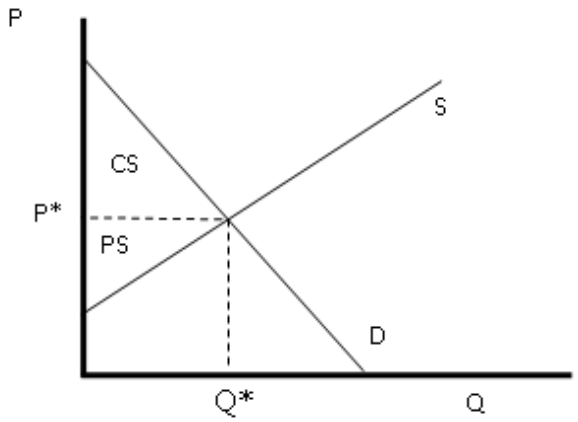
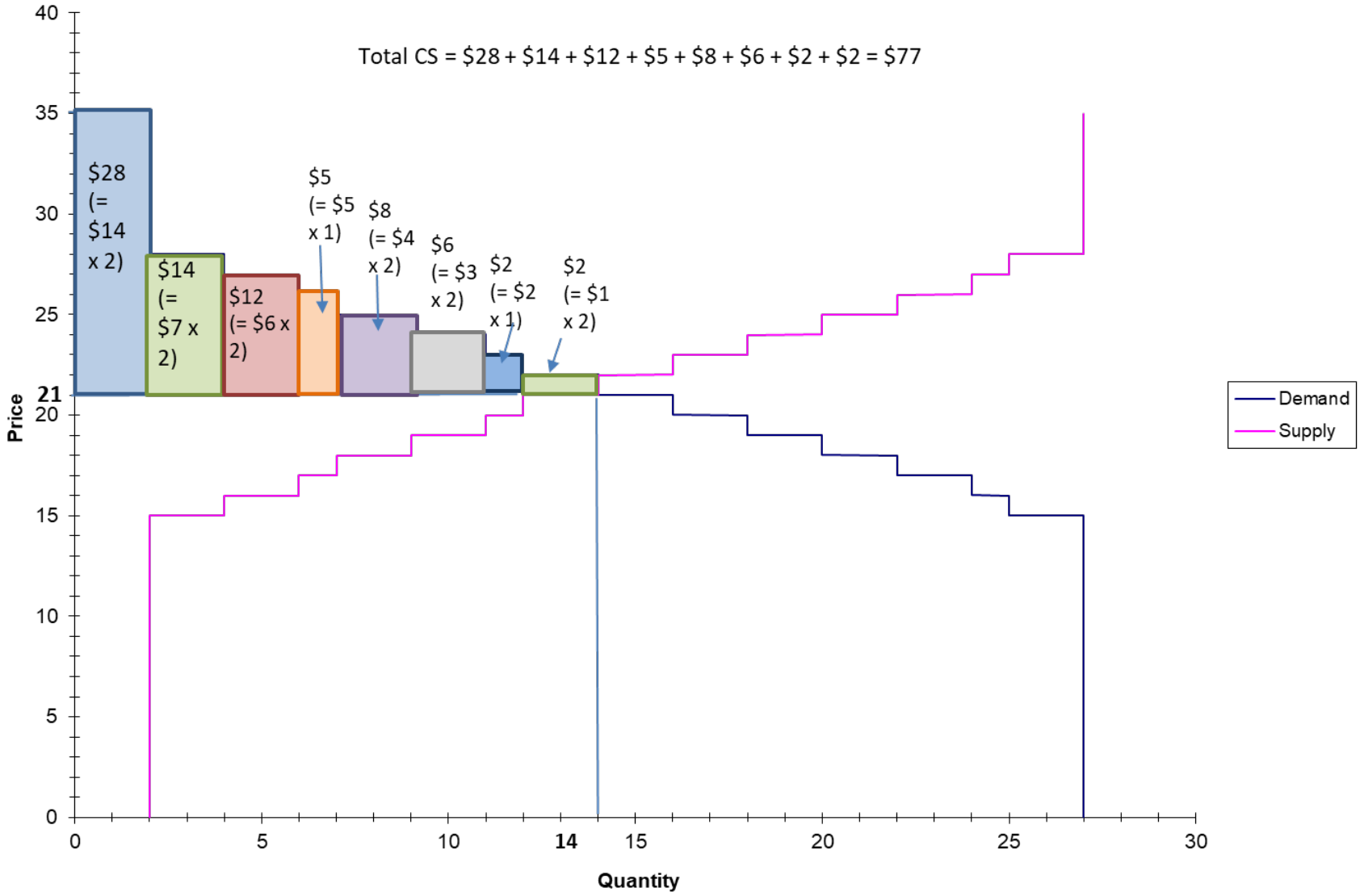
Lecture # 4 – More on Supply and Demand

I. Consumer Surplus

- Consumer surplus is the difference between what consumers are willing to pay for a good and what consumers actually pay when buying it.
    - Graphically, it is the area under the demand curve and above the market price.
    - From the experiment last Wednesday, it is the sum of all the net benefits consumers gained in a single round, as shown in the example on the following page.
        - In this example, the equilibrium quantity was 14 and the average price was $21. Using these numbers, we get a total consumer surplus of $77.
    - It can be calculated by finding the area of the triangle described above.



Consumer Surplus example from experiment



II. Producer Surplus

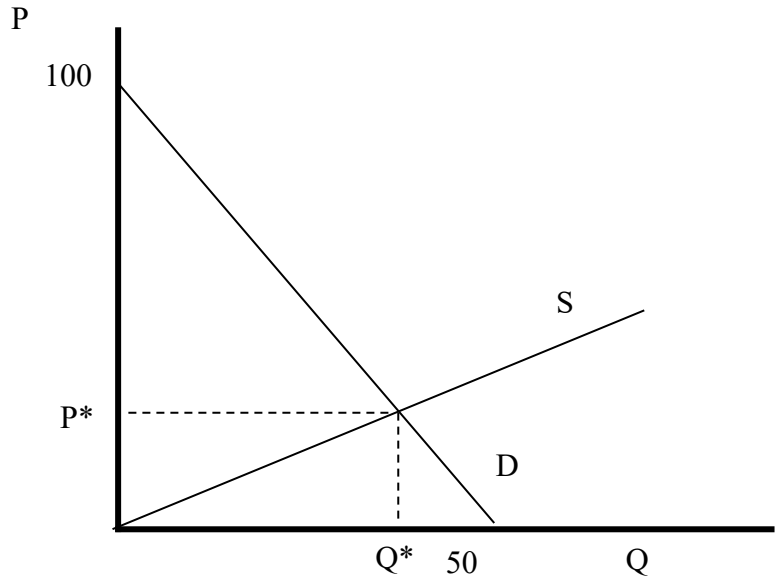
- Producer surplus is the sum of the difference between the market price of the good and the marginal cost of the good for all suppliers.
    - Graphically, it is the area above the supply curve and below the market price.
    - From the experiment on Wednesday, it is the sum of all the net profits producers earned gained in a single round.
    - It can be calculated by finding the area of the triangle described above.
- We then discussed an example of how to solve for equilibrium and calculate consumer and producer surplus when given equations.
    - Begin by using the equations to graph the supply and demand.
    - To find the initial equilibrium, set supply equal to demand to find the equilibrium quantity.
    - Then, plug this quantity into either the supply *or* demand curve to find the equilibrium price.
    - Once you have the price and quantity, you have the endpoints you will need to calculate the consumer and producer surplus.

The detailed calculations are as follows. This example reviews how to solve for equilibrium and calculate consumer and producer surplus.

Demand: $P = 100 - 2Q$
Supply: $P = 0.5Q$

The equilibrium occurs where supply equals demand. Begin with the graph:

From the demand equation, we know that the *y*-intercept (on the price axis) for demand is \$100. To see this, note that when Q is 0, the price would be \$100. Similarly, in this example, the supply curve starts at the origin, as the *y*-intercept of the supply equation is 0. Note that this won't always be the case, but is here since there is nothing added to $0.5Q$ in the supply equation.



To find the equilibrium price and quantity, we set supply and demand equal to each other and solve. Begin by solving for Q:

$$100 - 2Q = 0.5Q$$
$$100 = 2.5Q$$
$$Q = 100/2.5$$
$$\mathbf{Q = 40}$$

To find the price, we substitute the equilibrium quantity into either the demand or supply equation:

Either:

$$P = 100 - 2(40) = \mathbf{\$20}$$

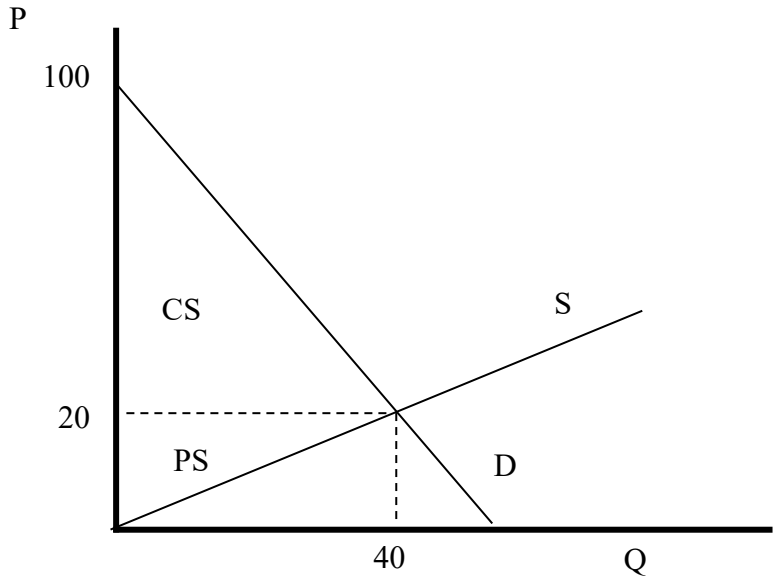
Or:

$$P = 0.5(40) = \mathbf{\$20}$$

Making sure you get the same answer using either equation is a good way to check your work.

Now that we know the equilibrium quantity and price, we have the information we need to calculate 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).

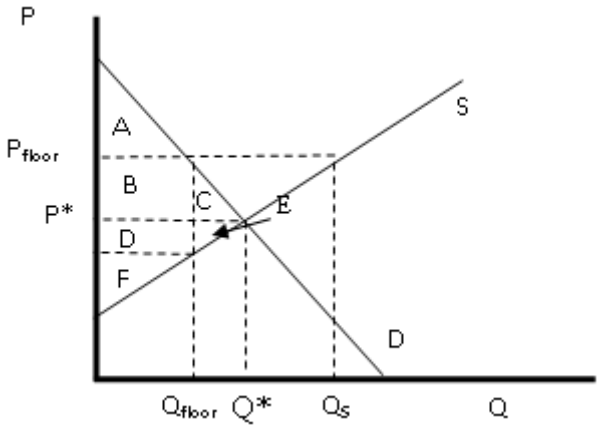


The area of a triangle is 0.5 x base x height. For consumer surplus, the height of the triangle is 80 (= 100- 20), and the base is 40. Thus, the consumer surplus is 0.5(40)(80) = **$1600**.

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

III. Deadweight Loss

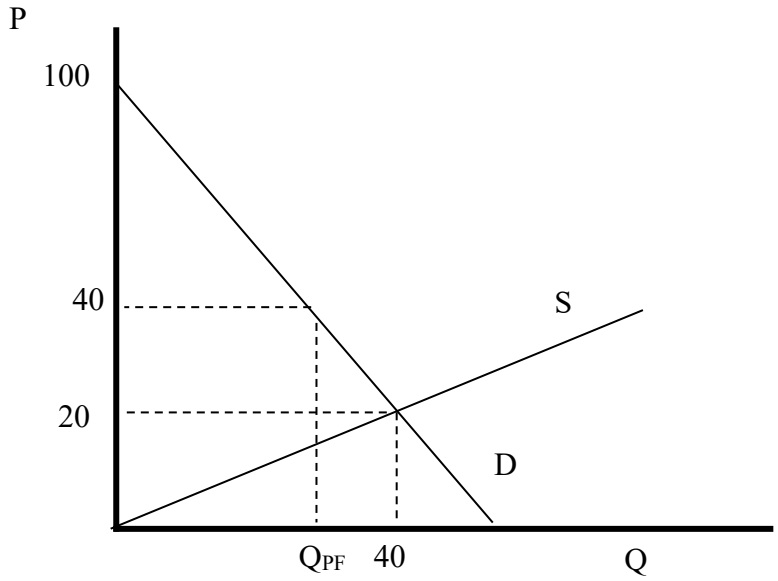
- Deadweight loss -- A measure of lost welfare. It is the potential consumer or producer surplus that is not captured because potentially beneficial trades do not occur.
    - Deadweight loss is the value of lost opportunities.
    - Since deadweight loss comes from beneficial transactions that no longer take place, it is greater when there is elastic supply and demand.
- As an example of deadweight loss, consider price controls.
    - We first look 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 continue with a numerical example of a price floor.

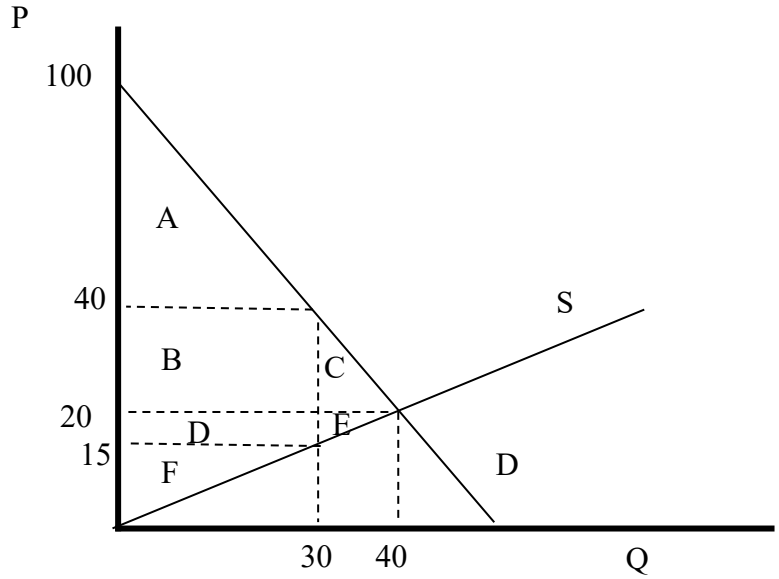
In our policy example, the price floor is $40. Begin by adding the price floor to our graph:



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*:

$$40 = 100 - 2Q$$
$$2Q = 60$$
$$Q = 60/2$$
$$\mathbf{Q = 30}$$

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) = **$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) = **$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	