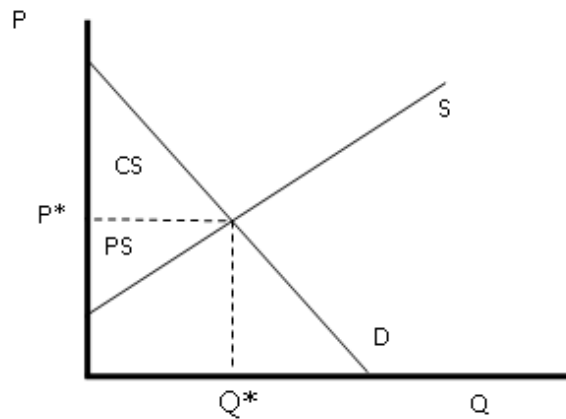


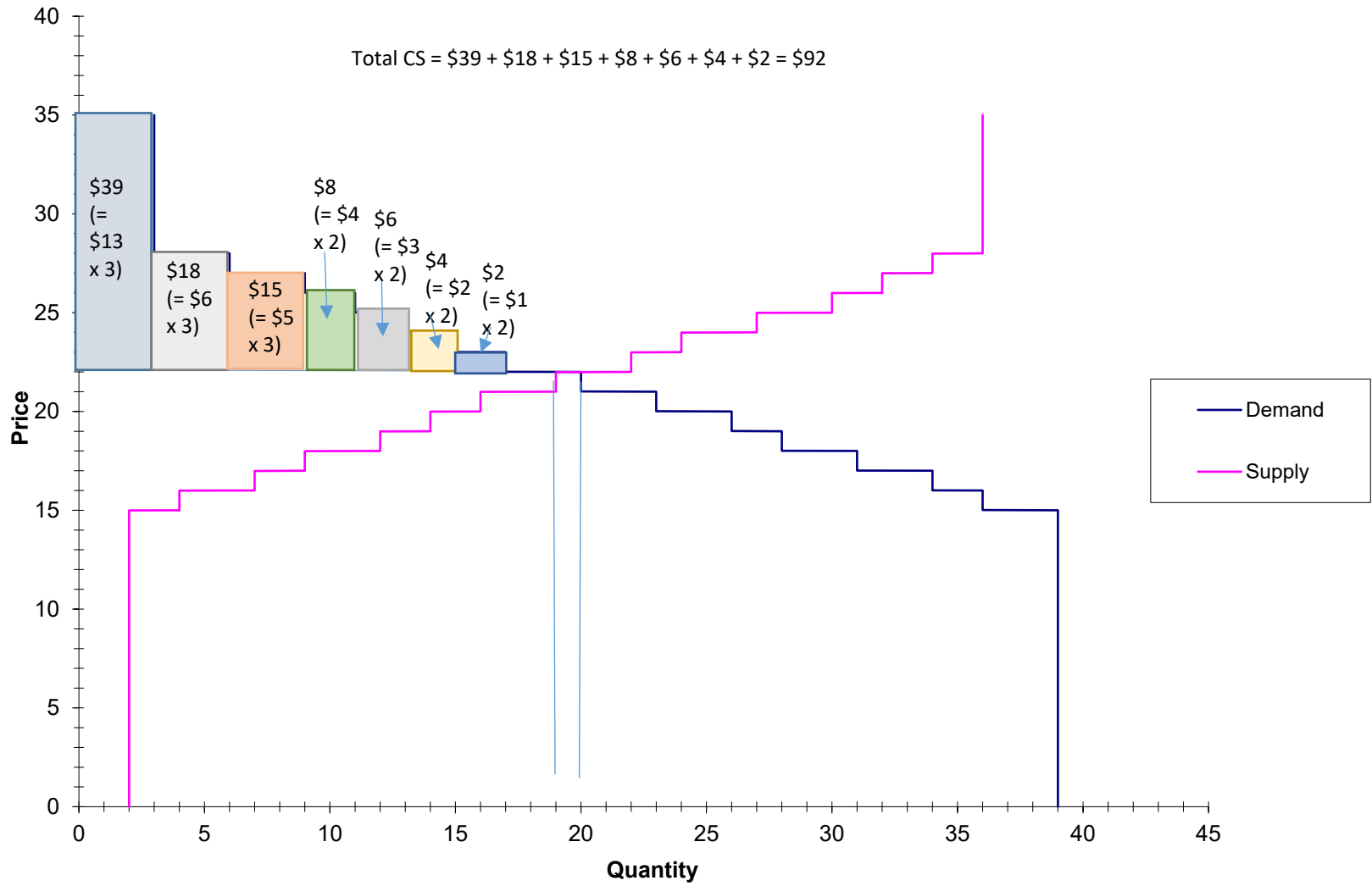
Lecture # 4 – Measuring Welfare

I. Consumer Surplus

- Consumer surplus is the difference between what a consumer is willing to pay for a good and what the consumer actually pays when buying it.
 - Graphically, it is the area under the demand curve and above the market price.
 - Consider the example on the following page, in which each person's willingness to pay is represented in whole dollar amounts.
 - Once we allow willingness to pay to have any value, the consumer surplus is simply calculated by finding the area of the triangle between demand and the market price:



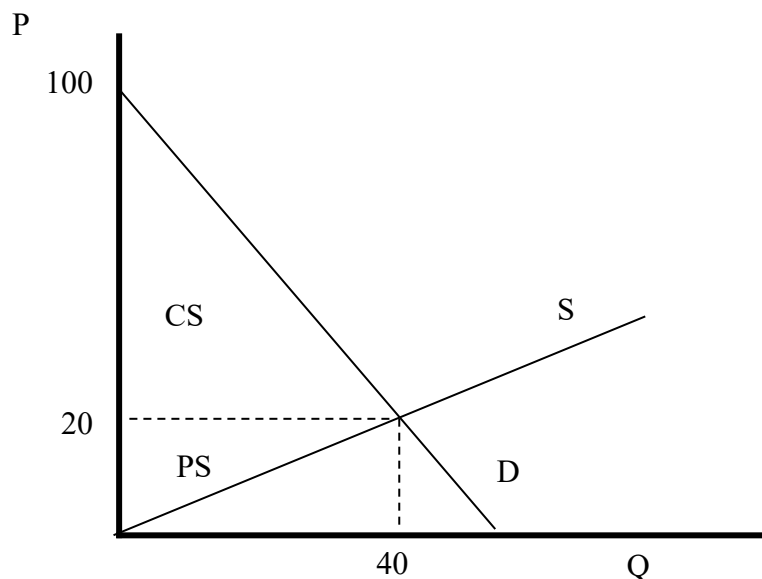
Consumer Surplus example with whole dollar values



II. Producer Surplus

- Producer surplus is the sum over all output of the difference between the market price of the good and the marginal cost of the good.
 - Graphically, it is the area above the supply curve and below the market price.
 - From the experiment on Wednesday, it is the sum of all the net profits producers earned gained in a single round.
 - It can be calculated by finding the area of the triangle described above.
- We continued the numerical example from last class to calculate consumer and producer surplus when given equations.
 - Once you have the price and quantity, you have the endpoints you will need to calculate the consumer and producer surplus.

Consumer surplus is the triangle below the demand curve and above the price (labeled CS below). Producer surplus is the triangle above the supply curve and below the price (labeled PS below).

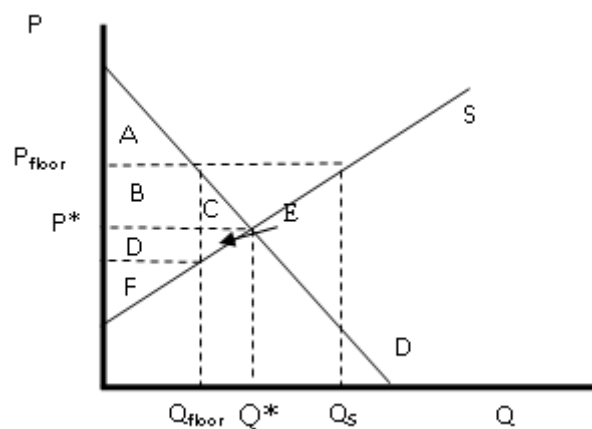


The area of a triangle is $0.5 \times \text{base} \times \text{height}$. For consumer surplus, the height of the triangle is 80 ($= 100 - 20$), and the base is 40. Thus, the consumer surplus is $0.5(40)(80) = \mathbf{\$1600}$.

For producer surplus, the height of the triangle is 20 and the base is 40. Thus, the producer surplus is $0.5(40)(20) = \mathbf{\$400}$.

III. Deadweight Loss

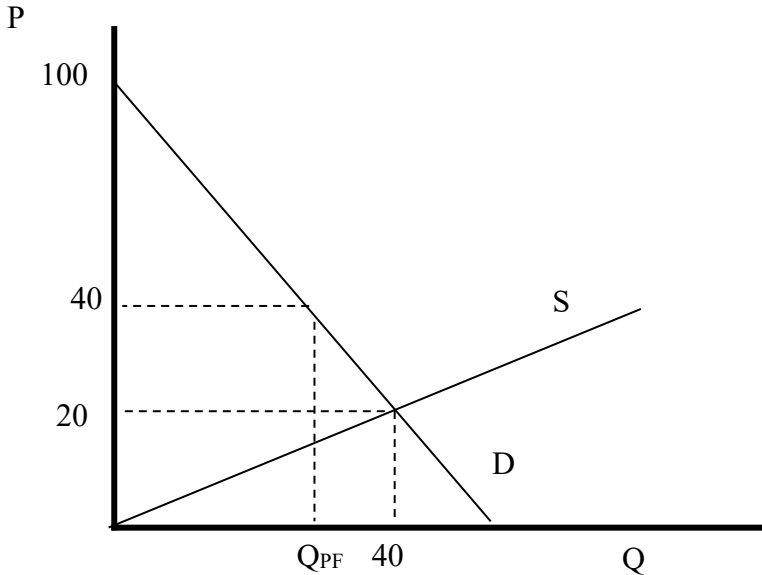
- Deadweight loss -- A measure of lost welfare. It is the potential consumer or producer surplus that is not captured because potentially beneficial trades do not occur.
 - Deadweight loss is the value of lost opportunities.
 - Since deadweight loss comes from beneficial transactions that no longer take place, it is greater when there is elastic supply and demand.
- As an example of deadweight loss, we discussed price controls.
 - We first looked at a case where the government sets a *price floor* -- a minimum price for the good
 - Examples include price supports for agriculture and minimum wages
 - For agriculture, the government often buys the excess supply to keep the price artificially high.
 - The figure below shows the changes in welfare resulting from a price floor.



- Before the price floor:
 - Consumer surplus is areas A, B, & C
 - Producer surplus is areas D, E, & F
- After the price floor:
 - Consumer surplus is area A
 - Producer surplus is areas B, D, & F
 - Deadweight loss is areas C & E

We continued with a numerical example of a price floor.

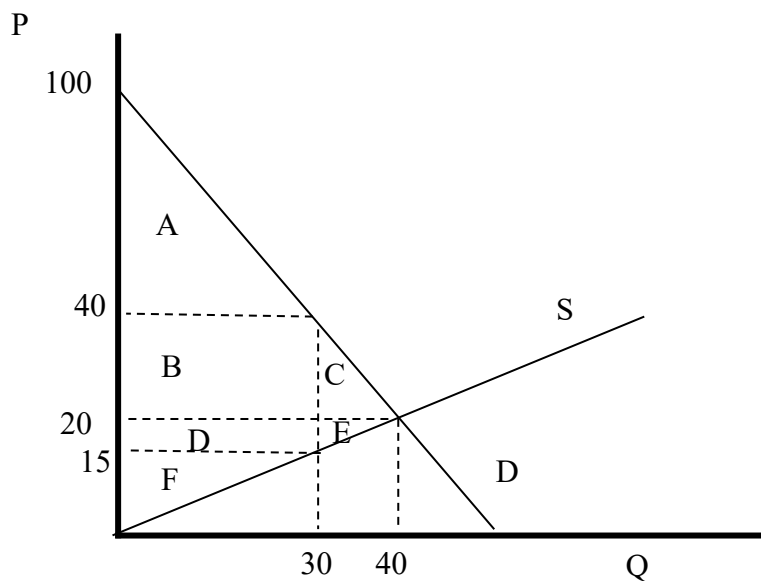
In our policy example, the price floor was \$40. Begin by adding the price floor to our graph:



Since the price floor is above the equilibrium price, there will be an excess supply – more producers will want to sell goods at \$40 than consumers will demand. Thus, the new quantity demanded will thus be limited by the demand of consumers at \$40 per hour, as shown on the graph above. Thus, to find the quantity, we simply substitute \$40 for P in the demand equation, and solve for Q :

$$\begin{aligned} 40 &= 100 - 2Q \\ 2Q &= 60 \\ Q &= 60/2 \\ \mathbf{Q} &= \mathbf{30} \end{aligned}$$

With this information, we can now observe how consumer and producer surplus changes after the price floor. The graph appears below.



Consumer Surplus

Before the price floor, consumer surplus was everything above the original \$20 price and below the demand curve. This is areas **A, B and C** above. As calculated before, this equals **\$1600**.

After the price floor, consumer surplus is everything below demand and above the price of \$40. This is area **A**. This is a triangle with a height of 60 (= 100 - 40) and a base of 30. Its area = $0.5(30)(60) = \mathbf{\$900}$.

Producer Surplus

Before the price floor, producer surplus was everything below the original \$20 price and above the supply curve. This is areas **D, E and F** above. As calculated before, this equals **\$400**.

After the price floor, the producer surplus includes the rectangle **B and D**, as well as the triangle **F**. To find the area of the rectangle, we need to know the value of the bottom line. This is the price at which suppliers would make 30 units of the good available. Plugging 30 into supply gives us $0.5(30) = 15$. Thus, this rectangle has a height of 25 (= 40-15) and a width of 30. Its area = $(25)(30) = \$750$. The triangle F has a height of 15 and a base of 30. Its area = $0.5(30)(15) = \$225$. The total producer surplus is the sum of these two areas, $\$750 + \225 , which equals **\$975**.

Deadweight loss

Note that we still have some surplus unaccounted for. The sum of consumer and producer surplus before the policy is \$2000. After the price floor, the sum of consumer and producer surplus is \$1875. Thus, \$125 of welfare has disappeared. This lost surplus is the deadweight loss.

Graphically, deadweight loss is equal to areas C and E. This is a triangle with a height of 25 (= 40-15) and a base of 10 (= 40 - 30). Its area = $0.5(25)(10) = \mathbf{\$125}$.

Summary Table

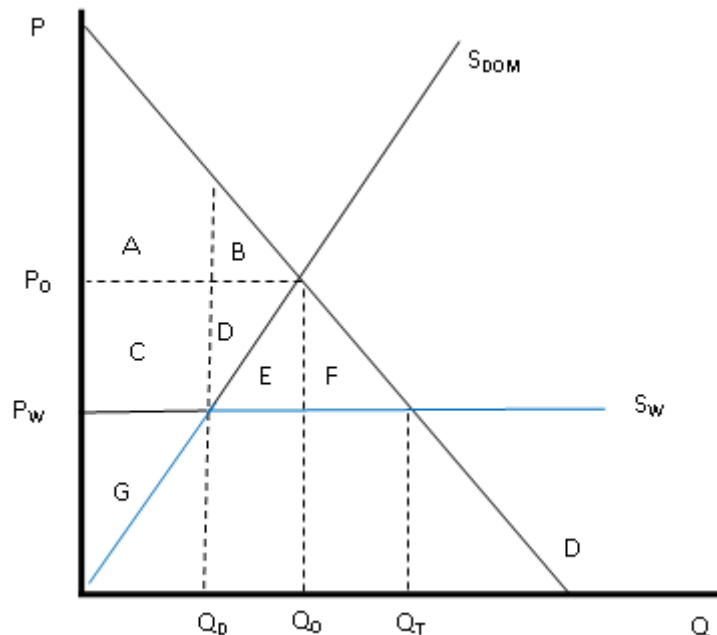
The table below summarizes the results. Note that producers are better off, since they are getting a higher price. But their welfare gain of \$575 is more than offset by the \$700 loss to consumers. Thus, overall welfare has fallen by \$125.

	Before	After	Change
Consumer Surplus	ABC \$1600	A \$900	-\$700
Producer Surplus	DEF \$400	BDF \$975	+\$575
Deadweight Loss		CE \$125	

- The example of a price ceiling – a maximum price for a good – is left as a practice problem for you to try.

IV. Trade Policy

- Next, we considered how trade policy affects welfare.
 - Our example applies to a small country. Because it is small, the country is a *price taker*. That is, its actions do not influence the world price of the product being considered.
 - Thus, we can apply our competitive model.
 - If the country were large enough to affect prices throughout the world, the perfectly competitive model would not apply.
 - There are two supply curves to consider.
 - S_{DOM} is domestic supply. This is what can be produced within the country.
 - S_W is the world supply. Because the country is small, it can purchase as much as it wants at the price prevailing in world markets.
 - Thus, this supply curve is horizontal.



- Without trade, only the domestic supply matters. The equilibrium is at P_0 and Q_0 .
- With trade, the blue lines represent supply.
 - The price that prevails in the market is the world price, P_W .
 - Total quantity demanded at this price is Q_T .
 - Domestic producers make as much as they can for that price. This is the blue portion of S_{DOM} .
 - Q_D is the quantity produced at home.
 - Foreign producers then provide the remaining goods.
 - Thus, imports = $Q_T - Q_D$.

- Finally, consider the change in welfare:
 - No trade:
 - Consumer surplus is areas A & B.
 - Producer surplus is areas C, D, & G.
 - With trade:
 - Consumer surplus is areas A, B, C, D, E, & F.
 - Consumers are better off. They buy more, and at a lower price.
 - Producer surplus is area G.
 - This is for domestic producers only.
 - They are worse off because they face more competition, and thus sell fewer goods at a lower price.
 - The gains from trade are areas E & F. These areas are only captured with free trade.
- Next, we considered the effect of a tariff.
 - A per unit tariff raises the world price in the country imposing the tariff.
 - The new supply is $S_W + \text{tariff}$.
 - The new price with trade is thus $P_W + t$.
 - The total quantity demanded at this higher price is Q'_T .
 - Local producers can supply more at the higher price.
 - Thus, Q'_D is now produced locally.
 - Imports fall to $Q'_T - Q'_D$.
 - Finally, consider the change in welfare.
 - With free trade:
 - Consumer surplus is areas A, B, C, D, E, & F.
 - Producer surplus is area G.
 - With the tariff:
 - Consumer surplus is areas A & B.
 - Producer surplus is areas C & G.
 - Revenue is area E.
 - For each unit imported, the government collects the tariff. The tariff times the number of imports is revenue to the government.
 - The rectangle E represents this area.
 - Areas D and F disappear. These are the deadweight loss.
 - F represents lost opportunities because fewer units are purchased.
 - D is lost because some goods are produced at a higher cost by local producers, rather than by foreign producers.
 - Consider, for example, the part time farmers in the *Economist* article on rice tariffs in Japan who would be forced out

of the market if Japan removed tariffs on rice.

- Consumers must now pay the higher cost of local production.

