5. DYNAMIC COMPETITION

In a broad sense, any competition involving actions taken at different points of time is of dynamic nature. In this sense, strategic behavior discussed in the previous section can also be considered dynamic models of competition. More specifically, in this section we discuss dynamic price competition.

Conventional Wisdom

– collusion
– information
– asymmetries

Static Approaches to Dynamic Competition

Kinked demand curve.—

Suppose that there are two firms, 1 and 2, with unit cost $c$. The demand function is $q = D(p)$. Suppose each firm has the following conjecture: there is some focal price $p^f > c$ such that if it charges $p > p^f$, its competitor will not follow suit; if it charges $p < p^f$, its competitor will also charge $p$. That is, the firm’s demand function has a kink at $p^f$. Given this conjecture, each firm will charge $p^f$.

This seems a reasonable conjecture. But in a static model, a firm does not have the opportunity to react.

Conjectural Variations.—

More generally, a firm may conjecture that another firm’s reaction function is $R_j(p_i)$. The has been research that employ dynamic models that generate the Kinked demand curves.
Supergames

The Basic Model:—

Two firms, 1 and 2, with unit cost $c$. The demand function per period is $q = D(p)$. When there are infinite periods and the discount factor $\delta \geq \frac{1}{2}$, any price between $c$ and $p^m$, the monopoly price, can be supported as an subgame perfect Nash equilibrium outcome.

$$\frac{\pi^m}{2} \left(1 + \delta + \delta^2 + \ldots\right) \geq \pi^m$$

or

$$\frac{1}{2(1 - \delta)} \geq 1,$$

or $\delta \geq \frac{1}{2}$.

Implications for Market Concentration:—

If there are $n > 2$ firms, to support collusive outcomes, the condition becomes

$$\frac{\pi^m}{n} \left(1 + \delta + \delta^2 + \ldots\right) \geq \pi^m$$

or

$$\frac{1}{n(1 - \delta)} \geq 1,$$

or

$$\delta \geq 1 - \frac{1}{n} = \frac{n - 1}{n}.$$ When $n$ is large, it becomes difficult to sustain collusion.

Information Lags.—

Suppose a firm can learn its competitor’s price only after two periods. Then the condition for collusive outcome becomes:

$$\frac{\pi^m}{2} \left(1 + \delta + \delta^2 + \ldots\right) \geq \pi^m (1 + \delta)$$
or

\[ \delta \geq \frac{1}{\sqrt{2}}. \]

**Multimarket Contact:**

Suppose that two firms participate in two identical and independent markets. In market 1, they meet every period, and in market 2, they meet every even period. Without multimarket interactions, \( \delta \geq \frac{1}{2} \) to sustain collusive prices in market 1, and for market 2,

\[ \frac{\pi^m}{2} \left(1 + \delta^2 + \ldots\right) \geq \pi^m \]

or

\[ \frac{\pi^m}{2 (1 - \delta^2)} \geq \pi^m. \]

or

\[ \delta \geq \frac{1}{\sqrt{2}} = .70711. \]

But with multimarket interactions,

\[ \frac{\pi^m}{2} \left(1 + \delta + \delta^2 + \ldots + 1 + \delta^2\right) \geq 2\pi^m, \]

or

\[ \frac{\pi^m}{2} \left(\frac{1}{1 - \delta} + \frac{1}{1 - \delta^2}\right) \geq 2\pi^m, \]

\[ \frac{\pi^m \left(1 + \delta + 1\right)}{2 \left(1 - \delta^2\right)} \geq 2\pi^m, \]

\[ 2 + \delta \geq 4 \left(1 - \delta^2\right) \]

\[ 4\delta^2 + \delta - 2 \geq 0, \]

or

\[ \delta \geq .593. \]
Thus, if

\[ 0.593 \leq \delta < 0.707, \]

multimarket interactions can help sustain collusion in market 2 that is otherwise not possible.

The key idea: multimarket interactions pool the incentives together and relax some binding constraints.

**Secret Price Cuts.**—

This can generate price cycles.

**Markov Strategies and Markov Perfect Equilibrium**


Price competition with infinite periods has been studied extensively. One approach is to study the subgame perfect equilibrium of such a game, and the conditions under which collusive prices can be sustained. A more interesting, but also more difficult, approach is to study the Markov Perfect Equilibrium of the model. The papers in this latter approach are usually very technical. There are some interesting problems in this area that are yet to be solved.

**Markets with Consumer Switching Costs**

In a repeated purchase context, consumers often need to incur costs when switching suppliers. Competition in markets with switching costs has been an area of active research in recent years.
Klemperer (1987) represents an early and important contribution in this literature. In a two period model, he shows that in the presence of switching costs, a firm with a higher market share tends to charge a higher price in the second period. This affects consumers’s choice in the first period, and can make the first period demand more inelastic. Thus the market may become less competitive in both periods due to switching costs. Klemperer’s paper represents a typical approach in this literature where a firm is assumed to charge the same price for all its customers at any given period. In other words, there is no price discrimination by firms.

Chen (1997) makes the observation that in situations with consumer switching costs and repeated purchases, it may be natural for firms to be able to engage in price discrimination, since it is easy for firms to separate its existing customers from new ones. This then leads to an alternative approach in the study of market competition in the presence of consumer switching costs, an approach where firms are able to price discriminate among new and existing customers. An interesting result is that when firms can “pay customers to switch”, the equilibrium prices of firms no longer depend on their market shares. This is known as the “independence result”.

Klemperer (1995) contains a review of the literature that assumes no price discrimination. For the alternative approach, Curtis Taylor (1999) extends the two-period model of Chen (1997) into an infinite-period model, and in doing so offering many interesting insights that are not available in a two period model. Fudenberg and Tirole (2001) and J. Miguel Villas-Boas (1999) are two other recent contributions.

REFERENCES


