1 Topic 7: Demand and Elasticity

- Market vs. firm’s demand
- Elasticity and revenue
- Numerical examples: Elasticity for linear and log-linear demand
- Determinants of elasticity
- Demand estimation exercise.

2 Perfect vs. imperfect competition

“firms are price-takers” vs. “firms have market power”

Firms are price-takers (Perfect competition)  Firms have market power (Imperfect competition)

(Sessions 5–7) (Sessions 8–15)
From the individual firm’s viewpoint

**Imperfect competition = firm has market power**

= firm sees a trade-off between price and volume

![Demand curve for i's output](image)

**Perfect competition = firm is a price-taker**

= firm believes it can sell any amount at the market price (e.g., market price is 3)

![i's volume-price trade-off](image)

Market power: where it comes from

Two cases:

1. **Differentiated products**: the firm’s **branded** product is differentiated from other products.

2. **Homogeneous goods**: Though products are not differentiated, the firm is a big player: increased output pushes down the market price.

Next let's compare **market** demand vs. a **firm's** demand …
Case 2: Homogeneous goods

Market vs. firm's demand
...starting with no market power

MARKET DEMAND

FIRM'S DEMAND

“El Guadal”
finca cafetera

...when total output of other farms
is 7.5M metric tons

Market power: Our simulation

MARKET DEMAND

FIRM'S DEMAND

When \( Q_{-i} = 3173 \)
Corning and glass substrate

Corning has over 50% market share of glass substrate. There are different grades (“5G, 6G, …”), but for a particular grade the products of different suppliers are viewed as close substitutes.

News item from December 2005 (for example):

The aggressive capacity added by both Corning of the U.S., the world’s No. 1 substrate supplier, and AGC, the No. 2, will lead to price drops for glass substrates and will especially benefit TV panel makers …

Market demand curve vs. Corning’s demand curve

**MARKET DEMAND**

\[ Q = 6000 - 100P \]

**FIRM’S DEMAND**

When \( Q_{-i} = 1500 \)

![Graphs showing market demand and firm's demand curves.](image)
Case 1: Differentiated products

Example: Airbus and Boeing

**Individual demand functions:**

\[ Q_A = 60 - 3P_A + 2P_B \]
\[ Q_B = 60 - 3P_B + 2P_A \]

**Market demand:**

Choose measure of aggregate output, say \( Q = Q_A + Q_B \).

Choose price index, say \( P = (P_A + P_B)/2 \).

\[ Q = 120 - 2P \]

(See workbook-style “Exercise on Demand and Elasticity” for details and review.)

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Labor markets: minimum wage

An increase in minimum wage has two effects on total wage bill:

- $P \uparrow$: Each worker is more expensive : wage bill ↑
- $Q \downarrow$: Firms employ fewer workers : wage bill ↓

Net effect depends on which is greater:

$$\% \Delta P \quad \text{or} \quad \% \Delta Q$$
Example: linear demand

Key point: own-price elasticity of demand

Useful measure of price-sensitivity of demand: Elasticity

\[ E = -\frac{\text{% change in } Q}{\text{% change in } P} \]

<table>
<thead>
<tr>
<th>If ...</th>
<th>then a price increase causes revenue (expenditure) to ...</th>
<th>and we say demand is ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E &lt; 1 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( E = 1 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( E &gt; 1 )</td>
<td></td>
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</tbody>
</table>
**Other elasticities**

We can measure elasticities between any two related variables (e.g., demand and income, supply and price, etc.)

Elasticity = sensitivity in terms of % changes (rather than slope).

Some elasticities of demand:

- **Own-price elasticity:** \( \frac{\% \Delta Q}{\% \Delta P} \)
- **Cross-price elasticity:** \( \frac{\% \Delta Q}{\% \Delta P} \)
- **Income elasticity:** \( \frac{\% \Delta Q}{\% \Delta I} \)

Remember:

- This course: 97% on own-price elasticity; 3% on other elasticities.
- “Elasticity of demand” (no qualifier) means “own-price elasticity.”
- Own-price elasticity is only one we use the minus sign for.

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**Point elasticity**

Loosely:

$$E = -\frac{\% \text{ change in } Q}{\% \text{ change in } P}.$$

**Point elasticity:** If $d(P)$ is smooth then elasticity at point $(P, Q)$ is

$$E = -\frac{dQ}{dP} \frac{P}{Q}.$$

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**Elasticity of linear demand:** $Q = A - BP$

**Choke price:** price at which demand is zero $= \bar{P} =$

**Point elasticity:** $\frac{P}{\bar{P} - P}.$

![Graph showing demand for minivans in thousands and price in thousands of dollars.](chart.png)
Elasticity of log-linear demand: \( Q = AP^{-B} \)

“Taking logs” yields:

\[
\log Q = \log A - B \log P
\]

\( d_1(P) = 6P^{-3} \)

\( d_2(P) = 1.7P^{-1.5} \)

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Determinants of elasticity

1. The more close substitutes a good has, the _______ elastic is demand.

2. ⇒ Demand for a particular brand (Samsung) or type (17” flat panel) is _______ elastic than demand for the entire category (computer displays).

3. ⇒ The more differentiated the brand, the _______ elastic is demand.

4. ⇒ Advertising usually both increases demand and makes it _______ elastic.

5. When a product’s close substitutes become more expensive, demand for the product becomes _______ elastic.

6. Demand is typically _______ elastic for people with lower income.

Elasticity of demand for some cars in USA (1980s data)

<table>
<thead>
<tr>
<th>Model</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mazda 323</td>
<td>6.3</td>
</tr>
<tr>
<td>Honda Accord</td>
<td>4.8</td>
</tr>
<tr>
<td>Nissan Maxima</td>
<td>4.8</td>
</tr>
<tr>
<td>Nissan Sentra</td>
<td>6.5</td>
</tr>
<tr>
<td>Ford Taurus</td>
<td>4.2</td>
</tr>
<tr>
<td>Ford Escort</td>
<td>6.0</td>
</tr>
<tr>
<td>Lexus LS400</td>
<td>3.0</td>
</tr>
<tr>
<td>Chevrolet Cavalier</td>
<td>6.4</td>
</tr>
<tr>
<td>Cadillac Seville</td>
<td>3.9</td>
</tr>
<tr>
<td>BMW 735i</td>
<td>3.5</td>
</tr>
</tbody>
</table>

But for entire category: 0.8
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➔ 5. Demand estimation exercise.

Estimating demand: Get some data

1. Consumer surveys.
2. Consumer focus groups.
3. Market experiments.
4. Historical (real) data: cross-section, time-series, or both (panel).
Estimating demand: Fit a curve

1. Write down model (equation) for demand, with unspecified coefficients.

2. Fit line or curve to data points using statistical techniques (regression).

It’s all approximate:

- Include most relevant variables.
- Pick a simple functional form without too many coefficients.

Two common parametric forms

Linear

\[ Q = A - B_1 P + B_2 P_s + B_3 I + \cdots \]

e.g.

\[ FPR = -0.02 - 0.8P_F + 0.4P_M - 0.07MPR + 0.35 GDP \]

Log-linear (constant elasticity)

\[ Q = A P^{-B_1} P_s^{B_2} I^{B_3} \cdots \]

taking logs yields

\[ \log Q = \log A - B_1 \log P + B_2 \log P_s + B_3 \log I + \cdots \]
Demand for US Gasoline Consumption

Variables:

\[ \begin{align*}
GPC &= \text{Per-capita U.S. gasoline consumption} \\
PG &= \text{Price index for gasoline} \\
Y &= \text{Per capita disposable income} \\
PNC &= \text{Price index for new cars} \\
PUC &= \text{Price index for used cars}
\end{align*} \]

Model:

\[ GPC = A \cdot PG^{B_1} \cdot Y^{B_2} \cdot PNC^{B_3} \cdot PUC^{B_4} \]

Or:

\[ \log GPC = \log A + B_1 \log PG + B_2 \log Y + B_3 \log PNC + B_4 \log PUC \]

Regression results

\[ \log G = -5.36 - 0.059 \log PG + 1.373 \log Y - 0.127 \log PNC - 0.119 \log PUC \]

Or:

\[ G = 0.00000436 PG^{-0.059} Y^{1.373} PNC^{-0.127} PUC^{-0.119} \]
Session 8: Pricing with Market Power

For a single firm with demand $d(P)$ and cost curve $c(Q)$:

- Output decision: $MR = MC$.
- Entry/exit decision: $\Pi > FC$?

**FPM reading.** Chapter 7.

**Deliverables.** Exercises 7.4 and 7.5.