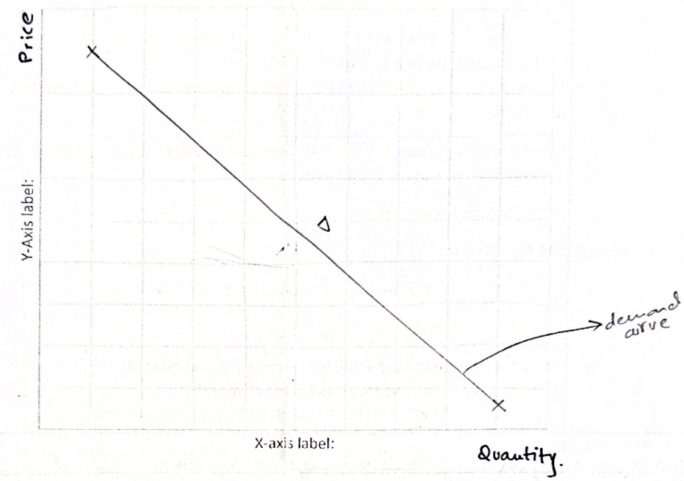
Breeha Darim.

Worksheet for Module IV. Class 19. Introduction to Climate Economics

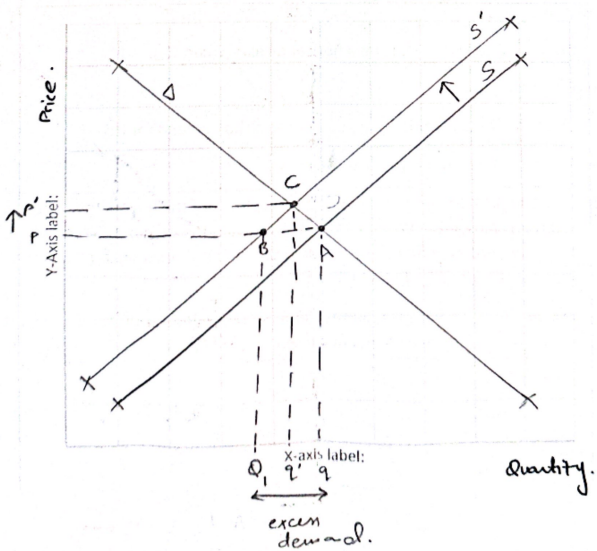
Part A: Learn how to create and interpret supply and demand graphs under normal market conditions.



1. **Draw the Axes:**
   - Draw a vertical axis (Price) and a horizontal axis (Quantity).
2. **Plot the Demand Curve:**
   - Think about how the price of a good impacts the demand for it.
   - Mark two points on the graph above:
     i. For the first point on the Demand Curve, think of the buyers for a good, for example, potato chips. If the price of chips is low, would the demand for chips be high or low?
     ii. For the second point on the Demand Curve, if the price of chips was high, what would the quantity demand be?
   - These points represent the quantity demanded at different prices. Connect the points to form a downward-sloping demand curve.
   - Label the demand curve as *D*.

3. **Plot the Supply Curve:**
    - Now think about the incentives of potato chips sellers.
    - Mark two points on the graph above:
        i. For the first point on the Supply Curve, if the price is high, would sellers prefer to sell a high quantity or a low quantity of chips?
        ii. For the second point on the Supply Curve, if the price is low, how would this impact the quantity supplied of chips?
    - These points represent the quantity supplied at different prices. Connect the points to form an upward-sloping supply curve.
    - Label the supply curve as *S*.
4. **Identify the Equilibrium:**
    - Find the point where the supply and demand curves intersect.
    - Label this point as *A*.
    - This point represents the equilibrium price (*p*) and quantity (*q*) where the market clears (suppliers sell exactly as much as buyers demand)

Part B: Learn how to create and interpret supply and demand graphs during a supply shortage.



1. Replicate the normal demand and supply curves you drew in **Part A**.
2. **Shift the Supply Curve:**
   - Draw a new supply curve S' to the left of the original supply curve S.
   - This represents a decrease in supply.
3. **Identify the New Quantity Supplied:**
   - Starting on the Y-axis at the original price p, find the new quantity supplied on the S' curve.
   - Label this point as B.
   - Label this quantity as Q_1.
4. **Identify the Excess Demand:**
   - At price p, the quantity demanded q exceeds the quantity supplied Q_1.
   - On the x-axis, mark the gap between q and Q_1 to represent excess demand.
5. **Adjust the Price:**
   - Show the upward pressure on prices due to excess demand.
   - On the Y-axis, mark a new price level p' where the new supply curve S' intersects the demand curve D.
6. **Find the New Equilibrium:**
   - Label the new equilibrium point as C.
   - This point represents the new equilibrium price and quantity after the supply shortage.

Questions:

1. What happens to the equilibrium price and quantity when there is a shortage in supply?
2. How does the market adjust to eliminate the shortage?
3. Explain the concept of a negative feedback loop in the context of supply and demand.

Answers:
1. The equilibrium price increases and the quantity decreases.
2. Market increases the price
3. Decrease in supply increases demand.

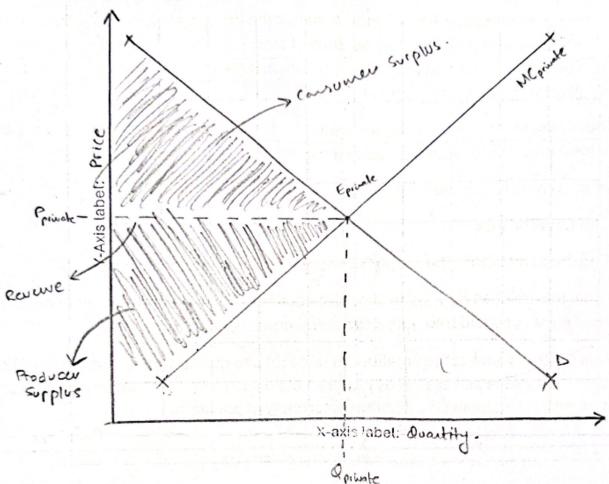
* deadweight loss arises whenever marginal social costs are equal to marginal social benefits
* no production without pollution.

Breeha Qasim.

Worksheet for Module IV. Class 21. Government Failure [Monday, March 17th]

Part A: Learn how to create and interpret supply and demand graphs under normal market conditions.

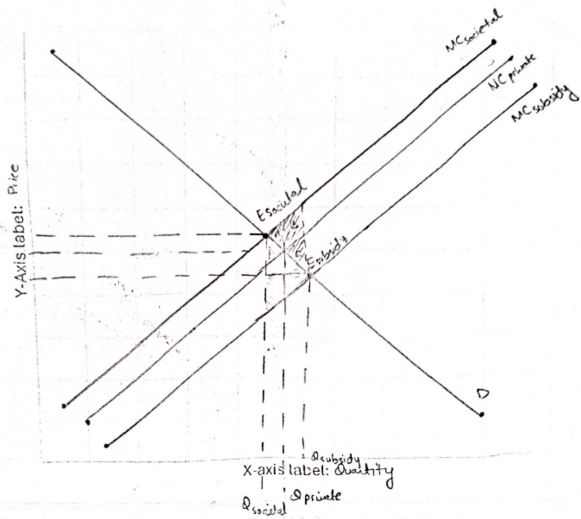
* In Pakistan Sugar and Fertilizers are biggest subsidy



1. **Draw the Axes:**
   - Draw a vertical axis (Price) and a horizontal axis (Quantity).
2. **Plot the Demand Curve:**
   - Think about how the price of steel impacts the demand for it.
   - Mark two points on the graph above:
     i. For the first point on the Demand Curve, think of the buyers for a good, for example, steel. If the price of steel is low, would the demand be high or low?
     ii. For the second point on the Demand Curve, if the price of steel was high, what would the quantity demand be?
   - These points represent the quantity demanded at different prices. Connect the points to form a downward-sloping demand curve.
   - Label the demand curve as *D*.

3. **Plot the Supply (Marginal Cost) Curve:**
    - Now think about the incentives of steel sellers.
    - Mark two points on the graph above:
        i. For the first point on the Supply Curve, if the price is high, would sellers prefer to sell a high quantity or a low quantity of steel?
        ii. For the second point on the Supply Curve, if the price is low, how would this impact the quantity supplied of steel?
    - These points represent the quantity supplied at different prices. Connect the points to form an upward-sloping supply curve.
    - Label this supply curve as $MC_{private}$.
4. **Identify the Equilibrium:**
    - Find the point where the supply and demand curves intersect.
    - Label this point as $E_{private}$ to show the equilibrium when only the private cost to the steel firms is considered. Label the corresponding quantity as $Q_{private}$.
    - This point represents the equilibrium price (p) and quantity (q) where the market clears (suppliers sell exactly as much as buyers demand) without any subsidy and also without including the negative externality of pollution.

Part B: Learn how to create and interpret supply and demand graphs when we consider (i) the total societal cost and (ii) governmental subsidy.



1. Replicate the normal demand and supply curves you drew in **Part A.**
2. **Shift the Supply Curve:**
    - Draw a new supply curve $MC_{societal}$ to the left of the original supply curve $MC_{private}$.
    - This represents a decrease in supply because the cost to society of pollution is higher when the negative externality is incorporated into the total cost.
3. **Identify the New Quantity Supplied:**
    - Find the new quantity supplied on the $MC_{societal}$ curve where it intersects with the demand curve.
    - Label this point as $E_{societal}$. Label the corresponding quantity as $Q_{societal}$.
4. **Identify the Deadweight Loss due to externality:**
    - Identify the area between the societal and private cost curves that is between the quantities $Q_{societal}$ and $Q_{private}$.
    - Label this triangle A, which represents the deadweight loss when the externality (pollution) is not accounted for in the total cost of steel production.
5. **Shift the Supply Curve again:**

- Draw a new supply curve $MC_{subsidy}$ to the right of the supply curve $MC_{private}$.
- This represents an increase in supply because the special interests lobby were able to secure a subsidy to produce steel.

6. **Identify the New Quantity Supplied:**
   - Find the new quantity supplied on the $MC_{subsidy}$ curve where it intersects with the demand curve.
   - Label this point as $E_{subsidy}$. Label the corresponding quantity as $Q_{subsidy}$.
7. **Identify the Deadweight Loss due to externality:**
   - Identify the area between the societal and private cost curves that is between the quantities $Q_{private}$ and $Q_{subsidy}$.
   - Label this triangle C, which represents the deadweight loss when there is a subsidy to pollute as compared to the private cost of steel production.
   - Identify the area between the societal and private cost curves that is between the quantities $Q_{societal}$ and $Q_{subsidy}$.
   - Label this quadrilateral area B, which represents the additional deadweight loss when there is a subsidy to pollute as compared to the total cost to society.
8. **Total Deadweight Loss**
   - The total deadweight loss to society is the area represented by A+B+C.

Brecha Qasim

Worksheet for Module IV. Class 22. Government Failure

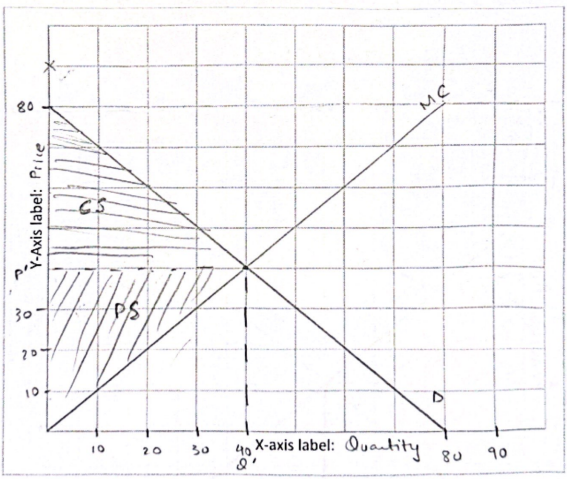
Qs. Suppose the market demand function (expressed in dollars) for a normal product is $P = 80 - q$, and the marginal cost (in dollars) of producing it is $MC = 1q$, where P is the price of the product and q is the quantity demanded and/or supplied.

a) How much would be supplied by a competitive market?

~~40 × 40 = 1600~~

$1q = 80 - q$

$q = 40$ units



$P = 80 - q$

$(x, 0)$

$(0, y)$

$P = 80 - 0$

$P = 80$

$(0, 80)$

$0 = 80 - q$

$q = 80$

$(80, 0)$

$80 - q = 1q$

$80 = 2q$

$q = 40$

b) Compute consumer and producer surplus.

For CS

$\frac{1}{2} \times (80 - 40) \times 40 = 800$

For PS

$\frac{1}{2} \times 40 \times 40 = 800$

c) Find the consumer and producer surplus assuming this same product was supplied by a monopoly. (**Hint:** The marginal revenue curve has twice the slope of the demand curve. You will have to plot 3 curves, MC, MR and Demand) 2

$MR \rightarrow P = 80 - 2q$

$(x,0)$

$0 = 80 - 2q$

$q = 40$

$(40,0)$

$(0,y)$

$P = 80 - 0$

$(0,80)$

CS

$\frac{1}{2} \times 27 \times (80 - 53)$

$\Rightarrow 364.5$

PS

$(53 - 27) \times 27$

$= 702.$

$\frac{1}{2} \times 27 \times 27 = 364.5$

$\Rightarrow 1066.5$

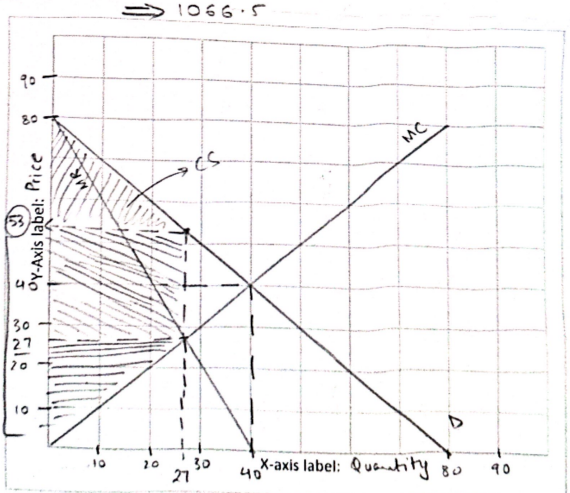
$80 - 2q = 80 - q$

$0 = q$

$80 - 2q = q$

$80 = 3q$

$q = \frac{80}{3} = 26.66$



PS

GDS

d) Show that, when this market is controlled by a monopoly, producer surplus is larger, consumer surplus is smaller, and the sum of the two surpluses is smaller than when the market is controlled by competitive industry. (Hint: calculate the CS and PS for both cases and compare the totals by filling in the table below)

	Monopoly	**Competitive Market**
Producer Surplus	1066.5	800
Consumer Surplus	364.5	800
Total	1431	1600

deadweight loss

Bicelia Oasim.

Worksheet for Module IV. Class 23. Present Value & Cost Benefit Analysis

Qs.1) A dollar invested today at 10% interest yields \$1.10 a year from now (the return of the \$1 principal plus \$0.10 interest)

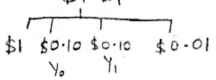
a) What is the present value of \$1.10 received 1 year from today?

$$\frac{1.10}{1+1\%} = \frac{1.10}{1+0.1} = \$1$$

b) What is the present value of \$X received 1 year from today?

$$PV = \frac{\$X}{(1+1\%)^1} = \frac{X}{1.1}$$

c) How much would \$1 invested today, earn in 2 years at r percent interest?



$$FV = PV * (1+r)^t$$
$$= 1 * (1+0.1)^2$$
$$= \$1.21$$

d) What is the present value of X received 2 years from now?

$$PV = \frac{X}{(1+r)^2} = \frac{10}{(1.1)^2} = 8.26$$

e) What is the present value of a one-time net benefit (**B**) received **n** years from now?

$$PV[B_n] = \frac{B_n}{(1+r)^n}$$

f) What is the present value of a stream of net benefits $\{B_0, B_1, \ldots, B_n\}$ received over a period of n years? β_0 *is received* 0 *years from now,* β_1 *is received* 1 *year from now* and so on. Write out the general formula in a concise way using mathematical notation.

$$PV[B_0, B_1, \ldots, B_n] = \sum_{i=0}^{n} \frac{B_i}{(1+r)^i}$$

* the process of calculati
* PV is called discounting
* if PV > 0, action can be supported.

g) What is the expected present value of net benefits? Write this out in mathematical notation assuming each net benefit is tied to an outcome that may occur with probability P_i.

$$EPV = \sum_{i=0}^{n} P_i \times \frac{B_i}{(1+r)^i}$$

OR

$$EPVNB_j = \sum_{i=0}^{J} P_i \, PVNB_{ij} \quad , \quad j = 1, 2, \ldots, J$$

* Select highest EPV of net benefits.
→ this approach weighs higher probability outcomes more heavily.
→ this approach is appropriate if society is risk-neutral.

Qs.2) Suppose you can have a definite $50 or enter a lottery with a 50% chance of winning $100 and a 50% chance of winning nothing. Determine the decision for the following types of individuals and provide a reason.

a) Risk-neutral (base their decision only on expected value)
$EV = (0.5 \times 100) + (0.5 \times 0) = 50$
since it's same as guaranteed option, they're indifferent.

b) Risk-loving (prefer higher risk and higher reward)
Since lottery has a chance to win $100 they choose lottery.

c) Risk-averse (prefer certainty)
Since $50 is guaranteed, they choose $50 instead of risky lottery

Qs.3) Suppose a project will impose an immediate cost of $4,000,000 (today's dollars), but the $5,500,000 benefits will not be earned until 5 years out. Is this project a good idea?

Determine the decision using both a 5% discount rate and a 10% discount rate.

→ 5% discount rate

$$PV = \frac{5,500,000}{(1.05)^5} = 4,311,430 \approx 3.9M$$

$$NPV = 4311430 - 4000000$$
$$= 311,430 > 0$$
(GOOD IDEA)

→ 10% discount rate

$$PV = \frac{5,500,000}{(1.1)^5} = 3415520$$

$$NPV = -584,480 < 0$$
(NOT)

* Discount Rate is social opportunity cost of capital
① Risk-free Cost of Capital
② Risk Premium.