Lecture 17-18,
(Minor 2 coverage until Lecture 18)

Mar 16 & 20, 2017
CHAPTER 12 OUTLINE

12.1 Monopolistic Competition
12.2 Oligopoly
12.3 Price Competition
12.4 Competition versus Collusion: The Prisoners’ Dilemma
12.5 Implications of the Prisoners’ Dilemma for Oligopolistic Pricing
12.6 Cartels
Monopolistic Competition and Oligopoly

- **monopolistic competition**  Market in which firms can enter freely, each producing its own brand or version of a differentiated product.

- **oligopoly**  Market in which only a few firms compete with one another, and entry by new firms is impeded.

- **cartel**  Market in which some or all firms explicitly collude, coordinating prices and output levels to maximize joint profits.
A monopolistically competitive market has two key characteristics:

1. Firms compete by selling differentiated products that are highly substitutable for one another but not perfect substitutes. In other words, the cross-price elasticities of demand are large but not infinite.

2. There is free entry and exit: it is relatively easy for new firms to enter the market with their own brands and for existing firms to leave if their products become unprofitable.
Because the firm is the only producer of its brand, it faces a downward-sloping demand curve. Price exceeds marginal cost and the firm has monopoly power.

In the short run, described in part (a), price also exceeds average cost, and the firm earns profits shown by the yellow-shaded rectangle.
12.1 MONOPOLISTIC COMPETITION

Equilibrium in the Short Run and the Long Run

Figure 12.1 (continued)

A Monopolistically Competitive Firm in the Short and Long Run

In the long run, these profits attract new firms with competing brands. The firm’s market share falls, and its demand curve shifts downward.

In long-run equilibrium, described in part (b), price equals average cost, so the firm earns zero profit even though it has monopoly power.
Monopolistic Competition and Economic Efficiency

*Comparison of Monopolistically Competitive Equilibrium and Perfectly Competitive Equilibrium*

Under perfect competition, price equals marginal cost. The demand curve facing the firm is horizontal, so the zero-profit point occurs at the point of minimum average cost.
12.1 MONOPOLISTIC COMPETITION

Monopolistic Competition and Economic Efficiency

Figure 12.2 (continued)

Comparison of Monopolistically Competitive Equilibrium and Perfectly Competitive Equilibrium

Under monopolistic competition, price exceeds marginal cost.

Thus there is a deadweight loss, as shown by the yellow-shaded area.

The demand curve is downward-sloping, so the zero-profit point is to the left of the point of minimum average cost.

In both types of markets, entry occurs until profits are driven to zero.

In evaluating monopolistic competition, these inefficiencies must be balanced against the gains to consumers from product diversity.
12.1 MONOPOLISTIC COMPETITION

TABLE 12.1 Elasticities of Demand for Brands of Colas and Coffee

<table>
<thead>
<tr>
<th>Brand</th>
<th>Elasticity of Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colas</td>
<td></td>
</tr>
<tr>
<td>Royal Crown</td>
<td>−2.4</td>
</tr>
<tr>
<td>Coke</td>
<td>−5.2 to −5.7</td>
</tr>
<tr>
<td>Ground coffee</td>
<td></td>
</tr>
<tr>
<td>Folgers</td>
<td>−6.4</td>
</tr>
<tr>
<td>Maxwell House</td>
<td>−8.2</td>
</tr>
<tr>
<td>Chock Full o’Nuts</td>
<td>−3.6</td>
</tr>
</tbody>
</table>

With the exception of Royal Crown and Chock Full o’ Nuts, all the colas and coffees are quite price elastic. With elasticities on the order of −4 to −8, each brand has only limited monopoly power. This is typical of monopolistic competition.
12.2 OLIGOPOLY

The Makings of Monopolistic Competition

In oligopolistic markets, the products may or may not be differentiated.
What matters is that only a few firms account for most or all of total production.
In some oligopolistic markets, some or all firms earn substantial profits over the long run because barriers to entry make it difficult or impossible for new firms to enter.
Oligopoly is a prevalent form of market structure. Examples of oligopolistic industries include automobiles, steel, aluminum, petrochemicals, electrical equipment, and computers.
Equilibrium in an Oligopolistic Market

When a market is in equilibrium, firms are doing the best they can and have no reason to change their price or output.

**Nash Equilibrium**  Equilibrium in oligopoly markets means that each firm will want to do the best it can *given what its competitors are doing*, and these competitors will do the best they can *given what that firm is doing*.

- **Nash equilibrium**  Set of strategies or actions in which each firm does the best it can given its competitors’ actions.

- **duopoly**  Market in which two firms compete with each other.
The Cournot Model

- **Cournot model**  Oligopoly model in which firms produce a homogeneous good, each firm treats the output of its competitors as fixed, and all firms decide simultaneously how much to produce.

**Firm 1’s Output Decision**

Firm 1’s profit-maximizing output depends on how much it thinks that Firm 2 will produce.

If it thinks Firm 2 will produce nothing, its demand curve, labeled $D_1(0)$, is the market demand curve. The corresponding marginal revenue curve, labeled $MR_1(0)$, intersects Firm 1’s marginal cost curve $MC_1$ at an output of 50 units.

If Firm 1 thinks that Firm 2 will produce 50 units, its demand curve, $D_1(50)$, is shifted to the left by this amount. Profit maximization now implies an output of 25 units.

Finally, if Firm 1 thinks that Firm 2 will produce 75 units, Firm 1 will produce only 12.5 units.
The Cournot Model

- **reaction curve**  Relationship between a firm’s profit-maximizing output and the amount it thinks its competitor will produce.

Firm 1’s reaction curve shows how much it will produce as a function of how much it thinks Firm 2 will produce.

Firm 2’s reaction curve shows its output as a function of how much it thinks Firm 1 will produce.

In Cournot equilibrium, each firm correctly assumes the amount that its competitor will produce and thereby maximizes its own profits. Therefore, neither firm will move from this equilibrium.

- **Cournot equilibrium**  Equilibrium in the Cournot model in which each firm correctly assumes how much its competitor will produce and sets its own production level accordingly.
12.2 OLIGOPOLY

The Linear Demand Curve—An Example

Duopolists face the following market demand curve
\[ P = 30 - Q \]
Also, \( MC_1 = MC_2 = 0 \)

Total revenue for firm 1:
\[ R_1 = PQ_1 = (30 - Q)Q_1 \]
then \( MR_1 = \frac{\Delta R_1}{\Delta Q_1} = 30 - 2Q_1 - Q_2 \)

Setting \( MR_1 = 0 \) (the firm's marginal cost) and solving for \( Q_1 \), we find

\[ Q_1 = 15 - \frac{1}{2}Q_2 \] \hspace{1cm} (12.1)

By the same calculation, \( Q_2 = 15 - \frac{1}{2}Q_1 \) \hspace{1cm} (12.2)

Cournot equilibrium: \( Q_1 = Q_2 = 10 \)

Total quantity produced: \( Q = Q_1 + Q_2 = 20 \)
12.2 OLIGOPOLY

The Linear Demand Curve—An Example

If the two firms collude, then the total profit-maximizing quantity can be obtained as follows:

Total revenue for the two firms: \( R = PQ = (30 - Q)Q = 30Q - Q^2 \), then \( MR = \frac{\Delta R}{\Delta Q} = 30 - 2Q \)

Setting \( MR = 0 \) (the firms’ marginal cost) we find that total profit is maximized at \( Q = 15 \).

Then, \( Q_1 + Q_2 = 15 \) is the *collusion curve*.

If the firms agree to share profits equally, each will produce half of the total output:
\( Q_1 = Q_2 = 7.5 \)
The demand curve is $P = 30 - Q$, and both firms have zero marginal cost. In Cournot equilibrium, each firm produces 10.

The collusion curve shows combinations of $Q_1$ and $Q_2$ that maximize total profits. If the firms collude and share profits equally, each will produce 7.5. Also shown is the competitive equilibrium, in which price equals marginal cost and profit is zero.
First Mover Advantage—The Stackelberg Model

- **Stackelberg model**  Oligopoly model in which one firm sets its output before other firms do.

Suppose Firm 1 sets its output first and then Firm 2, after observing Firm 1’s output, makes its output decision. In setting output, Firm 1 must therefore consider how Firm 2 will react.

\[ P = 30 - Q \]

Also, \( MC_1 = MC_2 = 0 \)

\[ Q_2 = 15 - \frac{1}{2}Q_1 \]  \hspace{1cm} (12.2)

Firm 1’s revenue:

\[ R_1 = PQ_1 = 30Q_1 - Q_1^2 - Q_2Q_1 \]  \hspace{1cm} (12.3)

And \( MR_1 = \Delta R_1/\Delta Q_1 = 15 - Q_1 \)  \hspace{1cm} (12.4)

Setting \( MR_1 = 0 \) gives \( Q_1 = 15 \), and \( Q_2 = 7.5 \)

We conclude that Firm 1 produces twice as much as Firm 2 and makes twice as much profit. *Going first gives Firm 1 an advantage.*
Price Competition with Homogeneous Products—The Bertrand Model

- **Bertrand model**  Oligopoly model in which firms produce a homogeneous good, each firm treats the price of its competitors as fixed, and all firms decide simultaneously what price to charge.

\[ P = 30 - Q \]

\[ MC_1 = MC_2 = $3 \]

\[ Q_1 = Q_2 = 9, \text{ and in Cournot equilibrium, the market price is } $12, \text{ so that each firm makes a profit of } $81. \]

Nash equilibrium in the Bertrand model results in both firms setting price equal to marginal cost: \( P_1 = P_2 = $3 \). Then industry output is 27 units, of which each firm produces 13.5 units, and both firms earn zero profit.

In the Cournot model, because each firm produces only 9 units, the market price is $12. Now the market price is $3. In the Cournot model, each firm made a profit; in the Bertrand model, the firms price at marginal cost and make no profit.
12.3 PRICE COMPETITION

Price Competition with Differentiated Products

Suppose each of two duopolists has fixed costs of $20 but zero variable costs, and that they face the same demand curves:

\[ Q_1 = 12 - 2P_1 + P_2 \quad (12.5a) \]
\[ Q_2 = 12 - 2P_2 + P_1 \quad (12.5b) \]

Choosing Prices

Firm 1’s profit:
\[ \pi_1 = P_1Q_1 - 20 = 12P_1 - 2P_1^2 + P_1P_2 - 20 \]

Firm 1’s profit maximizing price:
\[ \frac{\Delta \pi_1}{\Delta P_1} = 12 - 4P_1 + P_2 = 0 \]

Firm 1’s reaction curve:
\[ P_1 = 3 + \frac{1}{4}P_2 \]

Firm 2’s reaction curve:
\[ P_2 = 3 + \frac{1}{4}P_1 \]
12.3 PRICE COMPETITION

Price Competition with Differentiated Products

Figure 12.6

Nash Equilibrium in Prices

Here two firms sell a differentiated product, and each firm’s demand depends both on its own price and on its competitor’s price. The two firms choose their prices at the same time, each taking its competitor’s price as given.

Firm 1’s reaction curve gives its profit-maximizing price as a function of the price that Firm 2 sets, and similarly for Firm 2.

The Nash equilibrium is at the intersection of the two reaction curves: When each firm charges a price of $4, it is doing the best it can given its competitor’s price and has no incentive to change price.

Also shown is the collusive equilibrium: If the firms cooperatively set price, they will choose $6.
### 12.3 PRICE COMPETITION

#### Example 12.2

title: A Pricing Problem for Procter & Gamble

P&G’s demand curve for monthly sales:

\[ Q = 3375P^{-3.5}(P_U)^{25}(P_K)^{25} \]

Assuming that P&G’s competitors face the same demand conditions, with what price should you enter the market, and how much profit should you expect to earn?

#### Table 12.1 P&G’s Profit (in thousands of dollars per month)

<table>
<thead>
<tr>
<th>P&amp;G’s Price ($)</th>
<th>Competitor’s (Equal) Prices ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.10</td>
</tr>
<tr>
<td>1.10</td>
<td>-226</td>
</tr>
<tr>
<td>1.30</td>
<td>-56</td>
</tr>
<tr>
<td>1.40</td>
<td>-44</td>
</tr>
<tr>
<td>1.50</td>
<td>-52</td>
</tr>
<tr>
<td>1.60</td>
<td>-70</td>
</tr>
<tr>
<td>1.70</td>
<td>-93</td>
</tr>
<tr>
<td>1.80</td>
<td>-118</td>
</tr>
</tbody>
</table>
12.4 COMPETITION VERSUS COLLUSION: THE PRISONERS’ DILEMMA

In our example, there are two firms, each of which has fixed costs of $20 and zero variable costs. They face the demand curves:

**Firm 1’s demand:** \( Q_1 = 12 - 2P_1 + P_2 \)

**Firm 2’s demand:** \( Q_2 = 12 - 2P_2 + P_1 \)

We found that in Nash equilibrium each firm will charge a price of $4 and earn a profit of $12, whereas if the firms collude, they will charge a price of $6 and earn a profit of $16.

But if Firm 1 charges $6 and Firm 2 charges only $4, Firm 2’s profit will increase to $20. And it will do so at the expense of Firm 1’s profit, which will fall to $4.

\[
\begin{align*}
\pi_2 &= P_2Q_2 - 20 = (4)[12 - (2)(4) + 6] - 20 = 20 \\
\pi_1 &= P_1Q_1 - 20 = (6)[12 - (2)(6) + 4] - 20 = 4
\end{align*}
\]

<table>
<thead>
<tr>
<th>Firm 1</th>
<th>Charge $4</th>
<th>Charge $6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm 2</td>
<td>Charge $4</td>
<td>$12, $12</td>
</tr>
<tr>
<td></td>
<td>Charge $6</td>
<td>$4, $20</td>
</tr>
</tbody>
</table>
COMPETITION VERSUS COLLUSION: THE PRISONERS’ DILEMMA

Payoff Matrix

- **noncooperative game**  Game in which negotiation and enforcement of binding contracts are not possible.
- **payoff matrix**  Table showing profit (or payoff) to each firm given its decision and the decision of its competitor.

The Prisoners’ Dilemma

- **prisoners’ dilemma**  Game theory example in which two prisoners must decide separately whether to confess to a crime; if a prisoner confesses, he will receive a lighter sentence and his accomplice will receive a heavier one, but if neither confesses, sentences will be lighter than if both confess.

<table>
<thead>
<tr>
<th>TABLE 12.4 Payoff Matrix for Prisoners’ Dilemma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prisoner B</strong></td>
</tr>
<tr>
<td><strong>Prisoner A</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
We argued that P&G should expect its competitors to charge a price of $1.40 and should do the same. But P&G would be better off if it and its competitors all charged a price of $1.50.

**TABLE 12.5 Payoff Matrix for Pricing Problem**

<table>
<thead>
<tr>
<th></th>
<th>Unilever and KAO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Charge $1.40</td>
</tr>
<tr>
<td>P&amp;G Charge $1.40</td>
<td>$12, $12</td>
</tr>
<tr>
<td>P&amp;G Charge $1.50</td>
<td>$3, $21</td>
</tr>
</tbody>
</table>

So why don’t they charge $1.50? Because these firms are in a prisoners’ dilemma. No matter what Unilever and Kao do, P&G makes more money by charging $1.40.
12.6 CARTELS

Producers in a cartel explicitly agree to cooperate in setting prices and output levels.

Analysis of Cartel Pricing

Figure 12.10

The OPEC Oil Cartel

TD is the total world demand curve for oil, and Sc is the competitive (non-OPEC) supply curve.

OPEC’s demand \( D_{\text{OPEC}} \) is the difference between the two.

Because both total demand and competitive supply are inelastic, OPEC’s demand is inelastic.

OPEC’s profit-maximizing quantity \( Q_{\text{OPEC}} \) is found at the intersection of its marginal revenue and marginal cost curves; at this quantity, OPEC charges price \( P^* \).

If OPEC producers had not cartelized, price would be \( P_c \), where OPEC’s demand and marginal cost curves intersect.
12.6 CARTELS

The CIPEC Copper Cartel

TD is the total demand for copper and $S_c$ is the competitive (non-CIPEC) supply.

CIPEC’s demand $D_{CIPEC}$ is the difference between the two.

Both total demand and competitive supply are relatively elastic, so CIPEC’s demand curve is elastic, and CIPEC has very little monopoly power.

Note that CIPEC’s optimal price $P^*$ is close to the competitive price $P_c$. 
The cartel organization is the National Collegiate Athletic Association (NCAA). The NCAA restricts competition in a number of important ways.

- To reduce bargaining power by student athletes, the NCAA creates and enforces rules regarding eligibility and terms of compensation.
- To reduce competition by universities, it limits the number of games that can be played each season and the number of teams that can participate in each division.
In 1996, the federal government allowed milk producers in the six New England states to cartelize. The cartel—called the Northeast Interstate Dairy Compact—set minimum wholesale prices for milk, and was exempt from the antitrust laws. The result was that consumers in New England paid more for a gallon of milk than consumers elsewhere in the nation.

Studies have suggested that the cartel covering the New England states has caused retail prices of milk to rise by only a few cents a gallon. Why so little? The reason is that the New England cartel is surrounded by a fringe of noncartel producers—namely, dairy farmers in New York, New Jersey, and other states. Expanding the cartel, however, would have shrunk the competitive fringe, thereby giving the cartel a greater influence over milk prices.
Forecasting human behaviour

Thank You