

CHAPTER 5

ELASTICITY

SECTION 5.1 PRICE ELASTICITY OF DEMAND

- The law of demand establishes that quantity demanded changes inversely with changes in price, *ceteris paribus*. But how much does quantity demanded change? The extent to which a change in price impacts quantity demanded may vary considerably from product to product and over various price ranges for the same product. This is what the **price elasticity of demand** is designed to answer.
- The price elasticity of demand measures the responsiveness of quantity demanded to a change in price.
- The price elasticity of demand is defined as the percentage change in quantity demanded divided by the percentage change in price.

$$\text{Price elasticity of demand } (E_d) = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

- Because there is an inverse relationship between price and quantity demanded, the price elasticity of demand is, in theory, always negative. In practice, however, this quantity is always expressed in absolute value terms, as a positive number, for simplicity.
- The meaning of elasticity is straightforward, if you think of a rubber band. If the quantity demanded is very responsive to even a small change in price, we call it elastic. If even a huge change in price results in only a small change in quantity demanded, then demand is said to be inelastic.
- A demand curve or a portion of a demand curve can be relatively elastic, relatively inelastic, or unit elastic.
- A segment of a demand curve is **elastic** ($E_d > 1$) if the percentage change in quantity demanded is greater than the percentage change in price that caused it. A perfectly elastic demand curve is the limiting case and is represented by a horizontal demand curve.

Exhibit 1: Elastic Demand

- A segment of a demand curve is **inelastic** ($E_d < 1$) if the percentage change in quantity demanded is less than the percentage change in price. A perfectly inelastic demand curve is the limiting case and is represented by a vertical demand curve.

Exhibit 2: Inelastic Demand

- A segment of a demand curve is **unit elastic** ($E_d = 1$) if the percentage change in quantity demanded equals the percentage change in the price.

Exhibit 3: Unit Elastic Demand

- The **midpoint method** is a common method used to calculate elasticities.
- For the most part, the price elasticity of demand depends on the availability of close substitutes, the narrowness of the definition of the good, the proportion of income spent on the good, and the amount of time that has elapsed since the price change.
- Goods with close substitutes tend to have more elastic demands, while goods without close substitutes tend to have less elastic demands.
- The demand for a broadly defined good, like food, tends to be inelastic because there are few substitutes for food. The demand for a specific type of food, like pizza, is more elastic because there are substitutes available.
- The smaller the proportion of income spent on a good, the lower its elasticity of demand. If the amount spent on a good relative to income is small (Example: salt), then the impact of a change in its price on one's budget will also be small. As a result, consumers will respond less to price changes for these goods than for similar percentage changes in large-ticket items (such as university tuition), where a price change could have a potentially large impact on the consumer's budget.
- The more time that people have to adapt to a new price change, the greater the elasticity of demand. The more time that passes, the more time consumers have to find or develop suitable substitutes and to plan and implement changes in their patterns of consumption. Hence, the short-run demand curve is generally less elastic than the long-run demand curve.

Exhibit 4: Short-Run and Long-Run Demand Curves

Exhibit 5: Price Elasticities of Demand for Selected Goods

SECTION 5.2 TOTAL REVENUE AND PRICE ELASTICITY OF DEMAND

- **Total Revenue (TR)** is simply the price of the good (P) times the quantity of the good sold (Q).
- When demand is price elastic ($E_d > 1$), **total revenues** will rise as the price declines, because the percentage increase in the quantity demanded is greater than the percentage reduction in price. In this case, if the price rises and the quantity demanded falls, then total revenue falls because the percentage decrease in the quantity demanded is greater than the percentage increase in price.

Exhibit 1: Elastic Demand and Total Revenue

- When demand is price inelastic ($E_d < 1$), total revenues will fall as the price declines, because the percentage increase in the quantity demanded is less than the percentage reduction in price. In this case, if the price rises and the quantity demanded falls, then total revenue rises because the percentage decrease in the quantity demanded is less than the percentage increase in price.

Exhibit 2: Inelastic Demand and Total Revenue

Exhibit 3: Elasticities and Total Revenue

- Along a straight-line demand curve, when the price falls on the upper half of the demand curve, there is a negative relationship between price and total revenue, so demand is price elastic. When the price falls on the lower half of the demand curve, there is a positive relationship between price and total revenue, so demand is price inelastic.

Exhibit 4: Price Elasticity Along a Linear Demand Curve

Exhibit 5: Elasticity Varies Along a Linear Demand Curve

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SECTION 5.3 OTHER DEMAND ELASTICITIES

- Elasticities are also used to assess the magnitude of the effect of the other variables that determine demand.
- The **cross-price elasticity of demand** (E_{AB}) is a measure of the responsiveness of demand to changes in price of a different good. It is defined as the percentage change in the quantity demanded for one good divided by the percentage change in the price of a related good (substitute or complement).
- If the cross-price elasticity is positive, the good goods are substitutes. If the cross-price elasticity has a negative value, the two goods are complements.
- The **income elasticity of demand** (E_I) is a measure of how quantity demanded responds to changes in income. It is defined as the percentage change in quantity demanded divided by the percentage change in income.
- If the income elasticity of a good is positive, it is a normal good. If it is negative, it is an inferior good.

SECTION 5.4 PRICE ELASTICITY OF SUPPLY

- The **price elasticity of supply** measures how responsive the quantity sellers are willing and able to sell is to changes in the price. It measures the relative change in the quantity supplied that results from a change in price.
- The price elasticity of supply (E_S) is defined as the percentage change in the quantity supplied divided by the percentage change in price.
- Goods with a supply elasticity that is greater than 1 ($E_S > 1$) are elastic in supply. With that, a 1 percent change in price will result in a greater than 1 percent change in quantity supplied. (The extreme case is perfectly elastic supply, where $E_S = \text{infinity}$.)
- Goods with a supply elasticity that is less than 1 ($E_S < 1$) are inelastic in supply. This means that a 1 percent change in the price of these goods will induce a proportionately smaller change in the quantity supplied. (The extreme case is perfectly inelastic supply, where $E_S = 0$.)

Exhibit 1: The Price Elasticity of Supply

- Time is usually critical in supply elasticities, because it is more costly for producers to bring forth and release resources in shorter periods of time. Hence, supply tends to be more elastic in the long run than the short run.

Exhibit 2: Short-Run and Long-Run Supply Curves

- The relative elasticity of supply and demand determines the distribution of the tax burden for a good. If demand has a lower elasticity than supply in the relevant tax region, the largest portion of the tax is paid by the consumer. However, if demand is relatively more elastic than supply in the relevant tax region, the largest portion of the tax is paid by the producer. In general, the tax burden falls on the side of the market that is less elastic, which has nothing to do with who actually pays the tax at the time of the purchase.

SECTION 5.5 ELASTICITY AND TAXES

- While the legislation that accompanies a tax may designate who is responsible for paying the tax, the ultimate impact of the tax will be determined by the relative values of the elasticity of demand and supply.
- In the case where the elasticity of demand is relatively less than the elasticity of supply, the majority of the burden of the tax is passed on to the consumer, regardless of who actually pays the tax.
- In general, the tax burden falls on the side of the market that is less elastic.

Exhibit 1: Elasticity and the Burden of Taxation

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