ON THE OLIGOPOLY MARKET TYPE

by Werner SICHEL*

Part 1 Classification

The economic literature discusses four basic market types. These are: pure competition, pure monopoly, monopolistic competition, and oligopoly.

Pure competition is a market type where there exist many sellers. Each seller offers exactly the same product or service output (no product differentiation) and entry into and exit out of the industry is perfectly free and easy. The typical firm is therefore a price taker and will produce a quantity consistent with its profit maximization solution. The impersonal market forces insure a long-run equilubrium situation where each firm produces at price equal to marginal cost and minimum average cost.

Pure monopoly is a market type where only one seller exists and potential entrants have been effectively blocked. The firm is the industry and its demand curve is identical with the demand curve for the product or service. The monopolist will maximize his profits by producing a quantity consistent with marginal cost equal to marginal revenue and charge the highest price that this quantity can be sold for.

Monopolistic competition which is often heralded as blending monopoly and competition and therefore resembling the "real world" is a market type made up of many sellers with each offering a slightly different product. Sales are dependent not only upon price, but also upon the nature of the product and upon advertising outlays. Typical firm analysis brings about a long-run equilibrium solution based upon the large numbers concept that each firm does not consider the reactions of

*) Dr. Sichel is Associate Professor of Economics at Western Michigan University.

their rivals. The impersonal market forces, as in pure competion, bring about a normal above marginal cost (the demand curve is negatively sloped) and the corresponding quantity produced will be lower.

Oligopoly, the last of the four market types, is a market in which there are few sellers. The adjective "few" must be interpretated operationally. The minimum is two firms and the maximum is so many firms that if one additional firm were to enter the industry, each firm would no longer consider its rival's reactions (retaliations) before changing its price, or the quality of its product, or its advertising outlay, or any other competitive strategy that it uses.

The above definitions, which I believe are fairly representative of economics textbooks writers, are not at issue here. How these market types are classified is, however, open to question. Pure competition and pure monopoly are often portrayed as polar cases while the remaining two are said to resemble real world markets which lie between them. Monopolistic competition is depicted as being closer to pure competition than is oligopoly, and oligopoly closer to monopoly than is monopolistic competition. The impression that one is left with is illustrated in Diagram 1. Pure competition and pure monopoly are the extreme cases,

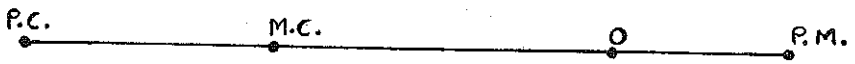

DIAGRAM 1

monopolistic competition is to the left of oligopoly and no importance is attached to the distance between the market types. This, I believe, is not a very useful classification. A much better classification is that which separates market types into those where firms are concerned about their rivals and those where firms are only concerned with their customers and potential customers. In such a classification we see that oligopoly stands alone. In pure competition, pure monopoly, and monopolistic competition, rival firms are never considered; in monopoly there aren't any and in pure competition and monopolistic competition there are so many that the typical firm considers itself to be so small a contributor to total output that rivals pay no attention to it.

Because of unfortunate classification, oligopoly being placed in close proximity with monopoly, the oligopoly market type has in some quar-

ters taken on sinister connotations. Few firms, it is reasoned, are apt to collude and thereby earn monopoly profits. It is a goal of some business executives to rid their industry of the oligopoly label. Admittedly, this is difficult to do. Oligopoly is the real world. With very few exceptions, firms consider what their rival's reactions might be in response to any change in a key variable that they contemplate. Oligopoly industries may be either "good" or "bad". There may be abundant competition among the firms or very little competition. Oligopoly covers so wide a range that judgements of this type must be made on an individual industry basis.

Part 2 Oligopoly Models

Since oligopoly includes the special case of duopoly (only two firms in the industry) let us begin with the contributions of Augustin Cournot over 130 years ago. Cournot analyzed the competitive rivalry between two producers of mineral water. Each firm was assumed to hold its price fixed and compete only on the basis of output. Cournot assumed that each duopolist acts independently and that he will offer an amount of spring water on the basis of the amount that the other firm presently offers. Each expects the other not to change his output, yet each will change his output on the basis of the other firms production. This continues until each produces the same quantity of spring water which constitutes an equilibrium position. This process can be followed in Diagram 2. If we begin at an arbitrary point, oq_2, output of Firm 2, Firm

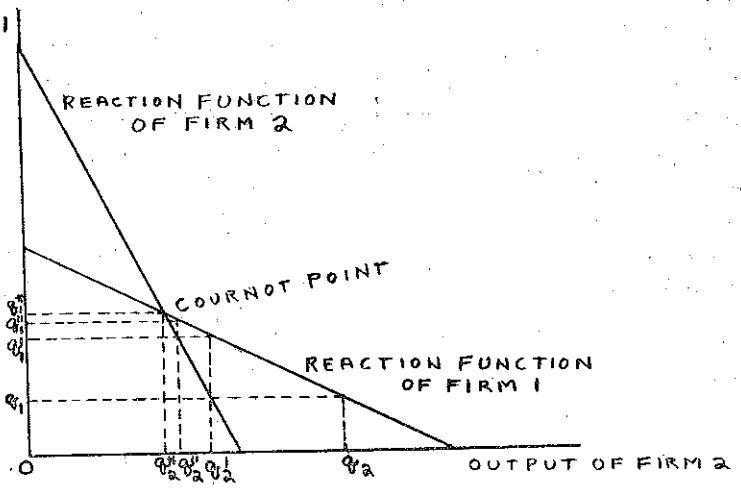

DIAGRAM 2

1 will respond by producing oq_1 output. Firm 2, which believes that Firm 1 will continue to produce oq_1 will lower its output to oq'_2. This will in turn bring a response of oq'_1 output by Firm 1. Firm 2 will again decrease its otuput (to oq''_2) with Firm 1 reacting by producing oq''_1. Equilibrium will be reached at the Cournot point (q^*_1 , q^*_1).

The reaction functions of Firms 1 and 2 are derived from iso-profit curves. This is illustrated in Diagram 3. Four iso-profit curves are drawn for each firm, with the highest number corresponding to the highest

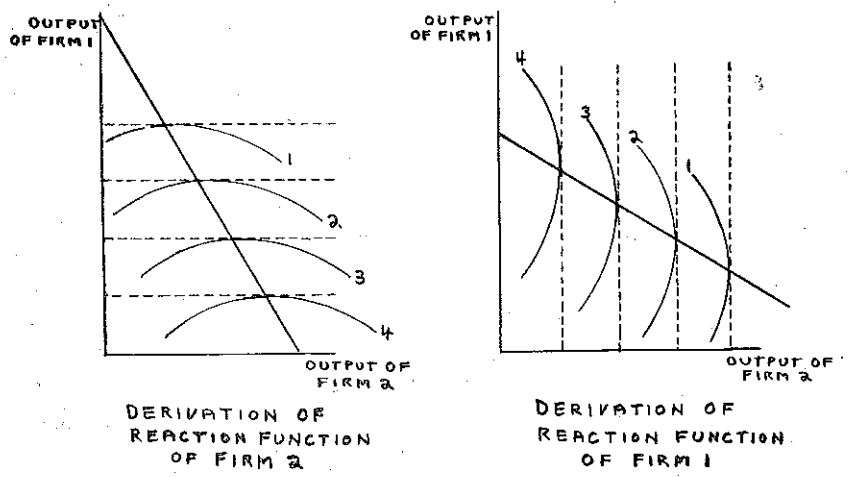

DIAGRAM 3

profits. Where the iso-profit curve is tangent to a line drawn from a particular output level, profits are maximized, given the output level of the other firm. The reaction function is therefore a locus of points each of which shows profit maximization given the other firm's output level.

About fifty years later, Joseph Bertrand contended that the constant output assumption of Cournot was fallacious and substituted what he thought was a more realistic approach, a constant price assumption. Each of the duopolists in the Bertrand model acts independently under the belief that regardless of what price changes he makes, the price charged by his competitor will remain fixed. The behavior of each duopolist, as in the Cournot model, is shown by a reaction function. Diagram 4 illustrates the Bertrand model.

If we begin at an arbitrary point, op_2 price of Firm 2, Firm 1 will respond by charging op_1 price. Firm 2, which believes that Firm 1 will

continue to charge op_1, will react by raising its price to op'_2. This will in turn bring a response of op'_1 price by Firm 1. Firm 2 will again increase price to op_2'' with Firm 1 reacting by raising its price to op''_1. Equilibrium will be reached at the intersection of the reaction functions (p^*_1, p^*_2).

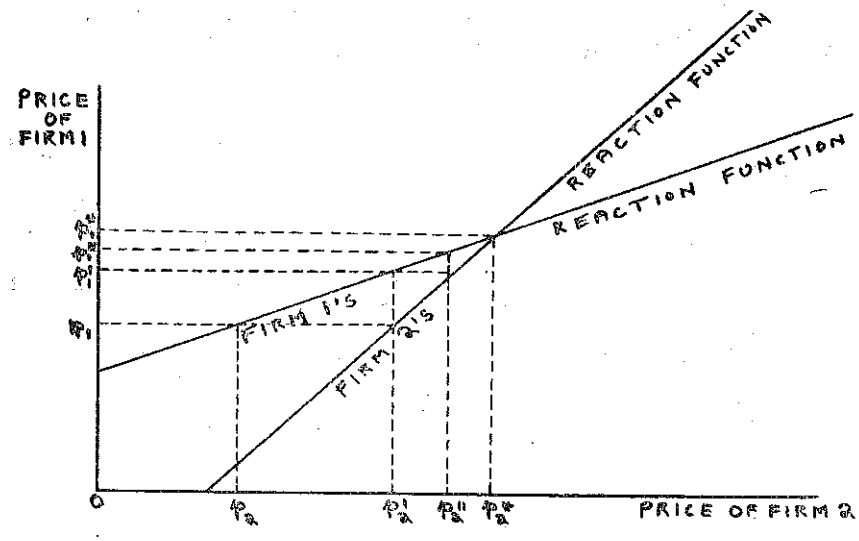

DIAGRAM 4

The reaction functions of Firms 1 and 2 are derived from iso-profit curves just as was the case in the Cournot model. This is illustrated in Diagram 5. Four iso-profit curves are drawn for each firm, with the

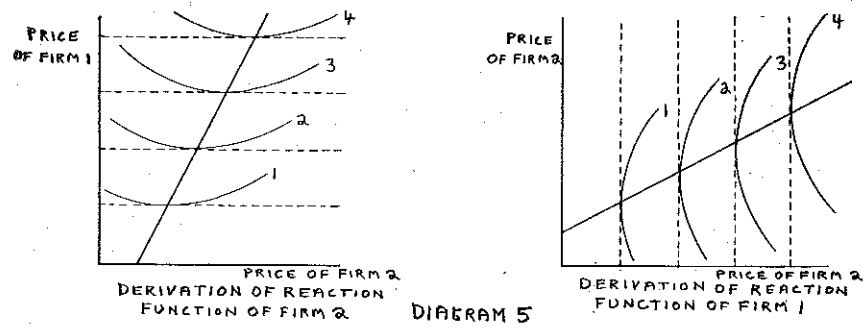

DIAGRAM 5

highest number corresponding to the highest profits. Where the iso-profit curve is tangent to a line drawn from a particular price level of the other firm, profits are maximized. The reaction function is therefore a

locus of points, each of which shows profit maximization, given the other firms' price.

The largely ignored Bertrand model was revived in the 1930's by Heinrich von Stackelberg. In addition to Bertrand's case where both duopolists are price followers, von Stackelberg introduced cases where both are price leaders and where one is a leader and the other a follower. He defined a price leader as one who does not adhere to his reaction function and a price follower as one who does. Four solutions are illustrated in Diagram 6. The diagram is identical to that of Betrand's and point F (follower-follower) is the solution of the Betrand case.

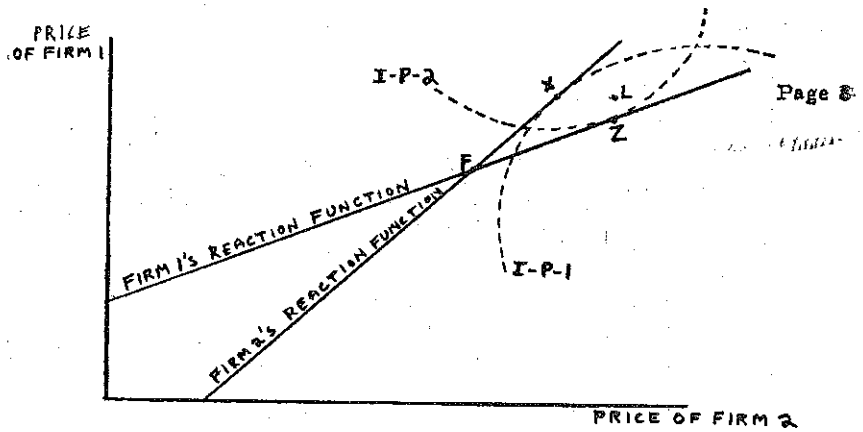

DIAGRAM 6

If Firm 1 decides to be a price leader and if Firm 2 continues to be a follower, equilibrium will be achieved at point X. This is where Firm 1's iso-profit curve (I - P - 1) is tangent to Firm 2's reaction function Firm 1 will maximize its profits, given Firm 2's reaction function at point X. When the roles are reversed, Firm 2 being the leader and Firm 1 following, point Z will be the equilibrium solution. Here, Firm 2's iso-profit curve (I - P - 2) is tangent to Firm 1's reaction function. "Stackelberg disequilibrium", the last of the four solutions, occurs when both duopolists want to be price leaders. Each believes that the other will follow and set his price so as to maximize profits, given the other firm's reaction function. Perpendiculars drawn from both axes, one running through point X and the other through point Z, will intersect at point L. Point L, the Stackelberg disequilibrium, falls on higher iso-profit curves for both (see Diagram 5).

In the late 1940's when game theory was introduced it naturally was immediately applied to duopoly - oligopoly theory. Payoff matrices were constructed to show the results of various strategies that could be adopted by rival business firms. Diagram 7 illustrates a payoff matrix for

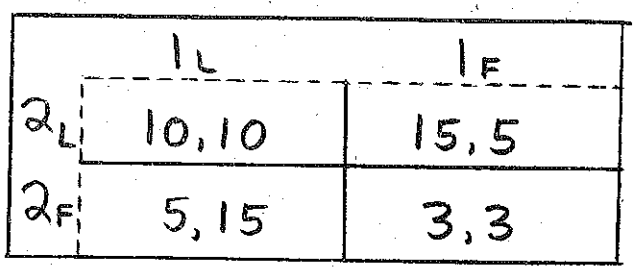

DIAGRAM 7

duopolists 1 and 2. The subscript L and F refer to the only two strategies available to them; being a price leader or a price follower. The numbers in the boxes refer to the profit payofs that the firms will receive as a function of the strategies that were chosen. The first number that apperas (to the left of the comma) is Firm l's payoff and the second number is Firm 2's payoff. It is evident that the follower-follower solution will be avoided. Firm 1 would like to follow if Firm 2 would lead, but Firm 2 would also like to follow if Firm 1 would lead. Neither being able to enforce a stratergy on its rival, they may agree to leader-leader strategies and enjoy equal profits of 10. Of course it pays for each firm not to abide by the agreement. Switching to a follower strategy while the other firm continues to lead will result in an increase in profit from 10 to 15 while the rival experiences a decrease in profits from 10 to 5.

Part 3 Critique

In Part 2 we have briefly examined four different duopoly-oligopoly models. They are different with respect to the assumptions that are made and the methodology that is applied. However, their similarities far outweigh their differences. I would classify all of them as determinate models. The participants are carefully defined as either leaders of followers and the solution follows. In the first two models (Cournot and Bertrand) it is assumed that each party believes that the other will always maintain his quantity output or price, even in light of experience which contra-

dicts it. In the latter two models, particular roles are assumed for the parties (the selection of a clear - cut strategy) and then the solution is given.

How useful are such determinate models? I would argue that because of the nature of the oligopoly market type the answer to this question is "not very." A much more reasonable approach, in my opinion, is to realize that while there is a solution in oligopoly (particular quantities of specified goods and services are sold at particular prices) it is not determinate in the usual sense of that term. In Part 1, we set oligopoly apart from the other three market types because it was the only one where rivals reactions were considered. Conjectural interdependence (what one firm is willing to do depends on what it believes the reactions to be of the rival firms and what each of these firms will do depends upon what it thinks the original firm as well as the other rivals' reactions will be) defines oligopoly and introducing some certain reaction assumptions circumvents the problem but does not provide us with a useful theory. It is more nearly a tautology. We define the parties' strategies and therefore "know" (rather than predict) the solution.

We may clarify our objection of determinate oligopoly models by providing the following hypothetical example of an oligopoly firm's decision making process as it contemplates a price change. Let us assume that on the basis of the available cost and demand data of our hypothetical firm it seems very clear to management that their set of prices on a particular key line of goods that they manufacture should be decreased. Demand is estimated to be fairly elastic over the relevant and it is believed that they are producing on the downward sloping portion of their average cost curve. *Ceteris paribus*, price should be lowered. However. since we are dealing with an oligopoly indusrty, management will ask the question; "what will the reaction of our rivals be?" Since this is an unknown, educated guesses made on the basis of management experience will ensue. The possibilities are infinite and may include both price and non-price variables. Expected price reactions can run the gamut from none at all to a substantial undercutting of the lowered prices. These two extremes as well as one that falls somewhere between them are illustrated in Diagram 8. OP and OQ represent the original price-quantity situation for our hypothetical firm. If on the basis of management experience it is forcast that no rival reaction will occur to a PP′ decrease in prices, the expected new equilibrium situation will be OP′, OQ′ and the expected demand curve over this range will be AB. The other extre-

me, that of management believing this industry to be cutthroat, and therefore expecting the new lowered prices to be substantially undercut, will result in an expected OP′, OQ″ "equilibrium" (the term equilibrium is in quotes to point out that OP′, OQ″ is not expected to be a stable equilibrium as our hypothetical firm will probably either follow the new lower price or undercut it again). In any case, the expected demand curve over this same price range, and before any further price changes, is this time the positively sloped segment. AC. One last example of a response that may be forcast by management is that their new lower

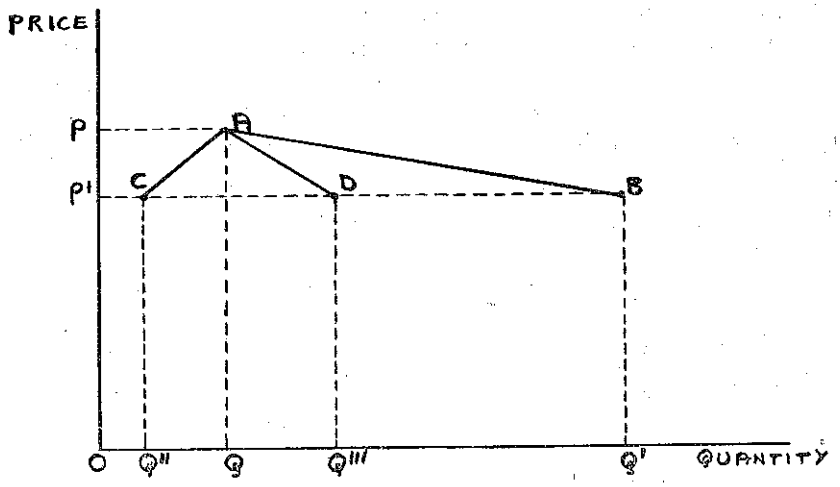

DIAGRAM 8

price will be followed by their rivals. In this case the price elasticity of demand for the industry product, rather than for our hypothetical firm's particular product is relevant and since it would undoubtedly be substantially more inelastic a new equilibrium solution such as OP′ OQ‴ is expected. The demand segment is represented as AD. It doesn't matter whether management's guess concerning the relevant demand segment turns out to be correct or not, in fact, it will never be tested if as a result of it the price will not be changed. What does matter is that the firm will act or not on the basis of their appraisal of rival reactions. Besides the multitude of price reactions, only three of which were illustrated here, non-price reactions such as quality changes, selling cost expenditure changes, changes in the nature of the product, changes in services rendered, and many more may be forecast and taken into consideration.

In our example of the hypothetical firm we have only presented illustrations of its management's appraisals concerning rivals. To complete the example we must add the rivals' appraisals of our hypothetical firm's action and possible reactions to their responses. Conjectural interdependence is reciprocal.

If determinate oligopoly models are inadequate to deal with real world oligopoly markets, what is the answer? This is a very difficult question and I do not pretend to have a ready answer. One thing is clear, and that is that a great deal of information is needed concerning the industry in question. William Fellner, in his fine book *Competition Among the Few*, writes: "...conjectural interdependence... increases the amount of information necessary for understanding or predicting the outcome of specific processes." He goes on to point out that this information cannot be obtained by the same methods used to study production functions or cost functions, but that the relevant information can be obtained only by observing the behavior of businessmen in a range in which their behavior depends on the assumed behavior of others and in which the actual behavior of others depends on the assumed behavior of the first group. Furthermore, this "understanding" must rely on variables that most economists are not used to dealing with and find objectionable since they are very difficult to quantify. Examples include personality traits like toughness, strength, honesty, the political consequences of particular actions taken by management persons, how popular they are, and how impetuous they are. These are very difficult to work with, but to avoid them is to disregard some of the most important factors that determine the outcome.

Part 4 Conclusion

In this concluding section it may be interesting to examine a few characteristics associated with oligopoly industries and see whether these can be explained along the lines of our discussion of the oligopoly market type. Four important characteristics - price rigidity, non-price competition, the price war, and a quest for bigness - will suffice.

Rigid prices have long been associated with oligopoly. Accusations against administered prices and their insensitivity to cost and demand changes are frequenty made. Since pure competition is associated with continuous price changes, very infrequent price changes are reasoned to be symptomatic of a high degree of monopoly control. However, such

conclusions may be fallacious. It follows from our discussion of the oligopoly market type that prices once arrived at are not altered without some risk. Competitors may misinterpret the motivation of a price decrease and retaliate by undercutting it. Unless an understanding (explicit or implicit) concerning price changes exists, a "leave well enough alone" attitude may pervade. Avoiding the risk of a very costly confrontation with rivals may easily outweigh the expected gains stemming from the contemplated price change.

The common use of non-price competition is, of course, closely associated with price rigidity. It presents alternative methods to changing the quoted price. Instead of lowering price, a firm may decide to increase the quality of its product, or offer certain hidden discounts, or more services without charging for them, or simply hire more salesmen or spend more on advertising. While such nonprice competition may be tantamount to changing price, it is less apt to upset the sensitive "state of peace" in the oliogpoly industry.

A third important feature of oligopoly and one which is associated with both price rigidity and non price competition is the price war. The price war is a major threat to the well being to the oligopoly firms. They don't occur very frequently, but one may not judge their importance by their limited occurence. Rigid prices are maintained and non-price competition practiced to avoid price wars. In the absence of this threat a very different set of prices would likely be set by the firms.

A last characteristic of oligopoly firms that also follows from our discussion of this market type is their quest for bigness. We refer here to bigness for its own sake, rather than because the firm is below "minimum optimal scale" on a production basis. The big firm is more impressive and powerful in dealing with its competitors. A big firm is better able to absorb losses during a conflict like a price war and to inflict losses on rivals. Its initial movements may be more forceful and its reactions more respected and feared.