Micro Handout 6: Elasticity Applications

Market Demand and Market Supply Curves

**Market demand curve:** How many cans of beer would consumers purchase (the quantity demanded), IF the price of beer were _____, given that everything else relevant to the demand for beer remains the same?

**Market supply curve:** How many cans of beer would firms produce (the quantity supplied), IF the price of beer were _____, given that everything else relevant to the supply of beer remains the same?

In equilibrium Demand and supply are equal partners in determining the equilibrium price and quantity.

Why is the Equilibrium Price Important? Market Forces, the Equilibrium Price, and the Actual Price

If Actual Price < Equilibrium Price

- Quantity Demanded > Quantity Supplied
- Shortage exists
- Actual Price rises until the equilibrium is reached

If Actual Price > Equilibrium Price

- Quantity Demanded < Quantity Supplied
- Surplus exists
- Actual Price falls until the equilibrium is reached

Market forces push the actual price toward its equilibrium level.

Assuming that the actual price is free to move, the actual price will equal the equilibrium price in short order.

Shifts versus Movements Along the Demand and Supply Curves

**Shifts**

- Change in something OTHER THAN the price of beer ITSELF
- The demand curve for beer can SHIFT ONLY if something that affects demand OTHER THAN the BEER PRICE changes.

**Movements Along**

- Change in the price of beer ITSELF
- The supply curve of beer can SHIFT ONLY if something that affects supply OTHER THAN the BEER PRICE changes.
**Price Elasticity of Demand**

Price Elasticity of Demand = **Percent** change in the quantity demanded resulting from a **1 percent** change in the price

If the quantity demanded is very sensitive to the price

\[ \text{Demand Is } \downarrow \]

Price elasticity of demand \[ \downarrow \] **1**.

If the quantity demanded is not very sensitive

\[ \text{Demand Is } \downarrow \]

Price elasticity of demand \[ \downarrow \] **1**.

\[ \text{Price elasticity of demand } \downarrow \] **1**.

\[ \text{Price elasticity of demand } \downarrow \] **1**.

\[ \text{Price elasticity of demand } \downarrow \] **1**.

\[ \text{TR } = P \times Q \]

\[ \begin{align*}
\text{P} & \Downarrow \quad \text{Q } \quad \text{P} \Upwardarrow \quad \text{Q } \\
\text{TR } & \Downarrow \quad \text{TR } \Downarrow
\end{align*} \]

**Linear Demand Curves: Slope versus Elasticity**

Geometric Interpretation of Total Revenue (TR)

What is the height of the rectangle? _____

What is the width of the rectangle? _____

What is the area of the rectangle? _____

Geometric interpretation of TR: ____________________.

“High” Price

\[ \text{P } \Downarrow \quad \text{Q } \quad \text{P} \Upwardarrow \quad \text{Q } \\
\text{TR } = P \times Q \\
\text{Demand Is } \downarrow \]

“Low” Price

\[ \text{P } \Upwardarrow \quad \text{Q } \quad \text{P} \Downarrow \quad \text{Q } \\
\text{TR } = P \times Q \\
\text{Demand Is } \downarrow \]

**Question:** Are elasticity and slope equivalent? **Answer:** ______
Effect of the First Persian Gulf War on Crude Oil Prices

Prior to Iraq’s invasion of Kuwait on August 2, 1990, approximately 65 million barrels of crude oil were produced in the world per day. The price of crude oil was about $17 per barrel. Kuwait and Iraq produced 5 of the 65 million barrels.²

The Security Council of the United Nations responded to the invasion by passing a resolution requiring nations to boycott Iraqi oil. The Security Council’s action succeeded: no Iraqi or Kuwaiti oil reached world markets.

**Question:** What does common sense suggest will happen to the quantity and price?

**Question:** Can we be more specific?
As always, begin by focusing on the demand and supply curves:

In terms of barrels, the supply curve shifted _______ million barrels to the _______ as a consequence of the first Persian Gulf War.

At a price of $17, how large was the shortage? _______ million barrels.

**Question:** Can we be more specific about the price?

---

² Crude oil production and price data from U.S. Energy Information Administration. Note that liberties were taken simplify the arithmetic.
Claim: We can be more specific by applying the price elasticities:

- Price elasticity of demand = .05
- Price elasticity of supply = .10

We will not see how.

In response to a shortage, the price of oil rises, we move along the demand and supply curves, increasing the quantity supplied and decreasing the quantity demanded:

We begin by reviewing the definitions of the price elasticity of demand and supply:

\[
\text{Price Elasticity of Demand} = \frac{\text{Percent change in the quantity demanded}}{\text{resulting from a 1 percent change in the price}}
\]

\[
\text{Price Elasticity of Supply} = \frac{\text{Percent change in the quantity supplied}}{\text{resulting from a 1 percent change in the price}}
\]

Question: What is the shortage in percentage terms? _______ = _______ \ldots \approx \ldots \%  

If the price were to rise by one percentage point:

The quantity demanded would _________________
by _____ percentage point(s).

The quantity supplied would _________________
by _____ percentage point(s).

After accounting for both the quantity demanded and the quantity supplied, the shortage “gap” would decrease by _____ percentage point(s).

If the price were to rise by ten percentage points:

The quantity demanded would _________________
by _____ percentage point(s).

The quantity supplied would _________________
by _____ percentage point(s).

After accounting for both the quantity demanded and the quantity supplied, the shortage “gap” would decrease by _____ percentage point(s).

If the price were to rise by fifty percentage points:

The quantity demanded would _________________
by _____ percentage point(s).

The quantity supplied would _________________
by _____ percentage point(s).

After accounting for both the quantity demanded and the quantity supplied, the shortage “gap” would decrease by _____ percentage point(s).
Summarizing:

<table>
<thead>
<tr>
<th>Price up by</th>
<th>Quantity demanded decreased by</th>
<th>Quantity supplied increased by</th>
<th>Portion of gap eliminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>_____%</td>
<td>_____%</td>
<td>_____%</td>
</tr>
<tr>
<td>10%</td>
<td>_____%</td>
<td>_____%</td>
<td>_____%</td>
</tr>
<tr>
<td>_____%</td>
<td>_____%</td>
<td>_____%</td>
<td>_____%</td>
</tr>
</tbody>
</table>

Accordingly, we estimate that the price increases by about 50 percent:

\[\text{\$17 \times 50\%} = \text{\$_________}\]

We estimate that the price rises from \$17 to \$_______ as a consequence of the Iraqi invasion and the Security Council’s action.

In fact, the price rose to about \$27 in August.
Minimum Wage Legislation: A “Price” Floor

Goal:

Explain why the demand curve for low skilled labor is downward sloping.

Explain why the supply curve for low skilled labor is upward sloping.

Currently, the Federal minimum wage is $7.25 per hour. Many states have established a minimum wage above the Federal level. The minimum wage in Massachusetts is $9.00 per hour. That is, by law the wage paid by employers cannot fall below $9.00 per hour. It is generally agreed that the minimum wage exceeds the equilibrium wage for low skilled workers as illustrated in the diagram above and to the right.

Question: As a consequence of the minimum wage, how is the number of low skilled workers seeking a job related to the number of workers actually hired?

Question: How might we test our logic?

Question: Is the wage for highly skilled labor less than or greater than the minimum wage?

Question: Will the minimum wage affect unemployment for highly skilled workers?

Question: As a consequence of the minimum wage, how would the 16-19 unemployment rate and the unemployment rate for all Americans be related?

Unemployment rates for August 2013:

All Americans: _____ percent  Americans 16-19: _____ percent

Question: Are some low skilled workers helped by the minimum wage?

Question: Are all low skilled workers helped by the minimum wage?
A Possible Justification for Minimum Wage Legislation: The Total Earned Income of Low Skilled Workers as a Group

Claim of many advocates of a higher minimum wage: A higher minimum wage will not increase low skilled unemployment as a consequence of the indirect earnings effect.

**Question:** How does a higher minimum wage affect the earned income of low skilled workers as a group?

\[
\text{Total Earned Earnings} = \text{Wage} \times \text{Quantity of Labor Demanded} = W \times L
\]

**Question:** What happens to the quantity of labor hired when the wage rate is raised?

**Answer:** Since the demand curve for labor is downward sloping, \[\text{Employment} \downarrow\].

**Question:** What additional information do we need to determine if the total earned income of low skilled workers increases or decreases?

**Answer:** \[\text{If demand were elastic} \downarrow \text{If demand were inelastic} \downarrow \]

\[w \uparrow L \downarrow \text{w} \uparrow L \downarrow \text{w} \times L \text{ falls} \downarrow \text{w} \times L \text{ rises} \downarrow \text{Total Earned Earnings} \downarrow \text{Total Earned Earnings} \downarrow \]

\[\downarrow \text{Indirect earnings effect} \downarrow \text{Indirect earnings effect} \downarrow \text{employment} \downarrow \text{employment} \]

What do many empirical studies suggest?³

<table>
<thead>
<tr>
<th>Study</th>
<th>Group</th>
<th>Wage elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welch and Cunningham (1978)</td>
<td>Teens</td>
<td>1.34</td>
</tr>
<tr>
<td>Baxen and Martin (1991)</td>
<td>Young</td>
<td>.51</td>
</tr>
<tr>
<td>Anderson (1977)</td>
<td>16-24</td>
<td>7.14</td>
</tr>
<tr>
<td>Grant (1979)</td>
<td>14-24</td>
<td>9.68</td>
</tr>
<tr>
<td>Hamermesh (1982)</td>
<td>14-24</td>
<td>.59</td>
</tr>
<tr>
<td>Layard (1982)</td>
<td>M &lt; 21</td>
<td>1.25</td>
</tr>
<tr>
<td>Lewis (1985)</td>
<td>F &lt; 18</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>M &lt; 21</td>
<td>1.80</td>
</tr>
</tbody>
</table>

**Question:** What should we conclude?

Micro Handout 7: Elasticity Applications

Background
In fact, gasoline is taxed at both the Federal and state levels. In some parts of the country, gasoline is also taxed by cities. The Federal tax on gasoline is 18.4 cents per gallon. State gasoline taxes range from a low of 12.4 cents per gallon in Alaska followed by 14.5 in New Jersey to a high of 52.9 in California followed by 49.4 cents in New York. (Actually, Alaska suspended its gasoline tax entirely in 2008, but reinstated it on August 1, 2009.) State and Federal tax rates are reported in table 7.1:

<table>
<thead>
<tr>
<th>State</th>
<th>Tax</th>
<th>State</th>
<th>Tax</th>
<th>State</th>
<th>Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ala.</td>
<td>20.9</td>
<td>La.</td>
<td>20.0</td>
<td>Ohio</td>
<td>28.0</td>
</tr>
<tr>
<td>Alaska</td>
<td>12.4</td>
<td>Maine</td>
<td>30.0</td>
<td>Okla.</td>
<td>17.0</td>
</tr>
<tr>
<td>Ariz.</td>
<td>19.0</td>
<td>Md.</td>
<td>27.0</td>
<td>Ore.</td>
<td>31.1</td>
</tr>
<tr>
<td>Ark.</td>
<td>21.8</td>
<td>Mass.</td>
<td>26.5</td>
<td>Pa.</td>
<td>41.8</td>
</tr>
<tr>
<td>Calif.</td>
<td>52.9</td>
<td>Mich.</td>
<td>41.4</td>
<td>R.I.</td>
<td>33.0</td>
</tr>
<tr>
<td>Colo.</td>
<td>22.0</td>
<td>Minn.</td>
<td>28.6</td>
<td>S.C.</td>
<td>16.8</td>
</tr>
<tr>
<td>Conn.</td>
<td>49.3</td>
<td>Miss.</td>
<td>18.4</td>
<td>S.D.</td>
<td>22.0</td>
</tr>
<tr>
<td>Del.</td>
<td>23.0</td>
<td>Mo.</td>
<td>17.3</td>
<td>Tenn.</td>
<td>21.4</td>
</tr>
<tr>
<td>Fla.</td>
<td>36.0</td>
<td>Mont.</td>
<td>27.8</td>
<td>Tex.</td>
<td>20.0</td>
</tr>
<tr>
<td>Ga.</td>
<td>27.5</td>
<td>Nebr.</td>
<td>27.3</td>
<td>Utah</td>
<td>24.5</td>
</tr>
<tr>
<td>Hawaii</td>
<td>48.1</td>
<td>Nev.</td>
<td>33.2</td>
<td>Vt.</td>
<td>32.1</td>
</tr>
<tr>
<td>Idaho</td>
<td>25.0</td>
<td>N.H.</td>
<td>19.6</td>
<td>Va.</td>
<td>17.3</td>
</tr>
<tr>
<td>Ill.</td>
<td>39.1</td>
<td>N.J.</td>
<td>14.5</td>
<td>Wash.</td>
<td>37.5</td>
</tr>
<tr>
<td>Ind.</td>
<td>40.8</td>
<td>N.M.</td>
<td>18.9</td>
<td>W.Va.</td>
<td>35.7</td>
</tr>
<tr>
<td>Iowa</td>
<td>22.0</td>
<td>N.Y.</td>
<td>49.9</td>
<td>Wis.</td>
<td>32.9</td>
</tr>
<tr>
<td>Kans.</td>
<td>25.0</td>
<td>N.C.</td>
<td>37.8</td>
<td>Wyo.</td>
<td>24.0</td>
</tr>
<tr>
<td>Ky.</td>
<td>30.1</td>
<td>N.D.</td>
<td>23.0</td>
<td>D.C.</td>
<td>23.5</td>
</tr>
<tr>
<td>Federal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.4</td>
</tr>
</tbody>
</table>

Table 0.1: Gasoline Tax Rates April 2014 (Cents Per Gallon)

The Federal tax is 18.4 cents per gallon. In Massachusetts, the tax is 26.5 cents per gallon. We will use Massachusetts in our example; in Massachusetts, the combined gasoline tax is 44.9 cents per gallon which we will round to $.40 per gallon.

Gasoline Tax in Massachusetts = 18.4 + 26.5 = 44.9 \approx 40 \text{ cents per gallon}

Tax Incidence – Who Bears the Burden of a Tax

- The legal (statutory) incidence of a tax refers to who is legally obliged to pay the tax.

  **Question:** Who bears the legal incidence of the gasoline tax? ________________.

- **Claim:** “Whenever the government imposes a tax, firms simply raise the price consumers pay by the amount of the tax and carry on business as usual.”

- The economic incidence of a tax refers to who is actually burdened by the tax.
Gasoline Market and Taxes in Massachusetts

Begin by assuming that there are no taxes imposed on gasoline:

Equilibrium Price = \( P^* = \) ______

Now, account for the fact that gasoline is taxed at both the Federal and state levels. In some parts of the country, gasoline is also taxed by cities.

- The Federal tax on gasoline is 18.4 cents per gallon.
- State gasoline taxes range widely:
  - From a low of 12.4 cents per gallon in Alaska followed by 17.0 in Oklahoma.
  - To a high of 52.9 cents in California, 49.9 in New York, followed by 48.1 in Hawaii, and 49.3 in Connecticut. (Actually, Alaska suspended its gasoline tax entirely in 2008, but reinstated it on August 1, 2009.) In Massachusetts, the tax is 26.5 cents per gallon.

In Massachusetts, the combined gasoline tax is 44.9 cents per gallon. We shall use Massachusetts as our example and round off the tax to $.40 per gallon.

Recall that there is a difference between the legal and economic incidence of a tax:

- The **legal (statutory)** incidence of a tax refers to who is legally obliged to pay the tax.
- The **economic** incidence of a tax refers to who is actually burdened by the tax.
Next, revisit the claim:

**Claim:** “Whenever the government imposes a tax, firms simply raise the price consumers pay by the amount of the tax and carry on business as usual.”

Now, impose the $.40 per gallon tax on gasoline>

**Two notions of the price**

When a tax is imposed, two notions of price emerge: the price from the perspective of

- consumers.
  
  The price that appears on the gasoline pump is the price from the perspective of ____________.

- firms.

**Question:** How is the price from the perspective of firms related to the price from the perspective of consumers when there is a $.40 per gallon tax on gasoline?

**Answer:** The price from the perspective of firms is _______________ the price from the perspective of the consumers.

**Question:** What equation describes the relationship between the price seen by firms, $P_F$, the price as seen by consumers, $P_C$, and the $.40 per gallon tax? **Answer:** $P_F = __________$

Next, revisit the claim:

**Claim:** “Whenever the government imposes a tax, firms simply raise the price consumers pay by the amount of the tax and carry on business as usual.”

- Raise the price they charge to consumers by the amount of the tax; that is, firms now charge consumers $______ per gallon.

- After the firms send gasoline tax revenues to the government, they would still receive $______ for each gallon sold.

**Question:** Could firms now continue to carry on business as usual by producing 400 million gallons per day?

**Gasoline Market in Massachusetts**

<table>
<thead>
<tr>
<th>$P$ ($/gallon)</th>
<th>Quantity Demanded (thousands of gallons per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>7,000</td>
</tr>
<tr>
<td>2.40</td>
<td>7,250</td>
</tr>
<tr>
<td>2.30</td>
<td>7,500</td>
</tr>
<tr>
<td>2.20</td>
<td>7,750</td>
</tr>
<tr>
<td>2.10</td>
<td>8,000</td>
</tr>
<tr>
<td>2.00</td>
<td>8,250</td>
</tr>
<tr>
<td>1.90</td>
<td>8,500</td>
</tr>
<tr>
<td>1.80</td>
<td>8,750</td>
</tr>
</tbody>
</table>

Quantity supplied is sensitive to the price from the perspective of the ____________.

Quantity demanded is sensitive to the price from the perspective of the ____________.
Illustrating the equilibrium with a tax:

- Start at the no tax equilibrium and move left until the vertical gap between the demand and supply curves equals the amount of the tax.
- The associated quantity is the new equilibrium quantity.
- The point on the demand curve is the equilibrium price from the perspective of consumers.
- The point on the supply curve is the equilibrium price from the perspective of firms.

**Question:** Why do we move left rather than right from the no tax equilibrium?

**Gasoline Market in Massachusetts**

<table>
<thead>
<tr>
<th>P ($/gallon)</th>
<th>Q (thousands of gallons per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>7,000</td>
</tr>
<tr>
<td>2.40</td>
<td>7,250</td>
</tr>
<tr>
<td>2.30</td>
<td>7,500</td>
</tr>
<tr>
<td>2.20</td>
<td>7,750</td>
</tr>
<tr>
<td>2.10</td>
<td>8,000</td>
</tr>
<tr>
<td>2.00</td>
<td>8,250</td>
</tr>
</tbody>
</table>

After the new equilibrium is established, what is the

- quantity? ______________
- price seen by consumers? ______________
- price seen by firms? ______________

In general, when the tax is imposed, what happens to the

- equilibrium quantity? ______________
- price seen by the consumers? ______________, but by less than ______________.
- price seen by the firms? ______________, but by less than ______________.

**Legal versus Economic Incidence**

Even though the legal incidence is entirely on the firms, the economic incidence of the tax, how the tax actually burdens consumers and firms, is ______________.
**Exercise:** Suppose that the legal incidence of the gasoline tax were placed on consumers rather than of firms.

In this case, when a consumer buys a gallon of gasoline, the consumer would be legally obliged to send the $.40 tax to the government. In other words, the consumer would have to pay the firm something for each gallon of gasoline and also send $.40 to the government.

**Question:** How would the price from the perspective of consumers related the price to from the perspective of firms when there is a $.40 per gallon tax on gasoline?

**Answer:** The price from the perspective of the consumers is ______________ the price from the perspective of firms.

**Question:** What equation describes the relationship between the price seen by firms, $P_F$, the price as seen by consumers, $P_C$, and the $.40 per gallon tax?

**Answer:**

\[
P_C = \underline{\text{_______________}}
\]

or

\[
P_F = \underline{\text{_______________}}
\]

**Gasoline Market in Massachusetts**

\[
\begin{array}{c|c|c|c}
\text{P ($/gallon)} & \text{Q (thousands of gallons per day)} \\
\hline
2.50 & 7,000 & 2.10 & 7,250 \\
2.40 & 7,250 & 2.30 & 7,500 \\
2.30 & 7,500 & 2.50 & 7,750 \\
2.20 & 7,750 & 2.40 & 8,000 \\
2.10 & 8,000 & \text{Quantity Supplied} & \downarrow \\
2.00 & 8,250 & \text{Quantity Demanded} & \downarrow \\
1.90 & \text{S} & \text{D} & \downarrow \\
1.80 & \text{Q} & \text{P} & \text{C} = \underline{\text{_______________}} \\
\end{array}
\]

\[
P_F = P_C - \text{Tax}
\]

\[
P_F = P_C - .40
\]

After the new equilibrium is established, what is the

- quantity? ______________
- price seen by consumers? ______________
- price seen by firms? ______________

**Question:** Does the legal incidence of a tax affect its real economic incidence, how the burden of the tax is actually shared? _____
**Question:** Since the legal incidence of a tax does not affect its economic incidence, what does affect the real economic incidence?

**Answer:** Relative price elasticities of demand and supply.

![Graphs showing tax incidence](image)

Which is less elastic:
- demand or supply?

Who bears more of the burden:
- consumers or firms?

**Intuition:** The less flexible group bears ________ of the burden.

**Tax Incidence Summary**

- How does the imposition of a tax affect the equilibrium?
  - The equilibrium quantity decreases;
  - The price from the perspective of consumers increases, but by less than the full amount of the tax.
  - The price from the perspective of firms decreases, but by less than the full amount of the tax.

- How is the burden of a tax shared?
  - The legal incidence of a tax does not affect the real, economic incidence.
  - The economic incidence of a tax depends on the price elasticities of demand and supply:

  - **Demand less elastic than supply** ➔ **Consumers bear more of the burden**
  - **Supply less elastic than demand** ➔ **Firms bear more of the burden**

**Intuition:** The less flexible group bears more of the burden.