Lecture 9 -- The Effects of Taxes, Subsidies, and Price Controls on Welfare

I. Introduction

In this lecture, we will continue our application of the principles related to supply and demand to analyzing the welfare effects of taxation. As we noticed in the Lecture 9, when we are talking about welfare, we are asking about well-being. Essentially, we are asking whether or not society is better off or worse off when a tax is imposed. The will use the tools of consumer surplus and producer surplus and we will add government involvement.

Welfare = Consumer Surplus + Producer Surplus + Net Government

A. Consumer Surplus

B. Producer Surplus
C. Government

We saw that the with a tax, the government receives $t \cdot Q$ and with a subsidy the government pays $s\cdot Q$.

II. Analyzing the effects of a tax on welfare

A. Situation Before the Tax

Consumer Surplus – Area above price line and below demand curve
Producer Surplus – Area below price line and above supply curve
Government – Before tax government is not involved

B. Situation After the Tax

1. Price and Quantity

We know from Lecture 8 that the effect of the tax is to place a wedge between the amount that consumers pay and the amount that producers receive. The point at which quantity demanded and quantity supplied with the tax is:
We now have 6 areas (A through F). We can see that before the tax, consumer surplus was areas A, B, and C and producer surplus was areas D, E, and F.

2. Consumer Surplus

After the tax, consumers pay the higher $P_t^C$ and the consumer surplus is:

And we can see that consumer surplus goes down to the area A – consumers do not like a tax that results in their paying higher prices. Consumer surplus goes down for two reasons. First, those
that continue buying the good pay a higher price and get less extra satisfaction than in the situation prior to the tax. This is the reduction of the consumer surplus by the area B. Second, some people decide not to buy the good (or as much) following the price increase. This is the reduction in consumer surplus of the area C.

3. Producer Surplus

After the tax, producers receive the lower $P_t$ and producer surplus is:

Producer surplus goes down to the area F. – producers do not like a tax that results in their receiving a lower price. Producer surplus goes down for two reasons. First, those producers that continue to produce receive a lower price for their product. This is the reduction of producer surplus by the area D. Second, some producers can no longer stay in business when the price falls (or those that stay in business reduce the amount that they want to sell). This is the reduction in producer surplus of the area E.

4. Effect of Tax on the Government
The effect of the tax on the government is \( t^*Q^1 \). This is the areas B and D. Since the government takes in the revenue, this is a net gain for the government.

5. The Welfare Change following the Tax -- Change in Consumer Surplus, Producer Surplus, and Net Government

So far, we have seen that both producers and consumers are worse off following the tax and the government is better off. We can summarize this as:

<table>
<thead>
<tr>
<th></th>
<th>Before Tax</th>
<th>After Tax</th>
<th>Net Gain or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area of Consumer Surplus</strong></td>
<td>A, B, and C</td>
<td>A</td>
<td>Lose B and C</td>
</tr>
<tr>
<td><strong>Area of Producer Surplus</strong></td>
<td>D, E, and F</td>
<td>F</td>
<td>Lose D and E</td>
</tr>
<tr>
<td><strong>Government</strong></td>
<td>--</td>
<td>B and D</td>
<td>Gain B and D</td>
</tr>
<tr>
<td><strong>Total (Sum of Columns)</strong></td>
<td>A, B, C, D, E, and F</td>
<td>A, B, D, F</td>
<td>Lose C and E</td>
</tr>
</tbody>
</table>

We have shown that society is worse off with the tax. The government gains the amount of the tax revenue, but consumers and producers lose more than the government gains.

The intuition for this net loss is fairly simple. The tax results in a higher price to consumers that reduces the amount that is demanded. The tax results in a lower price to producers that reduces
the amount that is supplied. The amount of economic activity is reduced because of the tax. While the tax redistributes some money (areas B and D) from consumers and producers to the government, because the amount of economic activity is reduced society as a whole loses (areas C and E).

6. Deadweight Loss

The loss of the triangles C and E is called the deadweight loss of the tax. The area C is lost because the quantity demanded is reduced as consumers move up the demand curve. The area E is lost because the quantity supplied falls as the producers move down the supply curve.

Whether or not a tax is a good idea or not depends in large part on how big the deadweight loss is. This depends on the elasticities of the demand curve and the supply curve. Some general ideas:

When demand or supply is relatively inelastic, the deadweight loss is smaller. When the supply or demand is relatively elastic, the deadweight loss is larger.

III. Tax Revenue and the Size of the Tax

Now let’s analyze what happens as the size of the tax varies.
A. Small Tax

Distortion (change from equilibrium price and quantity) is small, deadweight loss is relatively small, and tax revenue is relatively small.

B. In-between Tax
Distortion (change from equilibrium price and quantity) is larger, deadweight loss is larger, and tax revenue is also larger.

C. Large Tax

Distortion (change from equilibrium price and quantity) is extreme, deadweight loss is even higher, and tax revenue is smaller.

D. Laffer Curve
This relationship between the size of the tax, the distortion of the tax, and the revenues of the tax has led some politicians to be concerned about whether taxes are too high. We can graph the relationship between tax revenues and the size of the tax as:

This relationship has been called the Laffer Curve, after an economist named Arthur Laffer. The implication of the curve is if we are at a tax rate past the tax that gives the maximum revenue, raising taxes will have the effect of lower tax revenues and (as always when taxes are increased) increasing the extent of distortion and increasing deadweight loss. If the level of taxation where beyond this point, it would be recommended to lower, not increase, taxes.

IV. Analyzing the effects of a subsidy on welfare
A. Situation Before the Subsidy

Consumer Surplus – Area above price line and below demand curve  
Producer Surplus – Area below price line and above supply curve  
Government – Before subsidy government is not involved

B. Situation After the Subsidy

1. Price and Quantity

We know from Lecture 7 that the effect of the subsidy is to place a wedge between the amount that consumers pay and the amount that producers receive. The point at which quantity demanded and quantity supplied with the subsidy is:
We now have 8 areas (A through H). We can see that before the subsidy, consumer surplus was areas A and B, and producer surplus was areas D and H.

2. Consumer Surplus

After the subsidy, consumers pay the lower $P^c$ and the consumer surplus is:

And we can see that consumer surplus goes up to areas A, B, D, E, and F – consumers like a subsidy that results in their paying lower prices.
3. Producer Surplus

After the subsidy, producers receive the hither $P^p$ and producer surplus is:

Producer surplus goes up to the areas B, C, D, and H. – producers also like a subsidy that results in their receiving a higher price.

4. Effect of the Subsidy on the Government

The effect of the subsidy on the government is a loss of $s \times Q^s$. This is the areas B, C, D, E, F, and G.
5. The Welfare Change following the Subsidy -- Change in Consumer Surplus, Producer Surplus, and Net Government

We can summarize this as:

<table>
<thead>
<tr>
<th></th>
<th>Before Subsidy</th>
<th>After Subsidy</th>
<th>Net Gain or Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area of Consumer Surplus</strong></td>
<td>A and B</td>
<td>A, B, D, E, F</td>
<td>Gain D, E, and F</td>
</tr>
<tr>
<td><strong>Area of Producer Surplus</strong></td>
<td>D and H</td>
<td>B, C, D, and H</td>
<td>Gain B and C</td>
</tr>
<tr>
<td><strong>Government</strong></td>
<td>--</td>
<td>Lose B, C, D, E, F, G,</td>
<td>Lose B, C, D, E, F, and G</td>
</tr>
<tr>
<td><strong>Total (Sum of Columns)</strong></td>
<td>A, B, D, and H</td>
<td>A, B, C, D, E, F, and H</td>
<td>Lose G</td>
</tr>
</tbody>
</table>

We have shown that society is worse off with the subsidy. The consumers and producers gain, but the government loses more than the combined gain to consumers and producers.

V. Analyzing the effects of a price floor on welfare
A. Situation Before the Price Floor

Consumer Surplus – Area above price line and below demand curve
Producer Surplus – Area below price line and above supply curve
Government – Before price floor government is not involved

B. Situation After the Price Floor

1. Price and Quantity

With the price floor:
We now have 5 areas (A through E). We can see that before the price control, consumer surplus is areas A, B, and C and producer surplus is areas D and E.

2. Consumer Surplus

After the price floor, consumers pay the higher $P_{\text{floor}}$ and the consumer surplus is:

And we can see that consumer surplus goes down to the area A – consumers do not like a price control that results in their paying higher prices.
3. Producer Surplus

After the floor, producers receive the lower $p_{\text{floor}}$ and producer surplus is:

Producer surplus goes up to areas B and D. There are two offsetting effects here. The producers that are able to sell after the price control really like the price control. They can charge a higher price even though their costs of production do not change. These producers gain area B. Another set of producers were selling at $Q^*$, but get shut out of the market because of the price control. These producers lose the area E. If area B is greater than area E (when demand is more inelastic), then the net gain to producers is positive. If the area B is smaller than the area E (when demand is more elastic), then the net gain to producers is negative.

4. Effect of Price Control on the Government

Ignoring the costs of enforcing the price control, the government neither collects nor receives money.

5. The Welfare Change following the Price Control -- Change in Consumer Surplus, Producer Surplus, and Net Government
<table>
<thead>
<tr>
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<tr>
<td><strong>Area of Consumer Surplus</strong></td>
<td>A, B, and C</td>
<td>A</td>
<td>Lose B and C</td>
</tr>
<tr>
<td><strong>Area of Producer Surplus</strong></td>
<td>D and E</td>
<td>D and B</td>
<td>Gain B, Lose E</td>
</tr>
<tr>
<td><strong>Government</strong></td>
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<td>--</td>
</tr>
<tr>
<td><strong>Total (Sum of Columns)</strong></td>
<td>A, B, C, D, and E</td>
<td>A, B, and D</td>
<td>Lose C and E</td>
</tr>
</tbody>
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We have shown that society is worse off with the price control.