ploy the same number of men in the improved processes. The same result will also occur where a plant producing a small part in an end product, such as the automobile supply factories, improves its efficiency.

To the extent, however, to which the price of the final article is lowered and demand increased, more men are needed in the other trades and divisions of the industry. With proper training the displaced workers may be at least partially absorbed in these other occupations.

2. The lower the ratio by which total costs are reduced as labor costs fall, the greater will be the temporary displacement of labor. The smaller the effect of increases of labor efficiency upon cost and price, the less will be the increase in the quantity demanded and therefore the greater the number of workers displaced.

3. The less business men reduce prices as costs fall, the greater is the displacement of labor. If they pocket part or all of the gain the increased profits which they receive will, when spent or saved, give increased employment for labor in other industries. But it will be a transfer of purchasing power which will take employment away from the industry in question. Similarly, if unit labor costs are not reduced commensurately with the increase in per capita output, prices will not be reduced and the quantity demanded will not increase as much as it otherwise would. The workers in an industry may, therefore, purchase higher money wages at the expense of displacing some of their members.

II

It is a logical consequence from all this that management should seriously concern itself with what is likely to be the effect upon employment of technical and managerial improvements. For truly good management will try to lessen the pains of the transitional period through which the displaced laborers will have to go, either by introducing technical changes as gradually as possible, by ceasing to hire workers for a time and thus allowing the working force to decrease through the natural process of attrition or by the payment of dismissal wages to those actually squeezed out. For all those purposes, therefore, it is important to know in advance what the probable displacement is likely to be.

It is also important for society to know what the probable tendencies will be so that it may give vocational advice to juveniles and adults and thus help to effect a gradual rather than a forced adjustment of the number of workers already in a given industry to the number demanded. Clearly, in order to be able to forecast these changes with any accuracy we must know: (1) the approximate technical and managerial improvements which are possible for the industry and (2) the approximate elasticity of demand for the commodity.

Since the first of these two variables differs from industry to industry and is so much a matter of technology, I do not consider myself competent to deal with it. Beyond remarking that for the last fifty years or so general production seems to have increased at an *average* rate of about 3 per cent a year, I shall pass over this phase of the question and devote myself to a consideration of how we may determine for a given commodity the second of these variables. I shall pause only to remark that the future prosperity of an industry is vitally bound up with the question of what its relative elasticity of demand is. The automobile industry has prospered in the past because the demand for its product has been highly elastic. This has operated to fill Flint, Detroit, Toledo and Akron to overflowing. On the other hand, the depressed state of the growers of cotton and wheat and of coal-mining communities is largely due to the fact that the demand for these products is relatively inelastic. An increase in production is accompanied by a more than corresponding fall in the unit price, with the result that a smaller total price is realized for a larger total volume. This means a lower than average return for labor and capital in these industries, and since labor and capital do not flow out of them automatically, a transitional period of suffering sets in. The devastating effects can be seen in the areas where these products are raised or mined.

Let us now turn to a consideration of the method and the formula by which we may measure the relative elasticity of demand. The common method of dividing the relative change in quantity by the relative change in price, or Marshall's formula of $\frac{dx}{x} \Big/ \frac{dy}{y}$ where x equals quantity demanded and y equals price per unit, is a purely static formula which assumes that there is no shift in demand, no change in the prices of other commodities and no change in their quantities. Very brilliant efforts have been made by Moore, Schultz, Lehfeldt and Ezekiel to derive from concrete historical data an approximation to the elasticities of demand for a number of commodities. Fundamentally, their methods have been two. One is to compute the relative changes in quantities demanded and in unit price for successive pairs of years and fit a line of regression by the method of least squares to these series of observations. The relative slope of this line of regression if price is taken as the independent variable will represent the elasticity of demand in relation to price while if quantity is taken as the independent variable the slope will represent the reciprocal of this or the flexibility of price in relation to quantity.

The other method is to fit a line of trend through the price quotations and a similar trend line through the quantities purchased. On the assumption that the factors other than the price-quantity relationship are contained within these trends, the ratios of the actual price and quantity quotations to their theoretical trend values for each year are then used to plot a series of observations. A line of regression is then fitted to these observations by the same method as that used in the case of link relatives.

Professor Schultz in his work has still further refined his computations by correcting his price data for changes in the general price level, and his statistics on quantities consumed by the growth of the population.

In my judgment, this type of measurement will be improved still further if we regard the change in the quantity of a commodity as consisting not only of the alteration in its own magnitude, i.e., more barrels of flour, tons of steel, etc., but also of the relative degree of this change as compared with that of production as a whole. I add this latter suggestion because of the fact that, if the production of a given commodity remains constant while that of other articles increases, then the price of this commodity will, in the absence of other disturbing factors, rise. This will be because it is now more scarce in relation to other commodities than it was before. The production of these other commodities furnishes indeed the demand for the commodity in question, and the greater this production the more intense is the demand for any product. Every wise manufacturer knows this and welcomes an increase in the production of all other industries (save those which produce articles which can be substituted), since this means more purchasers for his goods. The change in the value of a commodity is therefore affected not by a change in the quantity of that commodity alone but also by a change in the quantity of other goods and services. In order to isolate the effect upon real price, or unit value, of changes in the quantity of a commodity alone, it is necessary to express this change as a relative of the change in general production. This flexibility of value through time (which is the reciprocal of the relative elasticity of demand through time) may be expressed thus:

(1) Let m = Coefficient of the flexibility of value through time.

Y_1 = Relative exchange value of a unit of commodity "a" in year 1 as compared with year 0. ($Y_0 = 100.$)

X_1 = Relative quantity of commodity "a" in year 1 as compared with year 0 in terms of the relative change in the quantity of all goods and services. ($X_0 = 100.$)

q^1_0, q^1_1 = Absolute quantity of commodity "a" in years 0 and 1.

p^1_0, p^1_1 = Price per unit of commodity "a" in years 0 and 1.

P_0, P_1 = Index of general price level in years 0 and 1.

Q_0, Q_1 = Quantity of all goods and services in years 0 and 1, i.e., total national income in terms of dollars of constant purchasing power.

$\Sigma P_0Q_0, \Sigma P_1Q_1$ = Total sales prices of all commodities and services in years 0 and 1, i.e., total national income in dollars of current year.

Then

(2)
$$m = \frac{Y_1 - Y_0}{X_1 - X_0} \quad \text{or} \quad \frac{\log Y_1 - \log Y_0}{\log X_1 - \log X_0}$$

(3)
$$X_1 = \frac{q^1_1}{q^1_0} \Big/ \frac{Q_1}{Q_0}$$