Effects of Shifts in Demand and Supply

- When the demand curve shifts and the supply curve does not change, the price and quantity move *along the supply curve* (See Fig. 1)
  - In this case, the ratio of the change in price ($\Delta p$) to the change in quantity ($\Delta q$) is the *slope of the supply curve*.

- When the supply curve shifts and the demand curve does not change, the price and quantity move *along the demand curve*. (See Fig. 2)
  - In this case, the ratio of the change in price ($\Delta p$) to the change in quantity ($\Delta q$) is the *slope of the demand curve*. 
Identifying Shifts in demand or supply?

- In summer, raspberries are cheaper and more abundant than in winter. What shifts explain this?
- Sales (and prices) of Laker tickets increased after Shaq arrived. What shifted?
- OPEC reduced oil supply by about 10% and prices nearly doubled. What shifted?
- Recovery of Asian economies resulted in them demanding more oil. What shifted?
Figure 1: Shifting Demand Curves
Figure 2: Shifting Supply

The graph shows a supply curve represented by the black dashed line. Points A and B denote specific quantities and prices. The supply curve shifts to the right, indicating an increase in supply. The price and quantity axes are labeled as follows:

- **Price** axis: 0, 5, 10, 15, 20, 25
- **Quantity** axis: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120
Slope and Effects of Supply Shifts

- Since the demand curve slopes down, when the supply curve shifts, price and quantity move in opposite directions along the demand curve. (See Fig. 2).

- When the supply curve shifts up (to the left) the price rises and quantity falls.

- When the supply curve shifts down (to the right) the price falls and quantity rises.

- The ratio of the change in price to the change in quantity, $\Delta p / \Delta q$, is equal to the slope of the demand curve.

- The steeper the demand curve, the greater the effect of a given quantity change on the equilibrium price.
Figure 3: A “Flat” Demand Curve

\[ \frac{\Delta p}{\Delta q} = \frac{-0.25}{50} = 0.005 \]
Figure 4: A “Steep” Demand Curve

\[ \frac{\Delta p}{\Delta q} = \frac{-5}{50} = -0.10 \]
Slope and Effects of Demand Shifts

- Since the supply curve slopes up, when the demand curve shifts, price and quantity move in the same direction along the supply curve. (See Fig. 2).

- The ratio of the change in price to the change in quantity, \( \Delta p/\Delta q \), is equal to the slope of the supply curve.

- The steeper the supply curve, the greater the change in price that accompanies a given change in quantity.
Elasticity and Responsiveness

- Measuring responsiveness of demand or supply by slope has disadvantages.
  - Slope changes as you change units of account. (Dollars versus cents, or Euros, or Turkish Lira.)
  - Slope changes as you change units of quantity. (Tons versus pounds or grams, or barrels.)

- A more useful measurement of responsiveness is obtained by using percentage changes of quantity and price.

- Percent changes in quantity divided by percent change in price is called a price elasticity.
Elasticity of Demand

- The price elasticity of demand is the percentage change in quantity divided by the percentage change in price as one moves along the demand curve.

- That is if \((q, p)\) is a point on the demand curve and \((q', p')\) is another point, then the elasticity of demand for a price movement from the first point to the second is equal to

\[
\frac{\Delta q \div \Delta p}{q \div p},
\]

where \(\Delta q = q' - q\) and \(\Delta p = p' - p\).

- An equivalent way of writing the elasticity of demand is

\[
\frac{\Delta q}{\Delta p} \times \frac{p}{q}.
\]
Calculating Elasticity in Figure 4

- On the right side of Figure 4, the initial quantity, price combination is at the point $A$ where $(q, p) = (200, 5)$.

- After the supply shift, the new price quantity combination is at $B$ where $(q', p') = (150, 10)$.

- Then $\Delta q = q' - q = 150 - 200 = -50$ and $\Delta p = 10 - 5 = 5$.

- Thus the price elasticity of demand for this change is

$$
\frac{\Delta q}{q} \div \frac{\Delta p}{p} = \frac{-50}{200} \div \frac{5}{5} = -0.25.
$$
**Elasticity of Supply**

- The price elasticity of demand is the percentage change in quantity divided by the percentage change in price as one moves along the supply curve.

- We calculate this just as we calculate the elasticity of demand, except that we move along the supply curve.

- Notice that for an upward-sloping supply curve, the elasticity of supply is positive, while for a downward-sloping demand curve, the elasticity of demand is negative.
Elastic and Inelastic Demand and Supply

- Let $E_s > 0$ denote the elasticity of supply and let $E_d < 0$ denote the elasticity of demand.

- Supply is defined to be *elastic* if $E_s > 1$.

- Supply is defined to be *inelastic* if $E_s < 1$.

- Demand is defined to be *elastic* if $E_d < -1$. (That is, $|E_d| > 1$)

- Demand is defined to be *inelastic* if $0 > E_d > -1$. (That is $|E_d| < 1$)
Perfectly Inelastic and Perfectly Elastic Curves

- Supply is said to be *perfectly inelastic* if the price elasticity is zero. \((E_d = 0)\) In this case, the supply curve is vertical.

- Supply is said to be perfectly elastic if the elasticity of supply is infinite. \((E_d = \infty)\) This happens when the supply curve is horizontal.

- In our fish market, (Experiment 2, Figure 5), the supply is perfectly elastic for quantities below the total number of fish caught and perfectly elastic for quantities greater than the total number of fish caught.

- Similarly, demand is perfectly inelastic if the demand curve is vertical and perfectly elastic if it is horizontal.
Figure 5: The Fish Market

Demand and Supply, Session 2
Oranges Revisited

- In December 1998, frost destroyed half of the navel orange crop in California’s central valley.
- The central valley produces about 70% of the nation’s eating oranges.
- Therefore the nation’s total supply of eating oranges was cut by about 35%.
- In the week following the frost, wholesale prices of navel oranges rose from about $10 a box to $20 a box.
- What can we conclude about the price elasticity of demand for oranges?
- Quantity decreased by 35%.
- Price increased by 100%.
- Price elasticity is

\[
\frac{\text{percent change in quantity}}{\text{percent change in price}} = \frac{-35}{100} = -0.35.
\]
- Note that this means that demand is \textit{inelastic}.
- Note also that total revenue of all orange growers increased. Price went up by proportionately more than quantity fell.
- What happened to the revenue of average Central Valley grower? (Hint: They sold half as many oranges at twice the price.)
Total Revenue and Elasticity

- When supply curve shifts, price and quantity move in opposite directions. What happens to Revenue = Price \times Quantity?

- **Proposition** With a downward-sloping demand curve, as you move along the demand curve:
  - price and total revenue will move in the same direction if demand is price inelastic.
  - price and total revenue will move in opposite directions if demand is price elastic.
  - quantity and total revenue will move in opposite directions if demand is price inelastic.
  - quantity and total revenue will move in the same direction if demand is price elastic.
Elasticity of demand along a straight line

- The elasticity of demand is not necessarily the same everywhere along a demand curve.
- Consider a straight-line demand curve described by the equation $p = 100 - q$.
- The elasticity of demand can be written as

$$ E_d = \frac{\Delta q}{\Delta p} \times \frac{p}{q}. $$

- The slope of the straight line is equal to -1 all along the line. Therefore $\Delta q/\Delta p = -1$.
- For this demand function, it must be that $E_d = -p/q$. 
• The elasticity varies as you move along the demand curve. Demand is very elastic at points on the demand curve where $p$ is large and $q$ is small. Demand is very inelastic at points on the demand curve where $p$ is large and $q$ is small.

• At what price is $E_d = -1$?

• Things for you to figure out on your own.
  
  – When the demand curve is given by $p = 100 - q$, at what price is $E_d = -1$?

  – When the demand curve is given by $p = 100 - q$, for what prices is demand elastic and for what prices is demand inelastic?

  – How do you generalize this answer for a general linear demand curve, with equation $P = A - Bq$?
Figure 6: A Linear Demand Curve

\[ P_d(q) = 100 - q \]