Lecture 5 – Elasticity Part 1

The Magnitude of Change

- In the previous lecture, we learnt about the law of demand and supply.
- When prices increase, quantity demanded falls, and quantity supplied increases.
- However, we didn't know by *how much* will the demand or supply change in response to a change in price.
- For instance, if the price of ice creams rises, then the quantity demanded will fall. But by how much?

The Elasticity of Demand

- The price elasticity of demand measures how much the quantity demanded responds to a change in price.
- For instance, if a change in price changes quantity demanded by a lot, then we say demand is **elastic**.
- Conversely, if an increase in price changes quantity demanded by only a little, when we say demand is **inelastic**.
- The formula for computing demand is given below:

$$Price\ Elasticity\ of\ Demand\ (P.E.D) = \frac{\%\ \Delta\ in\ Quantity\ Demanded}{\%\ \Delta\ in\ Price}$$

- This formula is also called the **point elasticity of demand**.
- Let's say the price of a good increased from PKR 30 to PKR 40. Also, the increase in price caused the quantity demanded to fall from 1000 units to 800 units.
- We can calculate the P.E.D using the formula as follows:

$$\%\ \Delta\ in\ Quantity\ Demanded = \frac{New\ Demand - Old\ Demand}{Old\ Demand} * 100$$

$$= \frac{800 - 1000}{1000} * 100 = -20\%$$

$$\%\ \Delta\ in\ Price = \frac{New\ Price - Old\ Price}{Old\ Price} = \frac{40 - 30}{30} * 100 = 33\%$$

$$P.E.D = \frac{-20}{33} = -0.6$$

- Hence, the price elasticity of demand is -0.6. We ignore the negative sign, because it just indicates the inverse relationship between price and quantity demanded.
- We just see the absolute value, which is, 0.6.
- So, based on this, can we say the demand is elastic, or inelastic?
- A simple rule of thumb we follow in Economics is that if the absolute value of P.E.D < 1, we say demand is inelastic, if absolute value of P.E.D > 1, we say demand is elastic.
- Hence, the above result is 0.6, meaning demand is inelastic.

The Mid-Point Method

- The above method has a slight flaw. Suppose I reversed the scenario and asked you to compute P.E.D if price decreased from 40 to 30, due to which quantity demanded increased from 800 to 1000.
- Would you get the same answer?
- If you calculate using the above method, you will get:

$$\%\,\Delta\, in\ Quantity\ Demanded\ = \frac{New\ Demand\ -\ Old\ Demand}{Old\ Demand} * 100$$

$$= \frac{1000 - 800}{\mathbf{800}} * 100\ =\ 25\%$$

$$\%\,\Delta\, in\ Price\ = \frac{New\ Price\ -\ Old\ Price}{Old\ Price} = \frac{30 - 40}{40} * 100 = -33.33\%$$

$$P.E.D = \frac{25}{\mathbf{-33.33}} = -0.75$$

- Instead of 0.4, you get 0.75. The reason is that the denominators change when computing percentage changes in price and quantity.
- A more robust method is the mid-point method. The formula is given below:

$$Midpoint\ P.E.D = \frac{(New\ Quantity\ -\ Old\ Quantity)/[(New\ Quantity\ +\ Old\ Quantity)/2]}{(New\ Price\ -\ Old\ Price)/[(New\ Price\ +\ Old\ Price)/2]}$$

- Based on this, and using the figures from the above example we know:

$$New\ Quantity\ =\ 1000$$
$$Old\ Quantity\ =\ 800$$
$$New\ Price\ =\ 30$$
$$Old\ Price\ =\ 40$$

$$Midpoint\ P.E.D\ = \frac{(1000 - 800)/[(1000 + 800)/2]}{(30 - 40)/[(30 + 40)/2]} = \frac{0.22}{0.29} = 0.76$$

- According to Midpoint P.E.D, demand is still inelastic. However, you will get the same answer if you reversed the calculation.
- Try it!

Mid-point vs. Point Elasticity

- So, should we use mid-point or point-elasticity method?
- Practically, the mid-point method is more accurate for calculating elasticities over larger ranges.
- However, point-elasticity is appropriate when you want to calculate elasticities for very small price and quantity intervals.
- To understand why, consider rewriting the point-elasticity formula as follows:

$$Price\ Elasticity\ of\ Demand\ (P.E.D)\ = \frac{\%\ \Delta\ in\ Quantity\ Demanded}{\%\ \Delta\ in\ Price}$$

  - Assume price increased from P1 to P2, due to which quantity demanded decreased from Q1 to Q2.
  - We can write $\Delta Q\ =\ Q2\ -\ Q1$, and $\Delta P\ =\ P2\ -\ P1$,
  - Substituting this in the formula above, we get:

$$P.E.D\ = \frac{\frac{\Delta Q}{Q1}}{\frac{\Delta P}{P1}} = \frac{\Delta Q}{Q1} * \frac{P1}{\Delta P} = \frac{\Delta \boldsymbol{Q}}{\Delta \boldsymbol{P}} * \frac{\boldsymbol{P1}}{\boldsymbol{Q1}}$$

- The last term implies elasticity changes according to the initial price and quantity points – in this case, P1 and Q1.
- Hence, you will get different elasticities if you change values of P1 and Q1, and compute elasticity from these new points.
- Due to this, you can use point-elasticity to compute elasticity when price and quantity change only by a very little amount at different initial points.
- For instance, you should use point elasticity if you want to calculate the elasticity of demand for a good, whose price increases from Rs. 30 to Rs. 30.02, and quantity demanded decreases from 1000 to 999.99.
- These are very small changes, and point-elasticity will give you a better answer.
- In this case, P1 = 30, and Q1 = 1000, $\Delta Q\ =\ 0.02$, and $\Delta P = 0.01$.

- You will get a different answer if P1 = 40, and Q1 = 800, but changes in price and quantity demanded still remain the same.
- However, if ΔQ were equal to 10, and ΔP were equal to 5, then mid-point method would have given a better answer.
- That's because the changes are large.

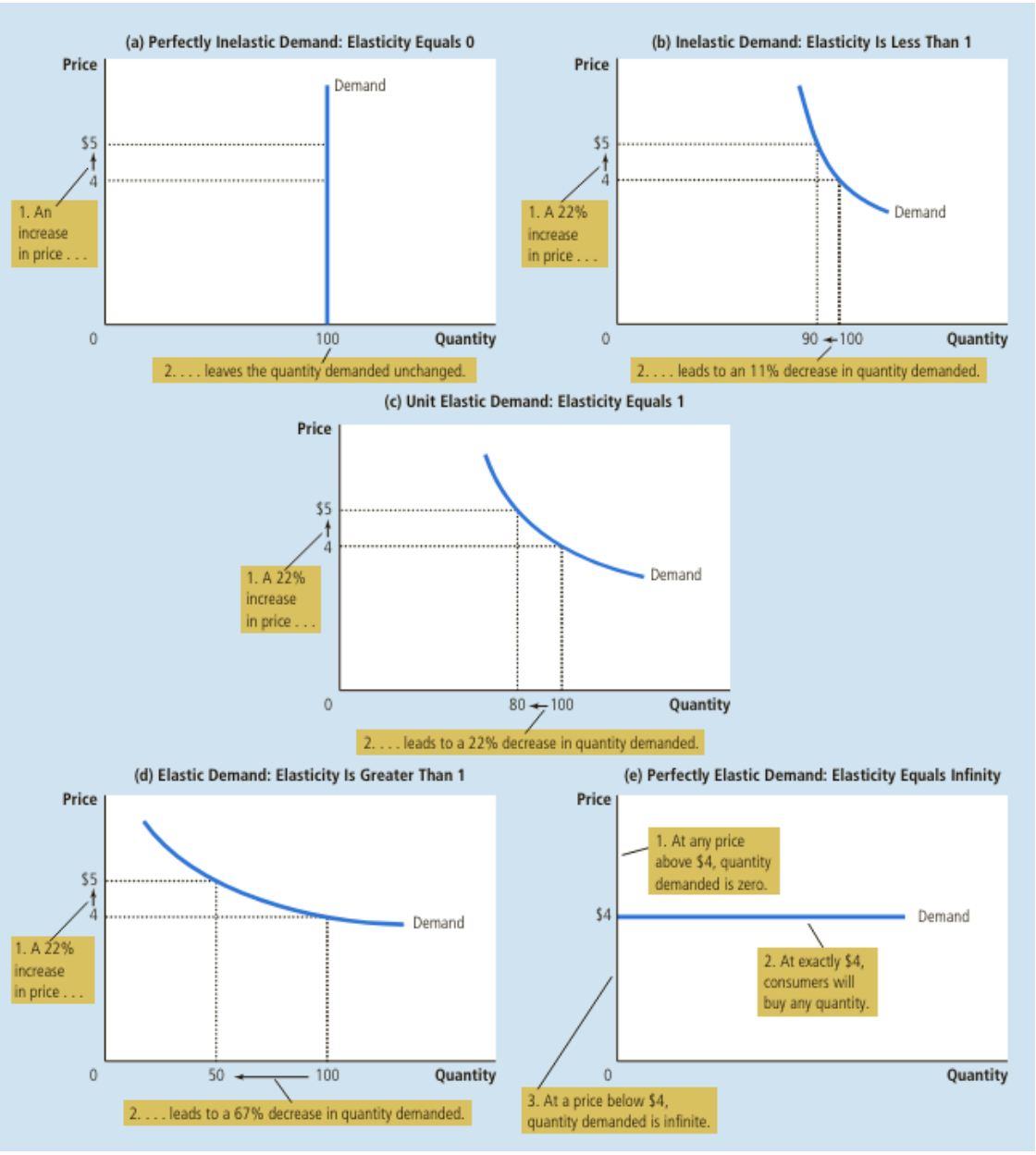
Determinants of Elasticity of Demand

- So, what makes demand inelastic or elastic? Below is a list of a few important determinants of P.E.D:
    - **Availability of Close Substitutes:** In economics, we say that two goods are substitutes if the price increase of one good, increases the demand of other good. For instance, if the price of Samsung phones increase, people will shift to Apple phones. This is because the Apple smartphone is a good substitute of Samsung phone.
        - Hence, if a good has many close substitutes, its demand will be highly elastic.
        - This is because if the price of the good increases even slightly, people will quickly shift to its substitutes.
        - Hence, a small increase price of a good, will lead to a great fall in its quantity demanded.
    - **Necessities versus luxuries:** Demand for necessities is relatively inelastic.
        - For instance, no matter how much the price of wheat increases, you will still need it to make bread.
        - Luxury good items have elastic demand. If the prices of diamonds increase, people will stop buying diamonds.
    - **Time Horizon:** Demand for goods in the long-run becomes elastic. This is because, in the long-run, people tend to find close substitutes of a particular good.
        - For instance, if the price of petrol increases, in the short-run, people will have no choice but to use petrol-based cars.
        - However, in the long-run, as electric cars become cheaper, people will switch to electric cars, and the demand for petrol will decrease significantly.
- Note that the last two factors are simply variants of the first factor.

- Necessities have less substitutes while luxuries have more. Hence, demand for necessities is inelastic and for luxuries elastic.
- Similarly, in the short-run, you can find less substitutes (inelastic), but in the long-run, more alternatives become available (elastic).

Demand Curves

- We can visually draw demand curves to illustrate elasticities. The figure below shows all the possible demand curves:
- Go through the figure carefully.



Other Demand Elasticities

- In addition to P.E.D, we can also compute **income elasticity of demand,** which measures how much demand for a good changes in response to a change in income.
- The formula is given below:

$$Income\ Elasticity\ of\ Demand\ = \frac{\%\ \Delta\ in\ Quantity\ Demanded}{\%\ \Delta\ in\ Income}$$

- Here, we distinguish types of goods based on income. If the demand for good rises due to a rise in income, we say it is a **normal good.**
- If the demand for a good falls when income rise, we say it is an **inferior good.**
- Examples of inferior goods can include public bus rides, inferior quality products, etc.
- For instance, if your income increases, you will most likely buy better quality branded items, and the demand for basic non-branded items will fall.
- Income elasticity of demand will have a +ve sign if the good is normal. For instance, if the income elasticity is 1.2, we will say the good is normal and the good is income elastic since the absolute value is greater than 1
- Conversely, it will have a negative sign if the good is inferior. For instance, if income elasticity is -1.2, we say the good is inferior, and income elastic.
- You can also compute the **cross-price elasticity** of goods. Cross-price elasticity measures how much the demand for a good changes in response to a change in the price of **other good.**
- You can compute the elasticity as follows:

$$Income\ Elasticity\ of\ Demand\ = \frac{\%\ \Delta\ in\ Quantity\ Demanded\ of\ good\ A}{\%\ \Delta\ in\ price\ of\ good\ B}$$

- We have two cases:
  - **Goods A and B are substitutes:** As discussed, if the price of a good increases, the demand for its substitute increases.
    - Cross-price elasticity for substitutes has a positive sign.
  - **Goods A and B are complementary:** The other case is of complementary goods. Complementary goods go together, for instance, cars and petrol, a board marker and an eraser, a mobile phone and its cover, etc.

- This means if the price of mobile phones increase, the quantity demanded for phones will decrease, and so will the demand for mobile phone covers.
- Cross-price elasticity for complements has a negative sign.