Chapter 13: Types of Market Structure

1. Types of market structure:
   A. 4 categories for **number of firms**
      (many/few/one dominant/one)
   \[ \times 2 \text{ categories for product differentiation} \]
      (homogeneous/differentiated)

<table>
<thead>
<tr>
<th>Product Differentiation</th>
<th>Many</th>
<th>Few</th>
<th>One Dominant</th>
<th>One</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms produce identical products</td>
<td>Perfect competition</td>
<td>Homogeneous products oligopoly</td>
<td>Dominant firm</td>
<td>Monopoly</td>
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<td></td>
<td>(Chapter 9)</td>
<td>Example: U.S. salt market</td>
<td>Example: German fixed-line telephone market</td>
<td>(Chapter 11)</td>
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<td>Example: fresh-cut rose market</td>
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<td>Example: Internet domain name registration*</td>
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<tr>
<td>Firms produce differentiated products</td>
<td>Monopolistic competition</td>
<td>Differentiated products oligopoly</td>
<td>No applicable theory</td>
<td>No applicable theory</td>
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<td></td>
<td>Example: local physicians markets</td>
<td>Example: U.S. cola market</td>
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<td>No applicable theory</td>
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</table>

B. Key points:
   - If there are only a few firms, each can affect all the others – and an individual firm may be able to take account of (and anticipate) behavior of all the others.
   - If output is homogeneous, everyone will have to end up charging same price; if output is differentiated, producers may be able to charge different prices.
2. Oligopoly with homogeneous products -- the Cournot model of duopoly

A. assumptions:

• two firms w/identical (and constant) marginal costs, homogeneous output – so both will charge same P for output; only decision is how much to produce

• firms decide their output levels simultaneously, noncooperatively, w/o knowledge of each other – once outputs are determined, market price instantly adjusts to clear the market

B. example: duopolists are LG, Samsung

market demand = \( D_M \)

• if \( LG \) produces X units, residual demand curve for \( Samsung = D_M - X \); Samsung then derives MR from this curve, determines the Q where MR = MC – thus determining the amount that Samsung will produce when LG produces X

• repeat this process to derive reaction functions for both Samsung and LG:
C. example: let Samsung = 1, LG = 2
market demand curve:  \( P = 100 - (Q_1 + Q_2) \)
Samsung's R:  \( PQ_1 = 100Q_1 - (Q_1)^2 - Q_1Q_2 \)
Samsung's MR:  \( MR_1 = 100 - 2Q_1 - Q_2 \)
Samsung's profit-maximizing condition:  
\[ MC = MR, \text{ or } 10 = 100 - 2Q_1 - Q_2 \]
solve this for \( Q_1 \), to get Samsung's reaction function:  
\[ Q_1 = 45 - 0.5Q_2 \]
shows what Samsung (#1) will do in response to any given output decision of LG (#2)

LG's reaction function derived similarly:  
\[ Q_2 = 45 - 0.5Q_1 \]

D. equilibrium occurs where the two reaction functions cross – the rivals' actions are mutually consistent here
E. equilibrium for the duopoly:
   \[ Q_1 = 45 - 0.5 Q_2 \]
   \[ Q_2 = 45 - 0.5 Q_1 \]
   solve to obtain: \[ Q_1 = 30, \ Q_2 = 30, \ P = 40 \]
   (note that \( P > MC = 10 \))

F. monopoly/cartel solution:
   \[ R = PQ = (100 - Q)Q = 100Q - Q^2 \]
   so \( MR = 100 - 2Q \)
   \( MC = MR \) when \( 10 = 100 - 2Q \),
   \[ \Rightarrow Q = 45, \ P = 55 \] for monopolist

G. implication: as more firms enter the market, market power and price fall, and output rises (see text, pp. 491-493)

3. Bertrand model of oligopoly
A. now assume firms are *price-setters*
   so long as \( P > MC \), each firm always has an incentive to charge a price that is just a bit lower than the one now prevailing
B. ultimately, prices are driven down to \( P = MC \), and firms have same \( P \) and \( Q \) as in perfect competition
4. Stackelberg model of oligopoly
   A. one firm acts as *quantity leader*, making decisions about its Q first – other firms then decide on their own level of Q (this is a "sequential game")
   B. the leader is able to set its own Q while anticipating the reaction of the follower(s)
   C. e.g., in terms of the Cournot model: suppose Samsung (#1) is leader, LG (#2) is follower

market demand: \( P = 100 - (Q_1 + Q_2) \)
LG's reaction function: \( Q_2 = 45 - 0.5 Q_1 \)
since Samsung gets to move first, it can pick Q to maximize its profits, while anticipating what LG will do

i.e., \( P = 100 - Q_1 - (45 - 0.5 Q_1) \)
\[ = 55 - 0.5 Q_1 \] (including LG's reaction!)
so \( R_1 = PQ_1 = 55Q_1 - 0.5 (Q_1)^2 \)
so \( MR = 55 - Q_1 \)
so \( MC = MR \) when \( 10 = 55 - Q_1 \)
so Samsung's optimal \( Q_1 = 45 \)
so LG's optimal \( Q_2 = 45 - 0.5 Q_1 = 22.5 \)

Note how first move gives an advantage!
5. Dominant-firm markets
A. dominant firm acts as price setter; surrounded by small firms ("competitive fringe") who act as perfect competitors, choosing output taking the "market" (dominant firm's) price as given
B. dominant firm's residual demand curve:
   subtract fringe firms' supply ($S_F$)
   from the market $D$ curve ($D_M$)
C. then derive dominant firm's MR curve
   from its residual demand curve $D_R$
D. dominant firm maximizes profits
   by finding $Q$ at which $MC = MR$
E. NB: additional fringe firms can drive down profits, output and price for the dominant firm – to avoid this, dominant firm will set a price (the *limit price*) below the (short-run) profit-maximizing level, in order to discourage new entrants

6. Bertrand model of oligopoly with horizontally differentiated products

A. **vertical differentiation:**
   better/worse quality

**horizontal differentiation:** just "different" (e.g., Pepsi/Coke; Bud/Miller)

B. horizontal differentiation/substitutability reflected in *slope* of demand curves (strong diff = weak subst = steep slope; weak diff = strong subst = flat slope)

C. model of Bertrand price competition: two firms producing differentiated goods demand for each product depends on prices of both products each firm sets its *price* to maximize profit
D. determine solution in several steps:
- use demand curves for each firm's sales to get each firm's R, MR schedules given the other firm's P
- derive each firm's profit-maximizing P for each possible P set by its rival
- this yields each firm's reaction function

**Coke (#1):** \[ Q_1 = 64 - 4P_1 + 2P_2 \quad MC_1 = 5 \]
   or \[ P_1 = 16 + 0.5P_2 - 0.25Q_1 \]

**Pepsi (#2):** \[ Q_2 = 50 - 5P_2 + P_1 \quad MC_2 = 4 \]
   or \[ P_2 = 10 - 0.2P_1 - 0.2Q_2 \]

**solution for Coke:**
\[ R_1 = P_1Q_1 = (16 + 0.5P_2 - 0.25Q_1)Q_1 = 16Q_1 + 0.5P_2Q_1 - 0.25(Q_1)^2 \]
so \[ MR_1 = 16 + 0.5P_2 - 0.5Q_1 \]
to maximize profit, set \[ MR = MC \]
or \[ 5 = 16 + 0.5P_2 - 0.5Q_1 \Rightarrow Q_1 = 22 + P_2 \]

substitute this back into Coke's demand curve to get **Coke's reaction function:**
\[ P_1 = 10.5 + 0.25 P_2 \]
derive Pepsi's reaction function in same way
the two reaction curves are:

Coke: \[ P_1 = 10.5 + 0.25 P_2 \]

Pepsi: \[ P_2 = 7 + 0.10 P_1 \]

equilibrium = where the two curves cross
(i.e., solve the two equations for the P's):

\[ P_1^* = $12.56; \quad P_2^* = $8.26 \]

these P's then imply the Q's for the firms
(obtain by plugging back into D curves):

\[ Q_1^* = 30.28; \quad Q_2^* = 21.26 \]

NB: a monopoly firm would have

\textit{higher} P's and \textit{lower} Q's than these
7. Monopolistic competition
A. Many firms, no barriers to entry or exit, differentiated product
B. same basic rule as before: produce up to where MR = MC
C. in short run, monopolistic competitor may make excess profit
D. in long run, absence of entry barriers means that new entrants will be attracted to the market
   • D curve facing existing competitors will shift in and to left, and possibly tilt
   • eventually, P = ATC (zero excess profit) even though P > MC (= MR)