● **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.
12.1 Monopolistic Competition

The Makings of Monopolistic Competition

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.
Equilibrium in the Short Run and the Long Run

**Figure 12.1 (1 of 2)**

A MONOPOLISTICALLY COMPETITIVE FIRM IN THE SHORT AND LONG RUN

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.
Equilibrium in the Short Run and the Long Run

**Figure 12.1** (2 of 2)

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.
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.
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.
Is monopolistic competition then a socially undesirable market structure that should be regulated? The answer—for two reasons—is probably no:

1. In most monopolistically competitive markets, monopoly power is small.

   Usually enough firms compete, with brands that are sufficiently substitutable, so that no single firm has much monopoly power. Any resulting deadweight loss will therefore be small. And because firms’ demand curves will be fairly elastic, average cost will be close to the minimum.

2. Any inefficiency must be balanced against an important benefit from monopolistic competition: product diversity.

   Most consumers value the ability to choose among a wide variety of competing products and brands that differ in various ways. The gains from product diversity can be large and may easily outweigh the inefficiency costs resulting from downward-sloping demand curves.
12.2 Oligopoly

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.

Scale economies may make it unprofitable for more than a few firms to coexist in the market; patents or access to a technology may exclude potential competitors; and the need to spend money for name recognition and market reputation may discourage entry by new firms. These are “natural” entry barriers—they are basic to the structure of the particular market. In addition, incumbent firms may take strategic actions to deter entry.

Managing an oligopolistic firm is complicated because pricing, output, advertising, and investment decisions involve important strategic considerations, which can be highly complex.
Equilibrium in an Oligopolistic Market

In an oligopolistic market, however, a firm sets price or output based partly on strategic considerations regarding the behavior of its competitors. With some modification, the underlying principle to describe an equilibrium when firms make decisions that explicitly take each other’s behavior into account is the same as the equilibrium in competitive and monopolistic markets: *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**

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

  *Nash Equilibrium:* Each firm is doing the best it can given what its competitors are doing.

- **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.

**Figure 12.3**

**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.
REACTION CURVES

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

**Figure 12.4**

REACTION CURVES AND COURNOT EQUILIBRIUM

Firm 1’s reaction curve shows how much it will produce as a function of how much it thinks Firm 2 will produce. (The xs at Q2 = 0, 50, and 75 correspond to the examples shown in Figure 12.3.)

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

- **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.

Cournot equilibrium is an example of a Nash equilibrium (and thus it is sometimes called a *Cournot-Nash equilibrium*).

In a Nash equilibrium, each firm is doing the best it can given what its competitors are doing.

As a result, no firm would individually want to change its behavior. In the Cournot equilibrium, each firm is producing an amount that maximizes its profit *given what its competitor is producing*, so neither would want to change its output.
The Linear Demand Curve—An Example

Two identical firms face the following market demand curve  \( P = 30 - Q \)
Also,  \( MC_1 = MC_2 = 0 \)

Total revenue for firm 1:  \( R_1 = PQ_1 = (30 - Q)Q_1 = 30Q_1 - Q_1^2 - Q_2Q_1 \)
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

Firm 1’s reaction curve:  \( Q_1 = 15 - \frac{1}{2}Q_2 \)  \( (12.1) \)

By the same calculation, Firm 2’s reaction curve:  \( Q_2 = 15 - \frac{1}{2}Q_2 \)  \( (12.2) \)

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

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

If the two firms collude, then the total profit-maximizing quantity is:

Total revenue for the two firms:  \( R = PQ = (30 - Q)Q = 30Q - Q^2 \), then  \( MR_1 = \frac{\Delta R}{\Delta Q} = 30 - 2Q \)
Setting \( MR = 0 \) (the firm’s 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:

\( Q_1 = Q_2 = 7.5 \)
Figure 12.5  
Duopoly Example

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, \( MC_1 = MC_2 = 0 \)

*Firm 2’s reaction curve:* \( Q_2 = 15 - \frac{1}{2} Q_1 \) \( (12.2) \)

*Firm 1’s revenue:* \( R_1 = P Q_1 = 30Q_1 - Q_1^2 - Q_2 Q_1 \) \( (12.3) \)

\[
R_1 = 30Q_1 - Q_1^2 - Q_1 \left( 15 - \frac{1}{2} Q_1 \right) = 15Q_1 - \frac{1}{2} Q_1^2
\]

\[
MR_1 = \Delta R_1 / \Delta Q_1 = 15 - Q_1 \quad (12.4)
\]

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.*
12.3 Price Competition

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.

Let's return to the duopoly example of the last section.

\[ P = 30 - Q \]

\[ MC_1 = MC_2 = $3 \]

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

Now suppose that these two duopolists compete by simultaneously choosing a price instead of a quantity.

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.
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:

\textit{Firm 1’s demand:} \quad Q_1 = 12 - 2P_1 + P_2

\textit{Firm 2’s demand:} \quad Q_2 = 12 - 2P_2 + P_1

\textbf{CHOOSING PRICES}

Firm 1’s profit: \quad \pi_1 = P_1Q_1 - 20 = 12P_1 - 2P_1^2 - 20

Firm 1’s profit maximizing price: \quad \Delta \pi_1 / \Delta P_1 = 12 - 4P_1 + P_2 = 0

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

Firm 2’s reaction curve: \quad P_2 = 3 + \frac{1}{4} P_1
**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.

The firms have the same costs, so they will charge the same price $P$. Total profit is given by

$$\pi_T = \pi_1 + \pi_2 = 24P - 4P_2 + 2P_2 - 40 = 24P - 2P_2 - 40.$$  

This is maximized when $$\pi_T/\pi_P = 0.$$  

$$\pi_T/\pi_P = 24 - 4P,$$  

so the joint profit-maximizing price is $P = $6. Each firm’s profit is therefore

$$\pi_1 = \pi_2 = 12P - P^2 - 20 = 72 - 36 - 20 = $16.$$
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 same 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.

\[
\pi_2 = P_2Q_2 - 20 = (4)[(12 - (2)(4) + 6] - 20 = $20 \\
\pi_1 = P_1Q_1 - 20 = (6)[12 - (2)(6) + 4] - 20 = $4
\]

So 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.

**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.

---

**TABLE 12.3 PAYOFF MATRIX FOR PRICING GAME**

<table>
<thead>
<tr>
<th>FIRM 2</th>
<th>CHARGE $4</th>
<th>CHARGE $6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm 1</td>
<td>$12, $12</td>
<td>$20, $4</td>
</tr>
<tr>
<td></td>
<td>$4, $20</td>
<td>$16, $16</td>
</tr>
</tbody>
</table>
**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</th>
<th>PAYOFF MATRIX FOR PRISONERS’ DILEMMA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>PRISONER B</strong></td>
</tr>
<tr>
<td><strong>CONFESS</strong></td>
<td><strong>DON’T CONFESS</strong></td>
</tr>
<tr>
<td>Confess</td>
<td>–5, –5</td>
</tr>
<tr>
<td>Don’t confess</td>
<td>–10, –1</td>
</tr>
<tr>
<td></td>
<td>–1, –10</td>
</tr>
<tr>
<td></td>
<td>–2, –2</td>
</tr>
</tbody>
</table>

If Prisoner A does not confess, he risks being taken advantage of by his former accomplice. After all, *no matter what Prisoner A does, Prisoner B comes out ahead by confessing*. Likewise, Prisoner A always comes out ahead by confessing, so Prisoner B must worry that by not confessing, she will be taken advantage of. Therefore, both prisoners will probably confess and go to jail for five years. Oligopolistic firms often find themselves in a prisoners’ dilemma.
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>
<thead>
<tr>
<th></th>
<th>UNILEVER AND Kao</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHARGE $1.40</td>
<td>CHARGE $1.50</td>
</tr>
<tr>
<td>P&amp;G</td>
<td>$12, $12</td>
<td>$29, $11</td>
</tr>
<tr>
<td>Charge $1.40</td>
<td>$12, $12</td>
<td>$29, $11</td>
</tr>
<tr>
<td>Charge $1.50</td>
<td>$3, $21</td>
<td>$20, $20</td>
</tr>
</tbody>
</table>

Since these firms are in a prisoners’ dilemma, it doesn’t matter what Unilever and Kao do. P&G makes more money by charging $1.40.
12.5 Implications of the Prisoners’ Dilemma for Oligopolistic Pricing

Does the prisoners’ dilemma doom oligopolistic firms to aggressive competition and low profits? Not necessarily. Although our imaginary prisoners have only one opportunity to confess, most firms set output and price over and over again, continually observing their competitors’ behavior and adjusting their own accordingly. This allows firms to develop reputations from which trust can arise. As a result, oligopolistic coordination and cooperation can sometimes prevail.

Price Rigidity

- **price rigidity** Characteristic of oligopolistic markets by which firms are reluctant to change prices even if costs or demands change.

- **kinked demand curve model** Oligopoly model in which each firm faces a demand curve kinked at the currently prevailing price: at higher prices demand is very elastic, whereas at lower prices it is inelastic.
FIGURE 12.7
THE KINKED DEMAND CURVE

Each firm believes that if it raises its price above the current price $P^*$, none of its competitors will follow suit, so it will lose most of its sales.

Each firm also believes that if it lowers price, everyone will follow suit, and its sales will increase only to the extent that market demand increases.

As a result, the firm’s demand curve $D$ is kinked at price $P^*$, and its marginal revenue curve $MR$ is discontinuous at that point.

If marginal cost increases from $MC$ to $MC'$, the firm will still produce the same output level $Q^*$ and charge the same price $P^*$. 
**Price Signaling and Price Leadership**

- **price signaling**  Form of implicit collusion in which a firm announces a price increase in the hope that other firms will follow suit.

- **price leadership**  Pattern of pricing in which one firm regularly announces price changes that other firms then match.

In some industries, a large firm might naturally emerge as a leader, with the other firms deciding that they are best off just matching the leader’s prices, rather than trying to undercut the leader or each other.

Price leadership can also serve as a way for oligopolistic firms to deal with the reluctance to change prices, a reluctance that arises out of the fear of being undercut or “rocking the boat.”
The Dominant Firm Model

- **dominant firm** Firm with a large share of total sales that sets price to maximize profits, taking into account the supply response of smaller firms.

**Figure 12.9**

**PRICE SETTING BY A DOMINANT FIRM**

The dominant firm sets price, and the other firms sell all they want at that price. The dominant firm’s demand curve, $D_D$, is the difference between market demand $D$ and the supply of fringe firms $S_F$.

The dominant firm produces a quantity $Q_D$ at the point where its marginal revenue $MR_D$ is equal to its marginal cost $MC_D$.

The corresponding price is $P^*$.

At this price, fringe firms sell $Q_F$ so that total sales equal $Q_T$. 
Producers in a *cartel* explicitly agree to cooperate in setting prices and output levels.

If enough producers adhere to the cartel’s agreements, and if market demand is sufficiently inelastic, the cartel may drive prices well above competitive levels.

Cartels are often international. While U.S. antitrust laws prohibit American companies from colluding, those of other countries are much weaker and are sometimes poorly enforced. Furthermore, nothing prevents countries, or companies owned or controlled by foreign governments, from forming cartels. For example, the OPEC cartel is an international agreement among oil-producing countries which has succeeded in raising world oil prices above competitive levels.
CONDITIONS FOR CARTEL SUCCESS

First, a stable cartel organization must be formed whose members agree on price and production levels and then adhere to that agreement.

The second condition, and may be the most important, is the potential for monopoly power. Even if a cartel can solve its organizational problems, there will be little room to raise price if it faces a highly elastic demand curve.

Analysis of Cartel Pricing

Cartel pricing can be analyzed by using the dominant firm model discussed earlier. We will apply this model to two cartels, the OPEC oil cartel and the CIPEC copper cartel. This will help us understand why OPEC was successful in raising price while CIPEC was not.
ANALYZING OPEC

FIGURE 12.10

THE OPEC OIL CARTEL

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

OPEC’s demand \( D_{OPEC} \) 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 \( Q_{OPEC} \) 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.
ANALYZING CIPEC

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 $P_c$. 
As the examples of OPEC and CIPEC illustrate, successful cartelization requires two things:

First, the total demand for the good must not be very price elastic.

Second, either the cartel must control nearly all the world’s supply or, if it does not, the supply of noncartel producers must not be price elastic.

Most international commodity cartels have failed because few world markets meet both conditions.