ECON 415
Firms, Markets and Industry Structure

Review session 1: answers

• **Chapter 1**: problem 1 page 15 (Pepall, Richards and Norman, 2005)
  Examples of three imperfectly competitive markets are (1) automobiles, (2) beer and (3) personal computers. Large entry costs and significant economies of scale prevent the markets from having a large number of suppliers.

• **Chapter 2**: problem 6 page 44

  1. First find the inverse demand function

     \[ P = 60 - Q \]

     Find \( MR \)

     \[ TR(Q) = p(Q)Q \]
     \[ = (60 - Q)Q \]
     \[ MR = 60 - 2Q \]

     Then, set \( MR \) equal to \( MC = 10 \)

     \[ MR = MC \]
     \[ 60 - 2Q = 10 \]
     \[ Q = 25 \]
     \[ P = 35 \]

     Profits are given by

     \[ \Pi = TR - TC \]
     \[ = 25 \times 35 - 10 \times 25 \]
     \[ = 625 \]

  2. the inverse demand function is

     \[ P = 90 - 2Q \]

     \( MR \) is defined from \( TR \)

     \[ TR(Q) = p(Q)Q \]
     \[ = (90 - 2Q)Q \]
     \[ MR = 90 - 4Q \]

     Set \( MR = MC \)

     \[ 90 - 4Q = 10 \]
     \[ QW = 10 \]
     \[ P = 50 \]

     Profits are

     \[ \Pi = 50 \times 10 - 10 \times 10 \]
     \[ = 800 \]
3. Inverse demand function is

\[ P = 50 - 0.5Q \]

\[ MR = MC \] gives

\[ 50 - Q = 10 \]
\[ Q = 40 \]
\[ P = 30 \]

Profits are

\[ \Pi = 800 \]

4. graph

**Chapter 3:**

Exercise

1. Total sale: \[ S = 150 + 90 \times 2 + 30 + 20 + 5 = 385 \]

   (a) \[ C_4 = \frac{150 + 90 \times 2 + 30}{385} = 0.93506 \]. Very close to 1. Thus it is a highly concentrated market.

   (b) \[ HHI = \frac{10,000 (150^2 + 90^2 + 2 + 30^2 + 20^2 + 5^2)}{385^2} = 2,700 \]. Very concentrated.

2. Would you regard this industry as oligopolistic? Why or why not? Yes.

3. A merges with firm F. New firm A’ has sales of 155. \[ C_4 = \frac{155 + 90 \times 2 + 30}{385} = 0.94805 \].

4. A and F go out of business. \[ C_4 = \frac{90 \times 2 + 30 + 20}{230} = 1 \]. Very concentrated.

**Chapter 4:** problem 5 page 80

5. It is clear that \( AC \) start to rise once we move from 1,500 to 1,750 units of output. This can also be seen by computing the total cost at each output level and then computing a discrete measure of \( MC \). Once we get beyond 1,500 units, \( MC \) is higher than \( AC \).

<table>
<thead>
<tr>
<th>( q )</th>
<th>( AC )</th>
<th>( TC = AC \times q )</th>
<th>discrete ( MC )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>28.78</td>
<td>7195</td>
<td>( \frac{2195 - 0}{250} = 28.78 )</td>
</tr>
<tr>
<td>500</td>
<td>25.73</td>
<td>12865</td>
<td>( \frac{12865 - 195}{500} = 50.68 )</td>
</tr>
<tr>
<td>750</td>
<td>23.63</td>
<td>17723</td>
<td>( \frac{17723 - 12865}{750 - 500} = 19.432 )</td>
</tr>
<tr>
<td>1000</td>
<td>21.63</td>
<td>21630</td>
<td>( \frac{21630 - 17723}{1000 - 750} = 15.628 )</td>
</tr>
<tr>
<td>1250</td>
<td>21</td>
<td>26250</td>
<td>( \frac{26250 - 21630}{1250 - 1000} = 18.48 )</td>
</tr>
<tr>
<td>1500</td>
<td>20.75</td>
<td>31125</td>
<td>( \frac{31125 - 26250}{1500 - 1250} = 19.5 )</td>
</tr>
<tr>
<td>1750</td>
<td>20.95</td>
<td>36663</td>
<td>( \frac{36663 - 31125}{1750 - 1500} = 22.152 )</td>
</tr>
<tr>
<td>2000</td>
<td>21.5</td>
<td>43000</td>
<td>( \frac{43000 - 36663}{2000 - 1750} = 25.348 )</td>
</tr>
</tbody>
</table>

6. Find the \( MC \) first. Here is the answer for \( Q = 1000 \). The answers for the other values of \( Q \) can be found in a similar fashion. For output level 1000 it is computed as

\[ s(1000) = \frac{AC}{MC} = \frac{21.63}{18.48} = 1.17045. \]
7. The demand functions for the two consumer groups are

\[ X_1 = \begin{cases} 
200 - P & \text{if } P \leq 200 \\
0 & \text{if } P > 200 
\end{cases} \]

\[ X_2 = \begin{cases} 
50 - 0.5P & \text{if } P \leq 100 \\
0 & \text{if } P > 100 
\end{cases} \]

If \( P > 200 \). In this case \( X_1 = X_2 = 0 \), implying \( X_1 + X_2 = 0 \).
If \( 100 < P \leq 200 \), \( X_1 = 200 - P \) and \( X_2 = 0 \), implying \( X_1 + X_2 = X_1 = 200 - P \).
If \( P \leq 100 \), \( X_1 = 200 - P \) and \( X_2 = 50 - 0.5P \) implying \( X_1 + X_2 = 250 - \frac{3}{2}P \). Therefore the aggregate demand function is

\[ X = \begin{cases} 
250 - \frac{3}{2}P & \text{if } P \leq 100 \\
200 - P & \text{if } 100 < P \leq 200 \\
0 & \text{if } P > 200 
\end{cases} \]

8. First consider the case when \( P > 200 \), \( X_1 + X_2 = 0 \) implying \( \Pi = 0 \).
If \( 100 < P \leq 200 \), \( X = 200 - P \), i.e., \( P = 200 - X \) and therefore

\[ \Pi = PX - 40X \\
= (200 - X)X - 40X \]

\[ \frac{d\Pi}{dX} = 0 \]

\[ 200 - 2X - 40 = 0 \]

\[ X = 80 \]

\[ P = 120 \]

\[ \Pi = 6400 \]

If \( P \leq 100 \), \( X = 250 - \frac{3}{2}P \), therefore \( P = \frac{500}{3} - \frac{2}{3}X \). The profit is

\[ \Pi = \left( \frac{500}{3} - \frac{2}{3}X \right)X - 40X \]

\[ \frac{d\Pi}{dX} = 0 \]

\[ \frac{500}{3} - \frac{4}{3}X - 40 = 0 \]

\[ X = 95 \]

\[ P = \frac{310}{3} = 103.33 \]

\[ \Pi = 6016.66 \]

But this solution violates the assumption that \( P \leq 100 \), so is not viable. If \( P \) is 100, then \( X = 100 \) and profits will be 6000. This is less than 6400. The maximum is then
for the second case with no sales to group 2. Total profits are equal to 6400.

Consumer surplus is obtained by using the first market only, and is given by

\[
CS = \int_{120}^{200} (200 - x) \, dx
\]
\[
= 3200
\]

9. For the first market

\[
\Pi_1 = (200 - X_1)X_1 - 40X_1
\]

\[
\frac{d\Pi_1}{dX_1} = 0
\]
\[
= 200 - 2X_1 - 40 = 0
\]
\[
X_1 = 80
\]
\[
P = 120
\]
\[
\Pi_1 = 6400
\]

For the second market

\[
\Pi_2 = (100 - 2X_2)X_2 - 40X_2
\]

\[
\frac{d\Pi_2}{dX_2} = 0
\]
\[
= 100 - 4X_2 - 40 = 0
\]
\[
X_2 = 15
\]
\[
P = 70
\]
\[
\Pi_1 = 450
\]

Consumer surplus is

\[
CS = \int_{70}^{100} (50 - 0.5x) \, dx
\]
\[
= 225
\]

Total profit is then 6850 and total consumer surplus is 34250.

10. Price discrimination has increased total surplus. This is because without price discrimination, one market is not served.