Imperfect Information, Monopolistic Competition, and Public Policy

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Ever since the pioneering work of George Stigler (1961) and the provocative survey by Michael Rothschild (1973), economists have recognized that general equilibrium models yield competitive equilibria only by making strong assumptions about the information available to market participants. In response to this difficulty, theorists in recent years have developed a family of "search equilibrium models" that presuppose homogeneity and the absence of price discrimination, and which also assume that information acquisition costs are positive for at least a subset of buyers. On the basis of these and other assumptions, the models attempt to show how price dispersion equilibria can arise solely as a result of the strategies that firms and consumers pursue. One author summarized the results: "if information is costly, each small firm obtains market power" so that "*The relevant market structure with imperfect information is not perfect competition but rather monopolistic competition*" (Steven Salop, 1976, p. 240).

That search costs are positive is of normative interest as well because those costs could generate supracompetitive prices. Policy analysts thus should want to know: (a) When is insufficient search, rather than other factors, likely to cause supracompetitive prices? (b) How can markets that behave badly for information reasons best be moved toward competitive equilibria? (c) When are the costs of regulation to cure this sort of market failure likely to exceed the welfare gains? Some theorists and most decision makers assume that the answer to question (a) is "often, especially in consumer markets," a position that the evidence fails convincingly to sustain. Economists also seldom ask the last two questions. And decision makers have ignored question (c) while transmuting (b) into the inquiry whether the "typical" consumer lacks *any* information that he or she would find useful in making a "rational" choice. If so, an information problem justifying regulation is assumed to exist (Jonathan Landers, 1977; Landers and Ralph Rohner, 1979). The economists' concentration on theory and the policymakers' ignorance of economics thus has produced a large amount of regulation, much of which might be unnecessary and most of which is expensive to administer and obey.

The search equilibrium models alluded to focus attention on the strength of the informational assumptions that the neoclassical models make and on the potentially unpleasant normative consequences of relaxing those assumptions. These models, however, make strong assumptions of their own, in particular respecting the methods by which the consumers in them become informed and the nature of consumer expectations. Section I of this paper discusses the consequences of making assumptions of this sort, and it is argued that, because of them, most search equilibrium models do not readily yield usable policy instruments. Section II briefly sketches lines of research that seem interesting positively and that may generate helpful normative conclusions.

I

A useful way to begin is with a slightly modified version of the original and widely cited Salop and Stiglitz model (1977).[1] Sup-

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[1]A number of extensions and variations of the original Salop and Stiglitz model have appeared. See our working paper for a further discussion of these.

pose that (*i*) arbitrarily large numbers of firms and consumers exist, with the consumer/firm ratio endogenous; (*ii*) a homogeneous good is sold and consumed; (*iii*) no price discrimination occurs; (*iv*) consumers desire to purchase one unit of the good and will pay any price up to a common limit price (p_L); (*v*) consumers have rational expectations in that they know the true distribution of prices in a market when they begin to search, but do not know which firms charge these prices; (*vi*) consumers fall into two classes, as measured by the costs to them of becoming informed, with the low-cost group having information acquisition cost c_1 and the high-cost group having cost c_2, where $c_2 \geq c_1 \geq 0$; (*vii*) becoming informed is viewed as purchasing and reading a newspaper that reveals the relationship between firms and prices; (*viii*) consumers who become informed always buy at the stores that charge the lowest price while consumers who do not become informed visit one store chosen at random and buy if the price is less than or equal to the limit price; (*ix*) technologies are described by a fixed cost (F) and a marginal cost (p) that is constant up to a particular capacity (s); (*x*) firms maximize profits and in equilibrium earn zero expected profits.

Respecting Salop and Stiglitz's results, let $p^* =$ the competitive price $= p + (F/s)$, and $\alpha =$ the proportion of consumers with low-information acquisition costs (c_1). Then a competitive equilibrium exists if and only if enough consumers have zero information acquisition costs—if $c_1 = 0$ and $\alpha > 1 - [F/s(p_L - p)]$. If these two conditions are not met, all firms charge the monopoly price if it never pays consumers to seek a lower price—if $p_L - p^* \leq c_1 \leq c_2$; otherwise, two-price equilibria exist with the low price being p^* and the high price being either p_L or a price intermediate between p^* and p_L; or, no equilibrium exists.

There are four related difficulties with work of this sort. First, the particular rational expectations assumption used is strong; before they begin to search, consumers never know and could not know the entire price distribution unless they also knew the identity of the firms charging these prices. Second, the institution by which consumers become informed—buying a newspaper that contains *all* relevant information—does not exist. Third, nonexistence may occur more frequently than the authors suppose, because on this model's assumptions it is unlikely that two distinct groups of consumers will exist. Since consumers are assumed to be identical in all respects except analytical ability and the opportunity cost of time, two groups of consumers will exist only if the high-cost group has considerably less ability than the low-cost group to read the newspaper and match what they *know* is the lowest price to the name of the firm that charges it, or if the high-cost group attaches a much greater value to the twenty or so seconds it will take to do this than the low-cost group does. Because either possibility is implausible, only one consumer group actually would exist; everyone in this model would buy the newspaper and be perfectly informed or no one would. And since the authors show that a competitive equilibrium cannot exist when $c_1 > 0$, there will either be a monopoly equilibrium or nonexistence. Fourth, the particular rational expectations assumption used reduces the model's policy significance. Policymakers commonly perceive themselves as having to choose between regulating a transaction to achieve a desired outcome or reducing search costs to improve the outcomes markets reach. Whether the "regulation" or "disclosure" option should be chosen is in part a function of the nature of the equilibria that would be produced if information acquisition costs were reduced. These costs never can be reduced to zero, and the rational expectations assumption then implies that competitive equilibria are impossible but the authors do not otherwise indicate what the effect of reducing search costs would be. Thus it is difficult to draw insights from their theoretically interesting model that would illuminate the choice between regulation and disclosure. In addition, the model cannot generate criteria that decision makers can use to characterize observed behavior because it yields nonexistence over relevant ranges of the underlying parameters.

More recent work has advanced the Salop and Stiglitz analysis; however, it too makes strong assumptions about methods of information acquisition and about the strategies that some of the economic actors pursue. Hal Varian (1980), for example, supposes uninformed consumers to visit one store at random and purchase if the price they see equals or is less than the limit price, and informed consumers to shop at the stores charging the lowest price. Consumers again become informed by reading a newspaper that communicates the relationship between firms and prices, but the decision to become informed is taken to be exogenous. Finally, Varian assumes every firm to have declining average costs, with no capacity constraint. Firms are allowed to pursue mixed strategies. Thus they may randomly choose a different price each period (a "week"). If this turns out to be the lowest price, the firm sells to its share of the uninformed consumers and all the informed; otherwise, it sells only to the uninformed that week and loses money. Varian proves the existence of a mixed-strategy equilibrium in which all prices are charged with positive probability, from the lowest, where price equals average cost for the successful firm that captures all the informed consumers plus its share of the ignorant, to the highest, which equals the limit price.

This model relaxes the rational expectations assumption, for the uninformed consumers in it are not assumed to know the price distribution, but its assumptions respecting firm costs and the method of information acquisition are again unrealistic. So also may be its assumption respecting the way firms price. To see why this is so, suppose that on Tuesday a firm sends in its ad to the newspaper with its price for the following week; on Monday morning of that week the newspaper comes out and the firm then learns that it does not have the lowest price. It then has an incentive to raise its price to the limit price for the rest of the week. The model implicitly, but questionably, assumes that such price increases will not be made. Firms adhere to advertised prices because in some circumstances they are legally bound to do so and because altering advertised prices could cause goodwill losses if consumers commonly assume those prices to be fixed for short periods. Consumers in this model who visit a firm that is not low for the week, however, have not observed the firm's ad; if they had, they would also have observed the ad of the lowest priced competitor and gone there. No legal prohibition against altering prices on which consumers do not rely exists, nor is goodwill a factor because consumers would not know that the price they see has been raised. If neither the law nor the prospect of lost goodwill are relevant to firms, however, they would maximize profits by raising prices to the limit whenever they were not low, in which case the equilibrium in this model actually could involve all but one firm charging the monopoly price in each period.

For these and other reasons, Varian's imaginative model is difficult for decision makers to apply. Any welfare gains in it resulting from the state making information easier to get depends on prohibiting firms that were not low for a given week from raising their prices; this may be a difficult prohibition to enforce. Also, the model shows that the prices paid by informed consumers could decrease with increases in the size of the uninformed group, making the welfare effect of legal intervention ambiguous. Until these difficulties are resolved, it is difficult to distil directives for action from this model.

In an important sense, the qualms we have expressed about these models are beside the point; the models reflect thoughtful attempts to deal with even more serious defects in prior work and their authors apparently were not intent on producing analyses that would be immediately useful to decision makers. Nevertheless, the reliance of these search equilibrium models on strong versions of the rational expectations assumption combined with their use of imaginary institutions by which consumers become informed are the source of some difficulty even when the models are taken on their own terms. In particular, they seem responsible for the "discontinuous" nature of the equilibria these models generate, which are of concern theoretically. Also, given the great amount of

regulation that has been passed to cure the allegedly harmful effects of imperfect information, it now seems useful for economists to address the questions that decision makers should want answered. The Salop and Stiglitz model and its various extensions thus are best viewed as "worst-case" examples of what may occur when information acquisition costs are positive. A useful next step is to develop models intermediate to them and the neoclassical models discussed in the introduction to this paper. One way to do this is to weaken further the rational expectations assumption and to assume that consumers use more realistic methods of information acquisition.

An example of such a model can be found in our 1979 article. In this model consumers learn of prices by visiting stores, and shop pursuant to a fixed sample size strategy, with some consumers having sample sizes equaling one and others having sample sizes strictly greater than one. These assumptions differ from the standard ones in three ways. First, the method of acquiring information is reasonably realistic since consumers often do learn of prices by visiting stores. Second, no one in this model is perfectly informed, in the sense of knowing the distribution and the identity of all firms; rather, consumers only know what their limited samples reveal. Third, the shopping strategy it posits is consistent with much of what is known about actual shopping behavior, since in all markets studied some consumers visit one and others more than one store, and the "shoppers" sometimes return to earlier stores to take advantage of favorable prices.

This model is similar in its assumptions respecting consumer preferences and firm technology to the modified version of the Salop and Stiglitz model discussed above. The only difference is that α now refers to the proportion of comparison shoppers and n to the number of stores they visit ($n \geq 2$). Three qualitatively distinct equilibrium configurations emerge in this model: (*i*) if a significant proportion of consumers sample more than one firm, a competitive equilibrium occurs; (*ii*) if somewhat fewer consumers shop, the equilibrium distribution will have a mass point at p^*, a gap in which no prices are charged and a continuous distribution of prices above that to the limit price p_L; (*iii*) if still fewer consumer shop, the equilibrium distribution of prices will be continuous over some range $[\bar{p}, p_L]$ where $\bar{p} \geq p^*$. In this final case, $\bar{p}$ rises as α falls; prices thus begin to mass toward the monopoly price as the percentage of comparison shoppers gets small.

This model suggests that monopolistic competition sometimes is not the appropriate market structure in which to analyze imperfect information issues. Some theorists, as the introduction noted, have employed this theory to characterize market outcomes when information about price is costly to acquire in part because of their view that price dispersion may be common; when dispersion exists, price must exceed marginal cost for at least some firms, and this disparity is an inevitable feature of monopolistically competitive equilibria. Our model, however, makes no presumption that search costs are zero for the comparison shoppers, but a classic competitive equilibrium still can obtain in it. In addition, a normative implication of the model is that policymakers should consider curing the effects of costly search by reducing the costs to consumers of directly comparing purchase alternatives. Studies of actual markets suggest that such cost reductions can substantially lower prices; see for example, D. G. Devine and B. W. Marion (1979).

This model nevertheless is primitive. Initially, the model was designed to be of some help to decision makers in evaluating a market's competitive state if goods are homogeneous, but it is unilluminating if heterogeneity exists and consumers shop across quality levels or if firms can price discriminate. Since product heterogeneity is more often characteristic of monopolistic competition than homogeneity, the policy implications of our model would appear only to be relevant to a small number of markets. Further, the model makes the standard but strong assumptions that firms have perfect information about the prices other firms charge and that consumers purchase one good

or none; it treats consumers' search strategies as exogenously determined; and while it is relatively simple from a formal point of view, it is still difficult for decision makers to apply.

II

The analysis above implies that a useful task, from a theoretical viewpoint, is to see what equilibria would occur in models that drop the rational expectations assumption, assume real world methods of information acquisition and relatively plausible consumer search strategies and endow firms with realistic cost functions. Such models would be more likely to illuminate actual phenomena, and might provide the basis for empirical research or laboratory experiments that actually could test the effects of insufficient search on economic environments. These realistic models would also be helpful to policymakers for the reasons previously given and for another important reason. Because it is so difficult to test economic theories directly, the attractiveness of a model to decision makers becomes a function of the inherent plausibility of the economic story that it tells, and this plausibility is itself largely a function of the realism of the model's specifications. Search equilibrium models have not been used by decision makers in part because of the strength of the assumptions they have made.

A policy focus also suggests relaxing the homogeneity assumption. This is because a crucial question, when price dispersion is observed, is whether it is a function of insufficient search, which suggests inefficiency, or of heterogeneity. Our forthcoming paper addresses this question using a model in which goods of two qualities are sold and consumers have very imprecise information respecting the prices and qualities that obtain at any given firm. In consequence, the consumers are assumed to shop randomly across quality levels. The model characterizes necessary and sufficient conditions for both goods to trade at their competitive prices. This model yields three results: (*i*) heterogeneous goods markets are more likely to segment into roughly homogeneous subsets than is commonly supposed; (*ii*) when markets do not segment, heterogeneity can work to dilute the effectiveness of search, since, for example, a consumer who visits two stores that sell different qualities is in effect a nonshopper for both varieties; (*iii*) increases in quality density, sample sizes held constant, reduce the likelihood of competitive equilibria, since search becomes dissipated by the range of qualities. This model nevertheless only begins to explore the implications of heterogeneity. Its major defect, from a policy perspective, is that it fails to characterize equilibria intermediate between competitive and monopoly, and thus it is unhelpful to decision makers who want to know whether a particular heterogeneous goods market is behaving well or badly. An important next step, then, is for search equilibrium models formally to incorporate product and contract term heterogeneity.

Finally, the economic analysis to date has been of limited use to policymakers because the formal models deal only with search goods, all of whose properties are observable before purchase. Much regulation, however, deals with goods or services that have experience or credence qualities. The best formal treatment of this case is found in Mark Satterthwaite (1979). This paper analyzes a model of the medical services market and shows how an increase in the supply of physicians can cause prices to rise because the supply increase reduces the effectiveness of consumer search. Extending Satterthwaite's model or developing new models to deal with experience goods would obviously be useful.

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