Week #4 Notes – Elasticity ~ Case Study

1. **Elasticity:** Measures the responsiveness of demand or supply curve with respective to the variable we are interested (the variables we are interested in price—most of the time—and income).

   ➔ **Ex:** Suppose you are the owner of a coffee shop and you consider increasing the price of coffee. From the law of demand you know that the quantity demanded decreases in response to a price increase. However, the law of demand does not tell you the extent of this decrease. Since you are the owner and care about the revenue you make, you need to answer to the following question: "How much does the quantity demanded change when the price changes?

   Total Revenue: P*Q ➔ Law of demand tells if the price increase (decreases) then the quantity demanded decreases (increases). So, without the knowledge of the responsiveness of the demand curve with respect to price, you cannot tell whether the total revenue increases or decreases. That is why the economists care about elasticity (responsiveness).

2. **Price Elasticity of Demand:** Measures the responsiveness of quantity demanded of a good to changes in its price.

   Price Elasticity of Demand= $\frac{\%\ Change\ in\ Quantity\ Demanded}{\%\ Change\ in\ Price}$

   % Change in Quantity Demanded = $\frac{\Delta Q}{Q} * 100\%$ ➔Similarly you can show it for price

   The problem with the above calculation is about choosing Q. For example, the quantity demanded increases from 100 to 110. The change in quantity is 10 (110-100), and if we use the initial Q which is 100, the above formula gives as 10% change. However, if we use the final Q which is 110, the above formula gives us 9.09 % change. PROBLEM!!!

   $\frac{110-100}{100} * 100\% = 10\%$ ➔ % change in quantity using the initial quantity

   $\frac{110-100}{110} * 100\% = 9.09\%$ ➔ % change in quantity using the final quantity

   To prevent this calculation problem we take the average of the initial and final points as follows;

   % Change in Quantity Demanded = $\frac{\Delta Q}{\frac{1}{2}(Q_1 + Q_2)} * 100\%$

   % Change in Price = $\frac{\Delta P}{\frac{1}{2}(P_1 + P_2)} * 100\%$

   *So, the price elasticity of demand formula turns out to be (after some simplifications):

Price Elasticity of Demand ➔ $\varepsilon = \frac{\Delta Q/(Q_1 + Q_2)}{\Delta P/(P_1 + P_2)}$ ➔ Arc Elasticity (Mid point formula)

OR

Price Elasticity of Demand ➔ $\varepsilon = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q * P}{\Delta P * Q}$ ➔ Point Elasticity

**Note that "Q" indicates the quantity demanded.
***Although we have two different elasticity formulas as seen above, we generally use the point elasticity in advance economics. However, for this course you will usually use mid point formula. The reason for that is we consider the change in price or in quantity is very small, so the two formulas will be same. In the exams/problem sets, I will tell which formula you should use.

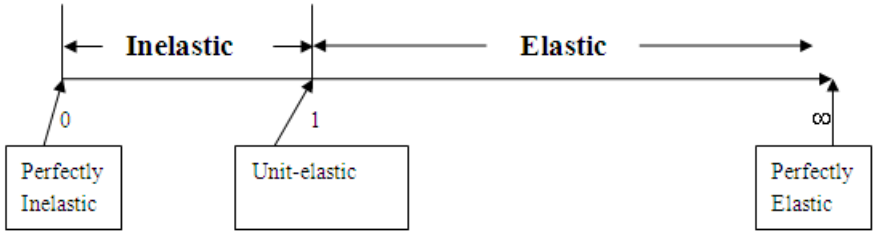
3. **<u>Some Notes About Elasticity:</u>**
   - **a.** There is **no unit** for price elasticity of demand since both the numerator and denominator are in terms of percentage change. Therefore, you can compare the price elasticity of demand between different kinds of goods.
   - **b.** In comparing price elasticity of demand between two goods, we are usually **interested in their absolute value**, which means that a demand with price elasticity of demand= -2 is more elastic than a demand with price elasticity of demand = -1 although -2 is actually a smaller number than -1.
   - **c.** Price elasticity of demand is **negative** due to **the law of demand.** Remember the sign of the slope of the demand curve.
   - **d. Don't judge** the price elasticity of demand at points on different demand curves by looking at their slopes.

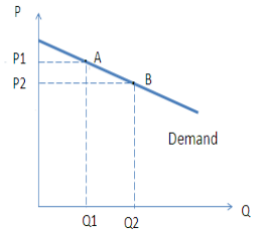
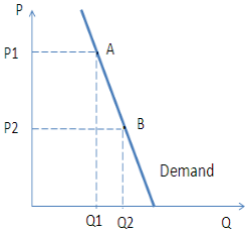
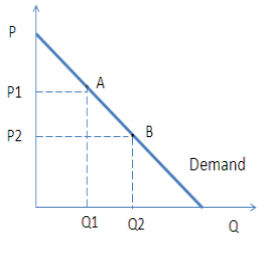
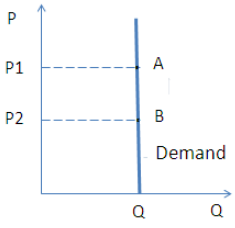
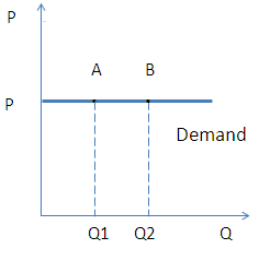
     Remember the slope of demand ➔ $\frac{\Delta Rise}{\Delta Run} = \frac{\Delta \text{Price}}{\Delta Quantity} = \frac{\Delta P}{\Delta Q}$ ➔ which is quite different from price of elasticity of demand (but related). Therefore, slope and elasticity is not the same thing!!!

   - **e. Interpretation:** 1% change in price will lead to PED% change in quantity demanded. Ex: PED = - 2 means if the price of the good increases by 1%, there will be 2% decrease in the quantity demanded.
   - **f.** Assuming that the demand curve for your product is linear, the demand for your product will tend to be more elastic at higher prices than at lower prices.
   - **g.** You should know how to calculate the third variable when you've already known the other two variables in the definition of the price elasticity of demand.
     - **i.** Suppose the price elasticity of demand for orange is **-0.5**. It follows that a **5% in increase the price** of orange will result in **a 2.5 % decrease in the quantity** demanded of orange.
     - **ii.** Suppose that you read the Wall Street Journal that the **quantity demanded for apple juice decrease by 0.2%** in response to a **2% increase in the price** of orange juice. It follows that the price elasticity of demand for apple juice is **0.1**.

iii. Suppose the price elasticity of demand for diamond ring is **-5**. **A 10 % decrease in the quantity** demanded of diamond ring results from **the 2 % increase in the price** of the diamond ring.

4. Elastic vs Inelastic:



Elastic	Inelastic	Unit-elastic	Perfectly Inelastic	Perfectly Elastic
|PED|>1	|PED|<1	|PED|=1	|PED|=0	|PED|=∞
Quantity demanded is responsive to price change	Quantity demanded is less responsive to price change	Quantity demanded is unit responsive to price change	Quantity demanded is completely unresponsive to price change	Quantity demanded is infinitely responsive to price change
$\%\Delta \mathbf{Q} > \%\Delta P$	$\%\Delta Q < \%\Delta P$	$\%\Delta Q = \%\Delta P$	$\%\Delta Q = 0$ No matter how P changes	$\%\Delta Q = \infty$ If P changes a Little bit
The demand curve is relatively flat	The demand curve is relatively steep	The demand curve is not that flat nor that steep	The demand curve is a vertical line	The demand curve is a horizontal line
				

5. Determinants of Price Elasticity of Demand:

a. The availability of substitutes: The more and better substitutes that exist for an item, the more elastic its demand.

b. Time: Demand tends to become more elastic with time because we find more substitutes for goods over time.

c. The proportion of income consumers spend on the good: Other things being equal, the smaller the percentage of income spent on a good, the less elastic the demand unless the good is considered a dispensable luxury. If the income share of the good is high and price of that good increases, your real income decreases which causes you to buy a lot less of that good.

➔Ex: the share of pencil consumption in income is low so the price elasticity of pencil is low (inelastic).

➔Ex: Although the share of oyster consumption in income is low, the price elasticity of oyster is high (elastic). The reason for this exception is that oyster is considered to be a dispensable luxury.

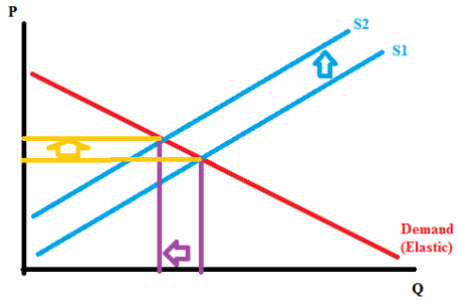
6. **<u>Relationship Between Price Elasticity of Demand and Total Revenue</u>:**

Why do we care about this? It helps us to predict total revenue that we could stand to make by changing prices. Note in the below analysis we are cheking demand curve.

Total Expenditure = P*Q= Total Revenue

a. **Elastic demand**: price and total revenue move in the **opposite direction**
   P increase, Q drops a lot => revenue decrease
   P decrease, Q increases a lot => revenue increase
b. **Inelastic demand**: price and total revenue move in the **same direction**
   P increase, Q drop only a little => revenue increase
   P decrease, Q increase only a little => revenue decrease
c. **Unit-elastic demand**: total revenue **doesn't change** no matter price increase or decrease
   P increase, Q drop the same amount => revenue remains the same
   P decrease, Q increase the same amount => revenue remains the same

➔The graph shows a market with elastic demand. Suppose there is a decrease in supply which causes supply curve to shift inward. Since the demand is elastic, the increase in price will be smaller than the decrease in quantity. Therefore, the total revenue will decrease.



7. **<u>Other Demand Elasticity Measures:</u>** *Just know what they are, you don't need to know them in detail.*

a. **<u>Income Elasticity of Demand:</u>** measures the percentage change in the number of units of a good consumers demand, other things being equal, resulting from each 1 percent change in income.

$$\text{Price Elasticity of Demand} = \frac{\%\ Change\ in\ \ Number\ of\ Units\ Consumers\ Demand}{\%\ \ Change\ \ in\ \ Income}$$

$$= \frac{\Delta Q/Q}{\Delta I/I}$$

b. **<u>Cross-elasticity of Demand:</u>** measures the sensitivity of purchases of one good to changes in the price of another good.

$$\text{Price Elasticity of Demand} = \frac{\%\ Change\ in\ \ Number\ of\ Units\ X\ Consumers\ Demand}{\%\ \ Change\ \ in\ \ Price\ of\ Y}$$

$$= \frac{\Delta Q_x/Q_x}{\Delta P_y/P_y}$$

8. **<u>Price Elasticity of Supply:</u>** A number used to measure the sensitivity of changes in quantity supplied to given percentage changes in the price of a good, other things being equal.

$$\text{Price Elasticity of Supply} = \frac{\%\ Change\ in\ Quantity\ Supplied}{\%\ Change\ in\ Price}$$

$$= \frac{\Delta Q_s / Q_s}{\Delta P / P} \qquad \text{where } Q_s \text{ is quantity supplied.}$$

*As you have noticed price elasticity of supply is very similar to price elasticity of demand. Note that price elasticity of supply ranges from 0 to infinity.

**The graph for inelastic, unit elastic and elastic supply is exactly same as in demand case. So please see the graphs on page 3 in this document.