Micro Lecture 9: Consumer and Producer Surplus Applications

Review

**Consumer Surplus:** The net benefit buyers enjoy from purchasing and consuming the good.
- **Height of Market Demand Curve:** Reflects the benefit a buyer enjoys from consuming a specific unit of the good.
- **Consumer Surplus:** The net benefit buyers enjoy from purchasing and consuming the good; the benefit each buyer enjoys from consuming the good less what each buyer must pay.
- **Area Beneath the Demand Curve Lying Above the Price:** Reflects all the net benefits buyers enjoy, the consumer surplus, from purchasing and consuming the good.

**Producer Surplus:** The net benefit sellers enjoy from producing and selling the good
- **Height of Market Supply Curve:** The seller’s opportunity cost of providing a specific unit of the good.
- **Producer Surplus:** The net benefit sellers enjoy from producing and selling the good; what each seller receives from the sale of the good less the opportunity cost each seller incurs by providing it.
- **Area Above the Supply Curve Lying Beneath the Price:** Reflects all the net benefit sellers enjoy, the producer surplus, from producing and selling the good.

Review: Tax Incidence

Figure 9.1 illustrates how a tax affects the equilibrium in three steps:
- Begin at the initial, no tax, equilibrium and move left until the vertical gap between the market demand and supply curves equals the tax, $.40 per gallon;
- The associated quantity is the new equilibrium quantity;
- The point on the demand curve is the new equilibrium price from the perspective of the consumers and the point on the supply curve represents the new equilibrium price from the perspective of the firms.

We can summarize the effect of a tax:
- The equilibrium quantity decreases;
- The price from the perspective of the consumers increases;
- The price from the perspective of the firms decreases.

**Question:** Since the price paid by consumers increase and the price received by firms decrease both consumers and firms are hurt. Can we quantify the amount by which they are hurt?
Tax Incidence: Consumer Surplus and Producer Surplus

How Are Consumers Affected by a Tax?

Since the price from the perspective of the consumers increases, consumers are hurt. But, by how much are they hurt? As shown in figures 9.3, 9.4, and 9.5 illustrate the change in consumer surplus allows us to measure this:

Before Tax

After Tax

Change

Consumers are hurt by an amount equal to the loss of consumer surplus.

How Are Firms Affected by a Tax?

Since the price from the perspective of the firms decreases, consumers are hurt. But, by how much are they hurt? As shown in figures 9.6, 9.7, and 9.8 illustrate the change in producer surplus allows us to measure this:

Before Tax

After Tax

Change

Firms are hurt by an amount equal to the loss of producer surplus.
**Government Surplus: How is the Government Affected by a Tax?**

The government is helped by the tax, since it collects more revenues. The increased tax revenues represent government surplus.

**Question:** How much revenue does the government collect from this tax?

**Answer:** Tax $\times Q^{**}$. The shaded green area in figure 6.19 reflects the tax revenue collected from the tax; that is, the shaded green area reflects how much the government is helped by the tax.

**How Is Society as a Whole Affected by a Tax**

Figures 9.10, 9.11, and 9.12 summarize the changes in consumer surplus, producer surplus, and tax revenue. The amount by which households and firms are hurt by the tax exceeds the amount by which the government is helped. The net harm done to society as a whole is called the excess burden or dead weight loss of the tax as illustrated in figure 9.13.

**Tax Incidence and Dead Weight Loss Intuition**

Why does a tax lead to dead weight loss? Focus on the units of the good between $Q^{**}$ and $Q^*$:

- The height of the demand curve is greater than and the height of the supply curve for these units. This means that the value consumers place on the units exceeds the costs firms incur from producing them.
- But as a consequence of the tax, these units are not produced. There is a loss to society as a whole.
Massachusetts Gasoline Tax Application

We will now apply this to the gasoline market in Massachusetts. Figure 9.14 illustrates the changes in consumer surplus, producer surplus, and government surplus (tax revenue):

![Gasoline Market in Massachusetts](image)

Changes in Consumer and Producer Surplus

Figure 9.15: Consumer surplus, producer surplus, and tax revenue

Next, we use a little arithmetic allows us to calculate the numbers in table 9.1:

<table>
<thead>
<tr>
<th>Change in Consumer Surplus</th>
<th>$-2,375 thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>$- (2.40 - 2.10) \times \left( \frac{7,500 + 8,000}{2} \right) = -2,375$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in Producer Surplus</th>
<th>$-775 thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>$- (2.10 - 2.00) \times \left( \frac{7,500 + 8,000}{2} \right) = -775$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in Government Surplus (Tax Revenue)</th>
<th>$3,000 thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.40 \times 7,500 = 3,000$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in Total Surplus</th>
<th>$-150 thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>$=$</td>
<td></td>
</tr>
</tbody>
</table>

Table 9.1: Gasoline tax dead weight loss calculations
To get a better sense for what these numbers mean we will now calculate the per capita annual changes in table 9.2. The population of Massachusetts is approximately 6.75 million, 6,750 thousand.

<table>
<thead>
<tr>
<th></th>
<th>Annual Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Consumer</td>
<td>(-\frac{2.375 \times 365}{6,750}) = (-$128.43)</td>
</tr>
<tr>
<td>Surplus</td>
<td></td>
</tr>
<tr>
<td>Change in Producer</td>
<td>(-\frac{775 \times 365}{6,750}) = (-$41.91)</td>
</tr>
<tr>
<td>Surplus</td>
<td></td>
</tr>
<tr>
<td>Change in Government</td>
<td>(\frac{3.000 \times 365}{6,750}) = $162.22</td>
</tr>
<tr>
<td>(Tax Revenue)</td>
<td></td>
</tr>
<tr>
<td>Change in Total</td>
<td>(-$8.11)</td>
</tr>
<tr>
<td>Surplus</td>
<td></td>
</tr>
</tbody>
</table>

Table 9.2: Per capita gasoline tax calculations

**Total Surplus and Efficiency**

**Total Surplus:** The total net benefits to society as a whole that the provision of a good provides.

To explain precisely what we mean by this we return tutor example and calculate the net benefit that the provision of each tutor provides to society as a whole; that is, we calculate society’s surplus, benefit less the costs to society as a whole of providing each tutor. Total surplus is simply the sum of these net benefits.

To do so recall that heights of the demand and supply curve reflect the benefits and costs of providing a specific unit:

- **Height of Market Demand Curve:** Reflects the benefit a buyer enjoys from consuming a specific unit of the good.
- **Height of Market Supply Curve:** The seller’s opportunity cost of providing a specific unit of the good.

<table>
<thead>
<tr>
<th>Student</th>
<th>Benefit Students Reap when Receiving Tutoring Services</th>
<th>Cost Tutors Incur when Providing Tutoring Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andy</td>
<td>$275</td>
<td>Kim</td>
</tr>
<tr>
<td>Kate</td>
<td>225</td>
<td>John</td>
</tr>
<tr>
<td>Dan</td>
<td>175</td>
<td>Adam</td>
</tr>
<tr>
<td>Liz</td>
<td>100</td>
<td>Lisa</td>
</tr>
<tr>
<td>Meg</td>
<td>75</td>
<td>Walt</td>
</tr>
<tr>
<td>Ned</td>
<td>25</td>
<td>Beth</td>
</tr>
</tbody>
</table>

Table 9.3
Table 9.4

Figure 9.16: Market demand and supply curves for tutors
We will now consider four scenarios:

**Scenario 1:** One tutor is provided.

**Question:** Which student values tutoring services the most?

**Answer:** Andy who receives $275 of benefits

Net benefit of the first tutor to society as a whole equals $250

Area of the vertical gap between the market demand and supply curves.

Figure 9.17

From the perspective of society as a whole, it makes sense for Beth to tutor Andy.

**Scenario 2:** A second tutor is provided.

**Question:** Which student values tutoring services the second most?

**Answer:** Kate who receives $225 of benefits

Net benefit of the second tutor to society as a whole equals $150

Area of the vertical gap between the market demand and supply curves.

Figure 9.18

From the perspective of society as a whole, it makes sense for Walt to tutor Kate.
Scenario 3: A third tutor is provided.

**Question:** Which student values tutoring services the third most?  
**Answer:** Dan who receives $175 of benefits

- Net benefit of the third tutor to society as a whole equals $50
- Area of the vertical gap between the market demand and supply curves.

From the perspective of society as a whole, it makes sense for Lisa to tutor Dan.

Scenario 4: A fourth tutor is provided.

**Question:** Which student values tutoring services the fourth most?  
**Answer:** Liz who receives $100 of benefits

- Net benefit of the fourth tutor to society as a whole equals negative $100
- Area of the vertical gap between the market demand and supply curves.

From the perspective of society as a whole, it doesn’t make sense for Adam to tutor Liz.

Table 9.5 summarizes our results by calculating the total surplus of providing tutors:

<table>
<thead>
<tr>
<th>Tutors</th>
<th>Total Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$250</td>
</tr>
<tr>
<td>2</td>
<td>$250 + 150 = $400</td>
</tr>
<tr>
<td>3</td>
<td>$250 + 150 + 50 = $450</td>
</tr>
<tr>
<td>4</td>
<td>$250 + 150 + 50 - 100 = $350</td>
</tr>
</tbody>
</table>

**Summary:**
- A tutor should be provided whenever the benefits exceed the costs; that is, whenever the demand curve lies above the supply curve.
- A tutor should not be provided whenever the costs exceed the benefits; that is, whenever the supply curve lies above the demand curve.

Three is the efficient number of tutors because three tutors maximizes total surplus.

**Generalization**

![Efficiency Guidelines Diagram](image)

Figure 9.19: Efficient quantity of output
Markets and Efficiency

**Efficiency:** Whenever total surplus, the total net benefit to society as a whole.

**Question:** Do markets always lead to efficiency?

To address this question compare figures 9.19 and 9.20. The equilibrium quantity in figure 9.20 is equivalent to the efficient quantity in figure 9.19. It would be a mistake to conclude that markets always lead to efficiency, however. In fact, we have already seen one example when a market fails to be efficient, when the government imposes a tax on a good. Figures 9.21 and 9.22 illustrate that the total surplus declines when a tax is imposed. The differences in the total surplus represents the dead weight loss.

There are other factors which also cause a market to fail. We will explore them in later lectures.