

March 17, 1948

THE THEORY OF PRICE ADJUSTMENT

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1. The Role of Price Adjustment Equations.

In the traditional development of economic theory, the starting point is usually the construction for each individual (firm or household) of its reaction pattern to outside events (example of elements of a reaction pattern: supply, demand curves, propensity to consume, liquidity preference, interindustrial movements of capital and labor in response to differential profit and wage rates, pecuniary emulation). This line of development is explicit in the neoclassicists (Cournot, Jevons, Menger, and successors) and strongly implicit in the classicists (from Smith through Cairnes) in their discussion of the motivations of capitalists, workers and landlords which lead to establishment of the equilibrium price levels for commodities, labor, and the use of land. Marx can, I believe, be brought into the same category, although some writers have referred to Marx's theories as being "class" economics rather than "individual" economics.<sup>1/</sup> Although the dialectical discussion of value in the opening sections of Volume I of Capital,<sup>2/</sup> lend some credence to this view, it is already clear in his discussion of relative surplus value (Volume I, Part IV) that the introduction of new production processes is based on the profit-maximizing behavior of the individual entrepreneur (see especially Volume I, pages 347-353); and the role of the individual behavior reaction is basic in Marx's discussion of the equalization of profit rates in different industries in Volume III (especially Chapter X). In the opinion of most contemporary Marxist economists, such as Dobb and P.M. Sweezy,

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1/ e.g. Klein, L.R., Theories of Effective Demand and Employment, Journal of Political Economy, Vol. 55 (1947), pp. 105-131. "Instead of studying the behavior of individuals, Marx studied the behavior of classes directly." (p. 118).

2/ Marx, K. Capital. Eng. tr., Charles H. Kerr and Co., 3 v. Volume I, Chapter I, and especially the discussion of surplus value in Chapters VI, VII, VIII, and IX.

and of sympathetic critics such as Lange<sup>1/</sup>, the value theory of Volume I is to be regarded only as a first approximation to that of Volume III, so that the latter must be regarded as the basic part of Marx's price theory.<sup>2/</sup>

There remains one group of economists who might be interpreted as objecting to the development of economics from the viewpoint of individual reaction patterns. These are the institutionalists, such as Veblen, who attacked the behavior patterns hypothesized by contemporary economists for stressing the passive reacting character of individual behavior.<sup>3/</sup> But this argument seems partly a terminological question and partly an attack on the limited, excessively hedonistic versions of the marginal utility theory current about 1900. Elsewhere, both Veblen and W.C. Mitchell have emphasized the importance for the course of economic activity of the behavior of individuals, especially profit-making by firms.<sup>4/</sup>

In this individualistic framework, every relevant variable, except those classified as exogenous for the whole economic system, is the result of a decision on the

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1/ Dobb, M., Marx as an Economist, International Publishers, New York, 1945, pp.19-20.  
Sweezy, P.M., The Theory of Capitalist Development, Oxford, 1942, Chapter VII.  
Lange, O., Marxian Economics and Modern Economic Theory, Review of Economic Studies, Vol. 2 (1934-1935), pp. 169-201, esp. pp. 184-195. The same view has been expressed by at least one Soviet textbook, Lapidus and Ostrovityanov, Outlines of Political Economy, referred to by Smith, H., Marx and the Trade Cycle, Review of Economic Studies, Volume 4 (1936-1937), p. 197.

2/ An alternative interpretation frequently adopted is that there is a basic contradiction between the two price theories. This position has been adopted by numerous critics of Marxism, following E.V. Bohm-Bawerk (Karl Marx and the Close of His System, London, 1898). The same view has been taken by the ultra-Marxist, Daniel de Leon, who rejects Volume III as Engels' misinterpretation.

3/ Veblen, T., Limitations of Marginal Utility and Professor Clark's Economics, reprinted in The Place of Science in Modern Civilization and Other Essays. "In all the received formulations of economic theory...the human material...is conceived .....in terms of a passive and substantially inert and immutably given human nature."

4/ Veblen, T., The Theory of Business Enterprise.  
Mitchell, W.C., Business Cycles: The Problem and Its Setting, pp. 105-107, National Bureau of Economic Research.

part of one individual unit of the economy. In this paper, we will consider the theoretical analysis of the location of the decisions as to prices.

The standard development of the theory under competitive conditions has made both sides of the market take prices as given by some outside agency. Thus,

$$D = f(p), \quad S = g(p) \quad (1)$$

where  $D$  is the demand for a certain commodity,  $S$  its supply, and  $p$  its price. The functions  $f(p)$  and  $g(p)$  represent the behavior of consumers and producers respectively. But (1) yields only two equations in the three unknowns  $D$ ,  $S$ , and  $p$ .

The structure of theoretical development is usually completed by adding the condition of equality of supply and demand.

$$S = D \quad (2)$$

What is the rationale of (2)? In the usual treatise on economics, a great deal of attention is paid to the derivation of the equations (1), but (2) is usually taken pretty much for granted. If we look further into the reasoning given by such writers as do not regard (2) as completely self-evident, it is clear that it is regarded as holding the limiting case of some equation of the form,

$$\frac{dp}{dt} = h(S-D), \quad (3)$$

where  $h' < 0, \quad h(0) = 0 \quad (4)$

The elucidation of the terms in expression (3), the well-known "Law of Supply and Demand," is the aim of this paper.

## 2. Supply and Demand.

Even after the several hundred years in which these terms have been used, they are not free from ambiguity. In the present paper supply refers to total output, whether or not offered for sale; demand, therefore, includes demand for inventories. Because production takes time, the best procedure seems to be to follow Marshall in considering supply as fixed in the shortest run, i.e., supply is a function of lagged and exogenous variables, although the lags may be quite short. The same cannot possibly

be universally true of demand, for, if prices are sufficiently higher than expected, the buyer may not possess sufficient cash to accomplish his purchases. The asymmetry between supply and demand is clearly due to the monetary nature of our exchange mechanism.

It cannot strictly be asserted that demand can be defined as a unique figure under conditions of uncertainty, because of the inventory demand component. The transaction demand for inventories is essentially a guard against contingencies. If an unexpected rise in consumer demand occurs, so that realized inventories are less than planned, this may simply be regarded by the seller as one of the contingencies for which the transaction demand was set up. At least as far as equation (2) goes, excess supply or demand may not be considered by the seller as having occurred unless the discrepancy between planned and realized inventories exceeds some figure.

### 3. Price Adjustment under Monopoly.

Before discussing the mechanics of price adjustment under competitive conditions (perfect or imperfect), we may consider the determination of price under monopoly. Here, there is no question of locus of the decision as to prices. In the classical theory (substantially unchanged from Cournot's original presentation), the monopolist fixes his price and output so as to maximize  $R(x) - C(x)$ , where  $R(x)$  is the total revenue curve and  $C(x)$  is the total cost curve. Hence price and output will be related by the demand curve, and presumably the firm's output will always equal demand. This theory presupposes that the monopolist knows the true demand curve confronting him.

Lange has sought to develop a theory of price adjustment for monopolies analogous to the Law of Supply and Demand for competitive firms.<sup>1/</sup> Let  $U(p)$  be the profit of the entrepreneur if he sets price  $p$ , assuming that the output has been fixed in accordance with the demand curve. Then Lange suggests

$$\frac{dp}{dt} = F(U'), \quad (5)$$

$$F' > 0, F(0) = 0 \quad (6)$$

<sup>1/</sup> Lange, O. Price Flexibility and Employment (Cowles Commission for Research in Economics), 1944, pp. 35-37, 107-109.

Lange gives no real justification for these postulates. Since he explicitly assumes output equal to purchases, he implies that the monopolist knows the demand at the price which he chooses and he must also know the rate of change of demand with respect to price at that point.

If the monopolist knew the entire demand curve, he would immediately jump to the optimum position. Lange's hypothesis is only justified by assuming a good deal of uncertainty on the part of the monopolist. He sets prices only at points where he knows the demand. In the process as described by Lange, the entrepreneur's knowledge must be changing; for, let  $p_0$  be the price set at time  $t_0$  and  $p_1$  at time  $t_1 > t_0$ . Assuming all other conditions are unchanged,  $t_1$  can be chosen so that  $dp/dt$  has a constant sign in the interval  $(t_0, t_1)$ . Then, also  $U'(p)$  has a constant sign in  $(t_0, t_1)$  and in fact, such that  $U'(p)(dp/dt) > 0$  in  $(t_0, t_1)$ . Therefore,  $U(p(t_1)) > U(p(t_0))$ , so that  $p_1$  is a more profitable position than  $p_0$ . If the monopolist had known the demand at  $p_1$  initially, he would immediately have chosen  $p_1$  as his price (I assume here, as elsewhere, that the monopolist's cost curve is completely known to him). The value of  $D(p_1)$  is knowledge available to the monopolist at time  $t_1$  but not at time  $t_0$ .

Uncertainty, then, appears to be the crucial consideration in the theory of monopolistic price adjustment. We cannot, however, completely follow Lange in assuming that the monopolist never wets his toe in the cold waters of uncertainty as to the demand curve. It may be that without knowing the exact value of demand at  $p_1$ , the monopolist may know that even under the worst possible conditions the profit will be greater than at  $p_0$ , where the demand is known. Hence, we must admit the possibility of a discrepancy between output and demand even for a monopolist. This discrepancy has two-fold significance for price adjustment. On the one hand, it informs the monopolist of the extent to which he is in error and yields knowledge to better estimate the demand curve; on the other hand, the discrepancy alters his stock of inventories, which may in turn affect his cost situation in the next period. The

latter effect would, of course, not apply to cases where either no inventories can be accumulated, as with services, or where the carrying costs are very high, such costs including storage costs, depreciation and foregone liquidity.<sup>1/</sup> It seems reasonable that adjustment will be slower in the last-mentioned case than where inventories can be accumulated more readily.

Further development of this subject belongs in the realm of the theory of uncertainty and will not be discussed here. But certain implications for the development of economic theory are clear: (1) The classification of markets according as production is for order or for stock should not be regarded as an institutional datum but as a subject for analysis, considering the factors suggested above; (2) Uncertainty, and its offspring, liquidity, play a basic role in the dynamics of price adjustment.

In a complete construction of a model of the activities of a monopolist in setting prices and outputs, one would also have to take into account the shifting of his demand and cost conditions over time. This might mean that uncertainty of the entrepreneur is not actually diminishing over time as implied by the previous statements, but the general tenore of the theory is not substantially altered.

#### 4. Competitive Price Adjustment.

The above sketch of the monopolistic theory has been introduced here not only for its own sake but for the purpose of laying the foundations of the development of the theory of price adjustment under competitive circumstances. As we learn from the work of E. Chamberlain and J. Robinson, rediscovering the work of A. Cournot, the competitive firm is merely a monopolist with a special environment.

Ordinarily, the firm acting under competitive conditions is pictured as a monopolist confronted with a perfectly elastic demand curve. More explicitly, it is assumed that there exists a price which we may refer to as the market price, such that the

<sup>1/</sup> Keynes, J.M., General Theory of Employment, Interest, and Money, pp. 225-226.

firm can sell any output it desires at a price not exceeding the market price but can sell nothing at a higher price.

Triffin<sup>1/</sup> has criticized the criterion of a perfectly elastic demand curve as a definition of pure competition, arguing that such a demand situation is a consequence of the fundamental technological and taste factors involved. He defines perfect competition instead in terms of certain cross elasticities of supply and demand as between different firms.

Indeed, suppose we have a situation which conforms in all the aspects of homogeneity of output and multiplicity of firms to the usual concept of perfect competition, but in which the aggregate supply forthcoming at the "market" price exceeds the demand at that price. Then the individual firm cannot sell all it wishes to at the market price; i.e., when supply and demand are not in balance, even in a competitive market, the individual firms are in the position of monopolists.

What is the meaning of the market price in such a situation? We are always told by the textbooks that there is one price rule in a competitive market at a given time. What determines this one price? It seems to me that the answer has been given clearly by M.W. Reder. There is no reason in such a condition why there should be a single market price, and we may very well expect that each firm will charge a different price.<sup>2/</sup> The law that there is only one price on a competitive market (Jevons' Law of Indifference) is derived on the basis of profit- or utility-maximizing behavior on the part of both sides of the market. But there is no reason for such behavior to lead to unique price except in equilibrium, or possibly under conditions of perfect knowledge.

Consider for example a situation in which demand exceeds supply at some given price. Any individual entrepreneur knows then that he can raise the price even if his competitors do not raise their prices, because they will not satisfy any more of the demand than they are already doing. In effect then, the individual entrepreneur

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<sup>1/</sup> Triffin, R.W., Monopolistic Competition and General Equilibrium Theory, Harvard, 1940, pp. 137-141.  
<sup>2/</sup> Reder, M.W., Studies in the Theory of Welfare Economics, Columbia, 1947, pp.128, 147-151.

is faced with a sloping demand curve and raises his price in accordance with the profit-maximizing tactics of a monopolist. If none of the entrepreneurs do in fact raise their prices, the market will be cleared providing the entrepreneur in question has correctly estimated the demand curve. But, under the conditions specified, it is clearly to the profit of all entrepreneurs to raise their prices although, if they are not subject to the same cost conditions, not necessarily by the same amount. Thus supply will still not be in balance with demand, and the process is repeated.

The situation is further complicated by the existence of uncertainty. Any individual entrepreneur does not know to what extent his competitors will in fact raise their prices at the same time that he is contemplating such a move. Also, and this is especially likely to be true under competitive conditions, no individual entrepreneur has a very good idea of the demand curve for the industry as a whole. The situation is thus very much like that of the monopolist described in section 3.

As with the monopolist, the possibility of accumulating inventories will play a role in the adjustment of prices. It is possible that under conditions of excess supply, the adjustment of prices on such markets as those for labor and housing services may be quite slow due to the impossibility of accumulating inventories of such commodities.