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ALWAYS LEARNING

PEARSON

Changes in Costs and Welfare in the Circle Model. Salop shows that, as in the representative consumer models, in the competitive region, as fixed costs rise, there are fewer firms or brands, so price rises and equilibrium variety falls. In that region, as the constant marginal cost rises, price rises by an equal amount (all increases in costs are shifted to consumers), but equilibrium variety remains unchanged.

At the kink in the demand curve at $\underline{p}_m$ in Figure 7.9, however, an increase in either fixed or marginal cost reduces the number of firms (variety) but, perversely, lowers price (the kink shifts down and to the right in Figure 7.9). Thus, if the economy is at such a point, a tax that raises firms' costs lowers prices and decreases variety. Salop shows, however, that welfare rises, even if the proceeds of the tax are ignored.

Indeed, welfare in this circle market can be studied in the same manner as in the representative consumer models. Salop shows that the first-best optimal variety is less than the variety in either the monopolistic or competitive equilibria. With fewer brands, the savings in fixed costs exceed the losses due to higher prices. Thus, in the circle model's monopolistic competition equilibrium, there are unambiguously too many brands; whereas in the differentiated products, representative consumer model equilibrium, there can be too many or too few brands.

Salop shows that the second-best optimum, given the government's only regulatory policy is to control entry, is either the market equilibrium or complete monopoly. That is, the optimal entry policy is either free entry or entry restricted so that each brand has a complete monopoly market.

Hybrid Models

We have drawn the distinction between representative consumer models and location models. Although the vast majority of all monopolistic competition models fall cleanly into one or the other of these two categories, increasing use is made of hybrid models that combine some of the properties of each model.[23]

One of these hybrid models, Deneckere and Rothschild (1986), includes the circle model and a version of the representative consumer model as special cases of Bertrand equilibrium. Using their hybrid model, Deneckere and Rothschild show that prices are lower in a representative consumer model than in the circle model because there is more competition in a representative consumer model. They also show that adding another brand benefits relatively few consumers in the circle model, whereas consumers benefit substantially from the introduction of extra brands in the representative consumer model. It is for these reasons that there are too many brands in the equilibrium of the circle model, but there may be too many or too few brands in the equilibrium of the representative consumer model.

[23] Hybrid models based on the work of Anderson and de Palma (1992a, 1992b), Besanko, Perry, and Spady (1990), Deneckere and Rothschild (1986), Perloff and Salop (1985), and Sattinger (1984) are discussed in **www.aw-bc.com/carlton_perloff** "Hybrid."

Estimation of Differentiated Goods Models

The properties of the differentiated goods models we have described depend critically on the pattern of substitutability among the products. In recent years, advances in statistical techniques and more powerful computers have made possible the simultaneous estimation of demand functions for many brands within a single market.

Nonetheless, it remains difficult to simultaneously estimate the demand curves facing all the differentiated products in a market because of the large number of parameters that must be estimated. For example, there are at least 174 firms selling 230 brands and 613 different products of canned juices in U.S. grocery stores. If we had to estimate 613 simultaneous equations of the quantity demanded for each good conditional on 613 prices with one coefficient for each price in each equation, we would have to estimate at least 375,769 parameters. Even if we use utility theory to restrict these parameters, we would still have to estimate many thousands of parameters.

To reduce the number of parameters that must be estimated, researchers use restricted demand systems in which they impose relationships among the various demand curves, some of which stem from theory and others that are arbitrary, such as the functional form. Analysts use many different functional forms when estimating demand equations, such as logit, nested logit, and the almost ideal demand system, but they all have the purpose of imposing constraints on the pattern of substitution among the differentiated products in order to limit the number of parameters that have to be estimated.[24] Further, researchers frequently estimate demand curves for only the major products within a market.

Two approaches are used frequently. The traditional approach is to estimate a system of demand curves—one for each product—but to impose enough restrictions so that the parameters in the demand curves can be estimated (for example, Hausman and Leonard, 1997). An alternative approach is to use a logit or the more general random parameter logit (or probit) model, in which the econometrician tries to explain the fraction of sales for each product conditional on its characteristics (such as, flavor and size of container) as well as relative prices.[25] Researchers must be careful in making assumptions about the structure of the demand curves that they do not implicitly assume their conclusions by the manner in which they restrict the substitution patterns.

After estimating the demand system, researchers frequently want to make “what if” prediction about how changes in a market (such as a merger) will affect prices. To do so, they need a model of oligopoly behavior. Researchers usually lack information about marginal costs. However, by making strong assumptions, they can estimate marginal costs.

[24]See, for example, Baker and Bresnahan (1988), Trajtenberg (1989), Hausman, Leonard, and Zona (1994), Bresnahan, Stern, and Trajtenberg (1997), Hausman and Leonard (1997), Hendel (1999), and Peters (2003).

[25]See Berry (1994), Berry, Levinsohn, and Pakes (1995), Nevo (2000, 2001), and Petrin (2002).

EXAMPLE 7.5

Combining Beers

Consumers can choose from among many different brands and types of beer, the latter including premium, light (low calorie), and imported. Postulating a demand curve for each brand and type of beer, an analyst would have to estimate a very large number of parameters. Instead, Hausman, Leonard, and Zona (1994) postulate that there is a three-stage decision process to beer consumption. First consumers decide how much beer to consume in the aggregate. Then they decide what share of each type to consume. Finally, they pick the share of each brand for each type of beer. By specifying demand in this way, the analyst is reducing the number of demand parameters at the cost of imposing restrictions on demand substitution patterns.

The analyst then uses the estimated demand elasticities from this demand system to determine the markup of price over marginal cost based on the assumption that the firms engage in a Bertrand game and have constant marginal costs. A logical question to ask is what will happen to prices if two of the firms merge. To answer this question, the analyst rewrites the profit-maximizing equations describing the equilibrium with fewer firms. Previously, the two firms set prices independently. Now the new merged firm takes into account that it controls the pricing of products previously set by the other firm. Using this technique, Hausman et al. calculate that a merger of Coors and Labatts, two brewers of premium beers, would raise the Coors price by 4.4 percent and the Labatt's price by 3.3 percent. However, they also conclude that, if the merger results in a 5 percent gain in efficiency so that marginal costs fall by 5 percent, the merger will lead to lower, not higher, prices.

Unfortunately, usually they do not know marginal cost, so they use the assumptions that the firms maximize profit, engage in a Bertrand game, and have a constant marginal cost, m, to estimate the marginal cost. For example, the Lerner Index markup of price over marginal cost for a profit maximizing monopoly is $(p - m)/p = -1/\epsilon$ (Equation 4.3). This equation shows that the price markup depends only on the elasticity of demand, ϵ. Moreover, given that we can observe p and have estimated the demand equation and have an estimate of ϵ, we can use this equation to estimate m. This profit-maximizing condition generalizes for any profit-maximizing firm, even in markets with many differentiated products, given that one knows the type of game, such as Bertrand, that the firms play and all own and cross-price elasticities. Even in these generalized expressions, the price markup depends only on the own and cross-price elasticities of demand of all the products, so that again one can infer the constant marginal costs (see, for example, Hausman et al. 1994). Using this approach, researchers predict the price effects of a merger (see Example 7.5) and the value of new products (see Example 7.6).[26]

[26] In a comparison of how the various methods worked in predicting the effect of airline mergers, Peters (2003) found that estimation of the demand system combined with assumed oligopoly behavior did not perform significantly better than a "reduced form" estimation that directly relates prices to concentration (which Peters treated as an endogenous variable).

EXAMPLE 7.6

Value of Minivans

In 1984, Chrysler introduced the first minivan, the Dodge Caravan. The minivan was a successful innovation because it handled like a passenger car even though it was substantially larger than one. General Motors and Ford soon introduced their own minivans. Minivans' success came partially at the expense of station wagons, whose sales fell by over 60 percent during the next seven years.

How much was the introduction of the minivan worth to consumers? To answer this question, Petrin (2002) estimated the demand curve for minivans so as to calculate the increased consumer surplus that consumers receive. But even consumers who do not purchase the minivan can benefit if the minivan simulates competition and lowers the price of the car they do purchase.

Petrin estimated a random coefficient discrete choice demand system, which was pioneered by Berry et al. (1995). Here, the demand estimation allows for differences in tastes across individuals. In this approach, the researcher assumes that each individual chooses that product that yields him or her the highest utility, and that firms maximize profits in competition with others in Bertrand competition. Even though Petrin lacked information on purchases by individuals, he had data on the average income of a buyer of each type of car, which he used to better estimate his model.

Petrin calculated the amount of money consumers would have had to receive in the absence of minivans in order to attain the same utility as when minivans did not exist. He estimated that the average benefit per consumer over a four-year period was $1,247 with over 40 percent coming as benefits to non-minivan purchasers from increased competition. Petrin calculated, if one ignored taste heterogeneity, that the benefit would have been overestimated to equal $13,652. His best estimates of the benefits to consumers of minivans totaled $2.8 billion over a four-year period. However, his estimates ignore the negative externality—more deaths—imposed by minivans and sport utility vehicles on drivers of normal size cars and pedestrians (White 2002).

SUMMARY

This chapter examines product differentiation and monopolistic competition. Product differentiation creates at least some market power for a firm. The greater the perceived difference between two firms' products, the more each firm can charge.

If free entry is allowed, firms enter markets until profits are driven to zero. A monopolistic competition equilibrium is one in which firms face downward-sloping demand curves and earn zero profits.

There are two basic types of monopolistic competition models. In Chamberlin's representative consumer model, a typical consumer views all products as equally good substitutes for each other. Price is above marginal cost, and there may be too much or too little variety. Entry (due, for example, to a reduction in fixed costs) tends to reduce the prices of all firms.

Hotelling's location (spatial) model postulates that consumers' preferences and brands are located in product or geographic space. Consumers prefer brands near them. As a result, firms have some market power. The pricing behavior of other firms has little effect if the consumers who buy from a given firm do not like the products of those firms. In the localized competition circle model, price is above marginal cost, and there is unambiguously too much variety. New entry does not lower the price a given consumer pays unless a firm enters near the firm that the consumer patronizes because consumers are uninterested in brands that are very dissimilar to the ones they like best.

PROBLEMS

1. Explain how, in a monopolistically competitive industry, high fixed costs can result in too little variety.
2. In the Salop circle model, if all consumers get more pleasure from ice cream (u increases), how does the equilibrium change?
3. Explain and illustrate the following claim: "In our example, a monopolistic competition industry with homogeneous products cannot be more than one firm away from the output sold at price equals marginal cost."
4. In Hotelling's town, if all firms are required to charge the same fixed price, describe the equilibrium location of three firms. Explain your answer. Now describe the equilibrium for four firms.
5. What is the effect of a cost-saving technological change on a monopolistic competition industry in which the cost curves facing each firm are $C(q) = mq + F$, where m is the constant marginal cost, and F is the fixed cost? *Hint:* A cost-saving technological change may be modeled as reducing m, reducing F, or reducing both.
6. Show graphically that if a firm's $MC = AC =$ a constant, it will produce a product if it is socially desirable for that product to be produced.

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

Friedman (1983) has a good survey and discussion of most of the models in this chapter. In the 1930s, there was a lively (and relatively nontechnical) debate between Chamberlin (1933) and Robinson (1934) and Kaldor (1935) concerning the necessary conditions for a firm to possess market power (the power to set price above marginal cost). For an excellent survey of the technical literature on product differentiation, see Eaton and Lipsey (1989).

APPENDIX 7A

Welfare in a Monopolistic Competition Model with Homogeneous Products

Why, a four-year-old child could understand this report. Run out and find me a four-year-old child. I can't make head or tail of it. —*Groucho Marx*

Two problems arise in a monopolistic competition equilibrium with homogeneous goods:[1]

1. Because price is greater than marginal cost, the industry produces too little output.
2. If marginal cost is constant, the industry bears excess fixed costs.

First-Best Optimum

All is for the best in the best of possible worlds. —*Voltaire*

Given constant marginal cost, the first-best optimum requires a single firm that charges a price equal to marginal cost, $p = m$, and a subsidy of the firm's losses. We illustrate this result using a simple, general equilibrium model. In this model, there is no important distinction between the partial and general equilibrium because the general equilibrium's income effect is the same as in the partial equilibrium.

The representative consumer's utility function is

$$U(Q, y) = u(Q) + y, \tag{7A.1}$$

where Q is the output of the monopolistic competition industry and y represents all other goods. Let y be produced at constant cost, and, by normalizing, let this constant cost equal 1 so that the competitive price is also 1.

The consumer maximizes his or her utility subject to the budget constraint

$$I = pQ + y, \tag{7A.2}$$

where I is the consumer's income and p is the price of a unit of Q. From Equation 7A.2, $y = I - pQ$. Substituting that expression for y into the consumer's utility function (Equation 7A.1), the consumer's utility maximization problem is

[1]Appendixes 7A and 7B draw heavily on Steven C. Salop's unpublished lecture notes, Dixit and Stiglitz (1997), and Spence (1976).