor, has increased by approximately 45 per cent. But to the surprise of most business men the number of workers employed in manufacturing has not only diminished relatively but absolutely. Before the business depression last fall there were approximately 900,000 or 10 per cent fewer wage-earners in our factories than there were ten years before. Nor is this phenomenon confined to manufacturing. Railway efficiency has risen, but the numbers employed there have fallen by approximately one-fifth or from around two million to about 1,600,000 workers. The output per worker has also increased very appreciably in the coal mines, but the number of miners has diminished by nearly 200,000. On every side, therefore, the question is being raised as to whether technical and managerial improvements do not after all cause unemployment, and the belief that they do is today one of the strongest obstacles to the program of rationalization in countries where, like England and Germany, the labor movement is strong. It is highly important, both for social and for business reasons, that technicians should face this question. It is to that end that this paper is devoted.

Now, it can be shown, as I believe I have demonstrated elsewhere and will try to prove briefly

here, that improvements in production do not cause workers to be permanently unemployed,² but that in those cases where the demand is not sufficiently elastic workers who are displaced from their old jobs are likely to suffer a painful transitional period of unemployment before they are again placed. I can, perhaps make this point clearer and indicate the types of cases in which a displacement of laborers will or will not occur if I choose a very simplified illustration.

Let us assume that it requires one thousand workers from chopping the trees to writing the copy to turn out in a day 50,000 copies of a periodical which sells for ten cents. Then if the efficiency of each worker is doubled by approved Taylor methods, from fifty to one hundred copies, while day wages are retained, labor costs per piece will be halved. Now, let us assume (1) that labor costs are total costs and (2) that there is free competition in the publishing industry. The result will be that total costs will also be halved and the publishers, in their anxiety to get more purchasers for their paper, will reduce the price to five cents. At five cents, more copies will be purchased than at ten cents but the results so far as the displacement of labor is concerned will depend on *how many* more copies will be demanded. There are, in fact, three main sets of possibilities and only three. (1) The quantity demanded may increase in the same proportion as that by which individual efficiency increased and price fell. This the economist terms an elasticity of demand equal to unity. (2) The quantity demanded may increase by a proportion greater than that by which individual efficiency increased and price fell. This is an elasticity greater than unity. (3) The quantity demanded may increase by a proportion less than that by which individual output rose and price fell. This is an elasticity of demand of less than unity. Let us see what happens in each of these cases.

In the first case, the quantity demanded would now be 100,000 copies. Since the average daily output is now one hundred, there would still be one thousand workers needed and there would thus be neither an addition to nor a decrease in the permanent working force. If the quantity demanded were to double or more with this halving in price and if, let us say, 150,000 copies were now pur-

²"Technological Unemployment," *The American Federationist*, Vol. XXXVII, No. 8, August, 1930, p. 923.

chased, then 1500 workers would be needed and the industry would have to hire five hundred additional men. It is obvious that this was the experience of most manufacturing industries during the nineteenth century and of the automobile industry during the last twenty years.

In the third case, however, the new quantity demanded would be less than 100,000. If, let us say, 75,000 copies were purchased, only 750 workers would be needed in the industry and 250 men would in consequence be displaced.

These men would not, however, be permanently unemployed since there would now be spent daily only \$3750 (i.e., 75,000 x \$.05) for periodicals instead of the \$5000 (i.e., 50,000 x \$.10) which was spent before. This \$1250 would now be spent on other industries, whether on commodities directly consumed or on those produced for future use; with the result that these other industries would ultimately need more labor. They would absorb a number equal to those displaced from the publishing industry since \$5 would be transferred for every man displaced, the rate originally and still prevailing in the industry in question.

But the displaced workers would beyond question suffer an appreciable amount of temporary unemployment before they could find work in these other lines, and even then would tend to be in a worse situation because of their lack of trade skill. In industries, therefore, where the elasticity of demand is less than unity and where the flexibility of price is greater than unity we may expect, if other things remain equal, that an improvement in production will cause a displacement of labor. This is indeed the cause for the decline in the numbers employed in coal mining, on the railroads and in the more standardized branches of manufacturing. The demand for these commodities as well as for agricultural products now seems to have reached a point where it is in the main inelastic.

The above sketch of the theoretical nature of the problem has of necessity been incomplete. There are various other qualifications and amplifications which need to be added.

1. The smaller the trade division of the industry in which the improvement takes place, the greater will be the displacement of labor. The improvement in a few operations will not, except in rare cases, lower costs and prices sufficiently to cause a large enough increase in the quantity demanded to em-