ON PRICE RIGIDITIES IN OLIGOPOLISTIC INDUSTRIES*

By

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Price rigidities in oligopolistic industries were reported in many statistical studies during the thirties, and a skillful rationalization of these observations is the theory of the kinked demand curve. The theory was proposed by Hall and Hitch (1939) and by Sweezy (1939) independently, and the empirical examinations were attempted by Stigler (1947) and recently by Simon (1969).

The theory is applied to the industries where the number of competitors is small and no single firm has enough power or initiative to undertake the role of price leader. In such a situation, if any one firm lowered its price, the others might feel that they had to lower theirs. This is because they felt compelled to retaliate to maintain their positions. There would be no incentive, however, for them to follow if the first firm raises its price, since to keep their prices unchanged could not imply its encroachment upon their markets. It is this entrepreneurial behavior that generates a kink in the oligopoly demand curve.

According to Stigler's study, however, "there is little historical basis for a firm to believe that price increases will not be matched by rivals and that price decreases will be matched" (p. 441). Here is another criticism against the theory. In oligopolistic industries where price makers' competitive behavior is restrained by their realization of the interdependence of their actions, the most reasonable rule is "not to rock the boat." In such a situation, it will be reasonable that they refrain from squeezing all the revenues from their markets, and leave some room for the excess demand for their products as a cushion. If this is true, the present position of an oligopolist in which a kink occurs does not lie on his demand curve. Hence, the theory of the kinked demand curve contradicts one of the main features of oligopolistic industries.

The purpose of this note is to present an alternative explanation of price rigidities in oligopolistic industries without recourse to the concept of a deterministic demand curve. This will be in accordance with Simon's suggestion:

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"What these data, together with Stigler's, do prove, I think, is that a deterministic function of any kind is quite inadequate to represent oligopolistic reality. What is needed is a decision tree that portrays the probabilities of the several possible outcomes and the payoffs in revenue and profit as perceived by the oligopolist" (p. 975).

I

Consider a situation in which a price maker has already established his position in an oligopolistic industry. He is selling his output Q_0 at price P_0 as is shown in Figure 1. As a rule of an oligopolist, he leaves some room for the excess demand for his products in his present position (Q_0, P_0). In such a situation, there remains a kind of uncertainty due to the excess demand, since his decision-making to reserve a cushion of the excess demand never fails to entail his subjective expectation. For simplicity, let us assume that he makes two representative estimates of his sales, one the pessimistic plan Q_1 and the other the optimistic plan Q_2, for his alternative selling price P_1.

A shift from his present position (Q_0, P_0) to the pessimistic plan (Q_1, P_1) will change his revenue, and the change in revenue can be described by the pessimistic marginal revenue line M_1R_1 in Figure 1. Similarly, a shift from (Q_0, P_0) to the optimistic plan (Q_2, P_1) will generate the optimistic marginal revenue line M_2R_2.

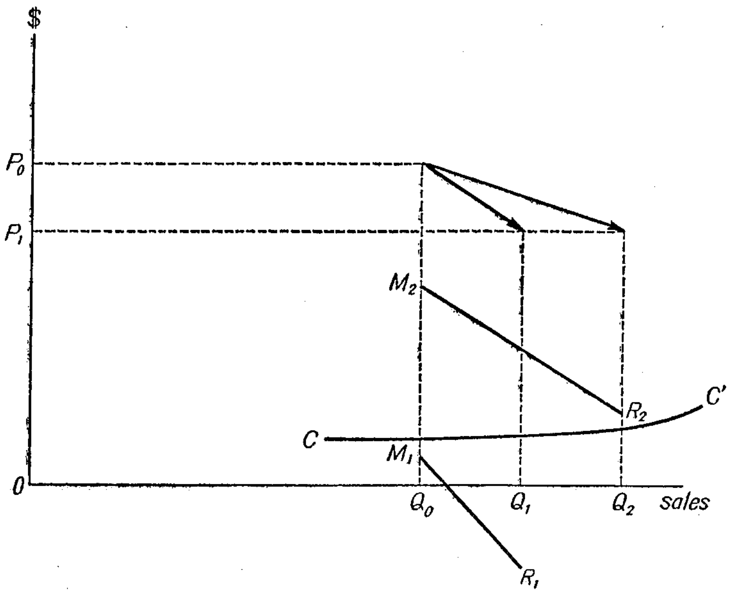

Figure 1.

Let us assume, further, that the marginal cost curve CC′ lies between the pessimistic and optimistic marginal revenue lines as is shown in Figure 1. Such a position of the marginal cost curve implies that a shift from (Q_0, P_0) to (Q_1, P_1) makes his profit reduce, since a divergence between CC' and M_1R_1 is enlarged by the shift; and that a shift from (Q_0, P_0) to (Q_2, P_1) raises his profit, since a divergence between CC' and M_2R_2 is shortened.

The price maker faces a choice between P_0 and P_1 for his price policy. If he chooses P_0, we will be assured of his present position. If he chooses P_1, he feels, on the basis of his pessimistic estimate, that he will suffer a change for the worse; and he also feels, on the basis of his optimistic estimate, that he will suffer a change for the better. Which, then, is his choice? Apparently, the answer will be P_0, if he follows a rule, "not to rock the boat." And this rule can be rationalized by one of the simplest applications of the theory of games.

II

Consider two players A and B. Let A be the above price maker, and B be a group of his rivals. In the above instance, A has two alternatives P_0 and P_1 for his price policy; and A knows that B does not react to his choice if he chooses P_0. If he chooses P_1, however, he feels that B is likely to react to his choice; but a definite effect of B's reaction upon his position is not within his knowledge. By virtue of our simplified assumption, A can make two rough estimates, the pessimistic and the optimistic. Hence, B's alternatives are three: (0) not to react, (1) to react as if he acted in conformity with A's pessimistic estimate, and (2) to react as if he acted in conformity with A's optimistic estimate. Let 0_0, 0_1 and 0_2 denote these alternatives, respectively.

The game is illustrated by a tree diagram in Figure 2. In move M_1, A chooses an alternative from the set $\{P_0, P_1\}$. In move M_2, B, who has been informed that P_0 was chosen in move M_1, chooses in turn an alternative from the set $\{0_0\}$. In move M_3, B, who has been informed that P_1 was chosen in move M_1, chooses an alternative from the set $\{0_1, 0_2\}$.

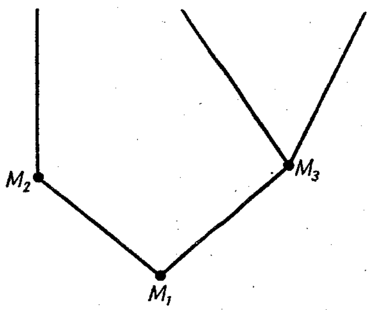

Figure 2.

Now, let us normalize the above extensive form of the game and find its payoff matrix. A strategy for the player A is a function which is defined for M_1, and its value is in the set $\{P_0, P_1\}$. We have two strategies f_1 and f_2 for the player A such that:

$$f_1(M_1) = P_0\,,$$
$$f_2(M_1) = P_1\,.$$

A trategy for the player B, on the other hand, is a function which is defined for M_2 and M_3, and its values are in the set $\{0_0\}$ for M_2, and in the set $\{0_1, 0_2\}$ for M_3. We have two strategies g_1 and g_2 for the player B such that:

$$g_1(M_2) = 0_0\,,$$
$$g_1(M_3) = 0_1\,,$$
$$g_2(M_2) = 0_0\,,$$
$$g_2(M_3) = 0_2\,.$$

Thus, we have a square payoff matrix as is shown in Table 1.

TABLE 1.

A's strategy	B's strategy	
	g_1	g_2
f_1	a_{11}	a_{12}
f_2	a_{21}	a_{22}

Let us assign an appropriate value to each coefficient a_{ij} of the above matrix in view of the situation shown in Figure 1. First, consider the case in which the player A chooses the strategy f_1 and B chooses g_1. In this case, the price maker keeps his price at P_0, and his rivals do not react: hence, his position remains unchanged. Since his profit never decreases nor increases, we may put

$$a_{11} = 0\,.$$

Similarly, in the second case where A chooses f_1 and B chooses g_2, the price maker keeps his price at P_0, and his rivals also do not react. Hence, we have

$$a_{12} = 0\,.$$

In the third case where A chooses f_2 and B chooses g_1, the price maker cuts his price from P_0 to P_1, and B reacts to A's price policy as if B acted in conformity with A's pessimistic estimate. Hence, the position (Q_1, P_1) is chosen in Figure 1. This implies that A suffers a change for the worse. Thus, we may put

$$a_{21} = \text{any negative value}\,.$$

In the last case where A chooses f_2 and B chooses g_2, A cuts his price from P_0 to P_1, and B reacts to A's price cut as if B acted in conformity with S's optimistic estimate. The position (Q_2, P_1) is chosen in Figure 1, and A suffers a change for the better. Hence, we may put

$$a_{22} = \text{any positive value.}$$

To sum up, we obtian the following payoff matrix:

$$\begin{bmatrix} 0 & 0 \\ - & + \end{bmatrix}.$$

It is easy to find out the solution of the game with the above payoff matrix, which has only one saddle-point, $a_{11}=0$. Hence, we conclude that the price maker has a good reason to keep his price at the present level P_0, if he is to act on the minimax principle that may be regarded as the axiom of the rational behavior in the oligopolistic situation. The above payoff matrix does not change in negative or positive sign of its elements, so long as the marginal cost curve CC' lies between both marginal revenue lines M_1R_1 and M_2R_2. This implies that the price maker will keep his price at the present level P_0, even if a certain small change occurs in his cost conditions.

III

So far, we have discussed the case where the price maker is concerned with a choice between to keep his price unchanged and to cut his price. We can discuss, symmetrically, the case of his choice between keeping his price unchanged and raising his price; and the result will be the same as the above discussion: i.e., "not to rock the boat."

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