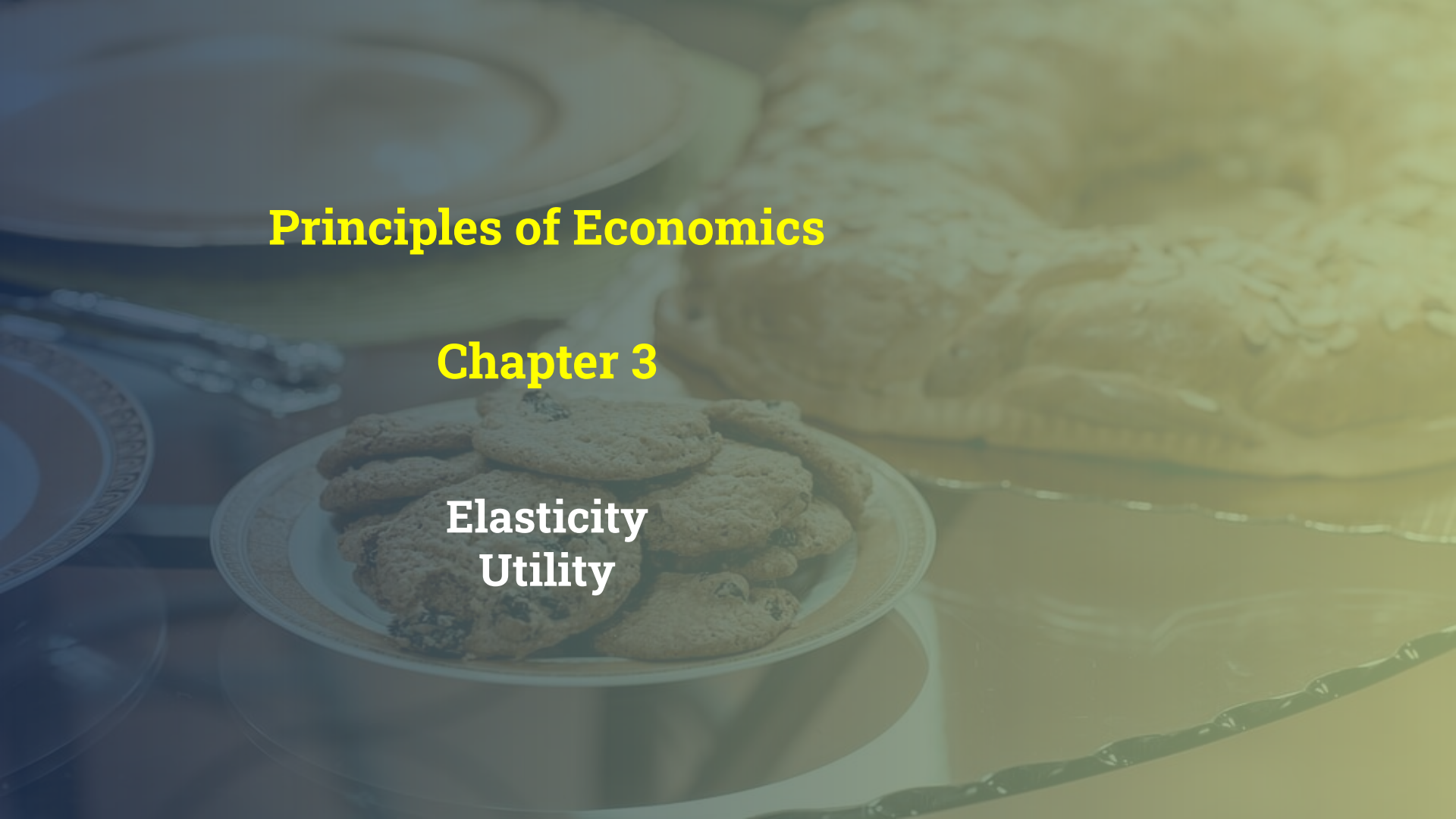


Principles of Economics

Chapter 3

Elasticity
Utility

You would be able to learn…

1. The price elasticity of demand and how to calculate it
2. The determinants of the price elasticity of demand
3. The relationship between the price elasticity of demand and total revenue
4. The cross-price elasticity of demand and the income elasticity of demand, and their determinants and how they are calculated
5. Using price elasticity and income elasticity to analyse economic issues
6. The elasticity of supply, and understand its main determinants and how it is calculated

You would be able to learn…

- Definition of utility
- Total utility vs. Marginal utility
- The law of diminishing marginal utility
- Water diamond paradox
- The equimarginal principle

Elasticity: the responsiveness of demand and supply

When studying how some event or policy affects a market, we can discuss not only the direction of the effects but also their magnitude. **Elasticity is a measure of how much buyers and sellers respond to changes in market conditions, a measure of the responsiveness of quantity demanded or quantity supplied to a change in one of its determinants.**

A 10 percent increase in gasoline prices reduces gasoline consumption by about 2.5 percent after a year and by about 6 percent after 5 years. About half of the long-run reduction in quantity demanded arises because people drive less, and half arises because they switch to more fuel-efficient cars. **Both responses are reflected in the demand curve and its elasticity.**

Elasticity of demand

The price elasticity of demand measures how much the quantity demanded responds to a change in price. Demand for a good is said to be **elastic** if the quantity demanded responds substantially to changes in the price. Demand is said to be **inelastic** if the quantity demanded responds only slightly to changes in the price.

The price elasticity of demand for any good measures how willing consumers are to buy less of the good as its price rises.

$$\text{price elasticity of demand} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

Suppose that a 10 percent increase in the price of an ice-cream cone causes the amount of ice cream you buy to fall by 20 percent. We calculate your elasticity of demand as

$$\text{price elasticity of demand} = \frac{20 \text{ percent}}{10 \text{ percent}} = 2$$

The elasticity is 2, reflecting that the change in the quantity demanded is proportionately twice as large as the change in the price.

Elasticity of demand: variety of demand curves

Eggs **0.1**
Healthcare **0.2**
Cigarettes **0.4**
Rice **0.5**
Housing **0.7**
Beef **1.6**
Peanut Butter **1.7**
Restaurant Meals **2.3**
Mountain Dew **4.4**

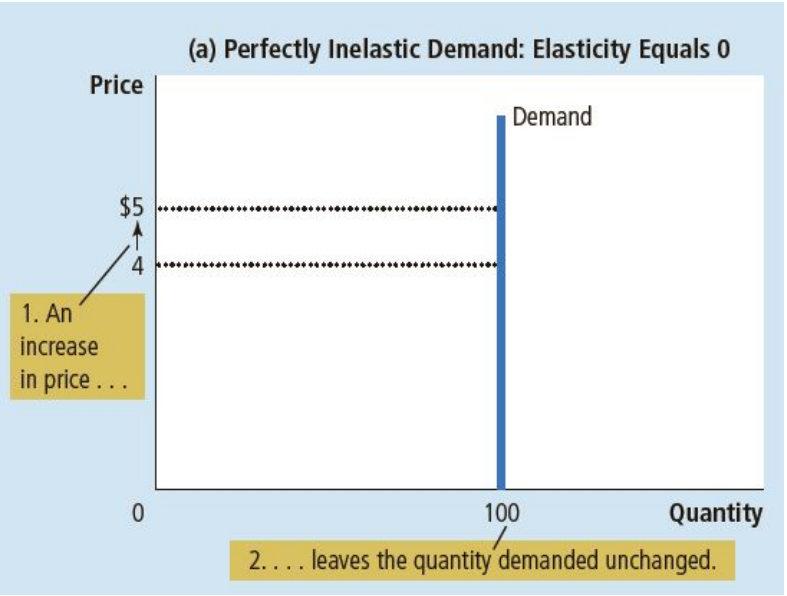
Economists classify demand curves according to their elasticity.

Demand is considered **elastic** when the elasticity is greater than 1, which means the quantity moves proportionately more than the price.

Demand is considered **inelastic** when the elasticity is less than 1, which means the quantity moves proportionately less than the price.

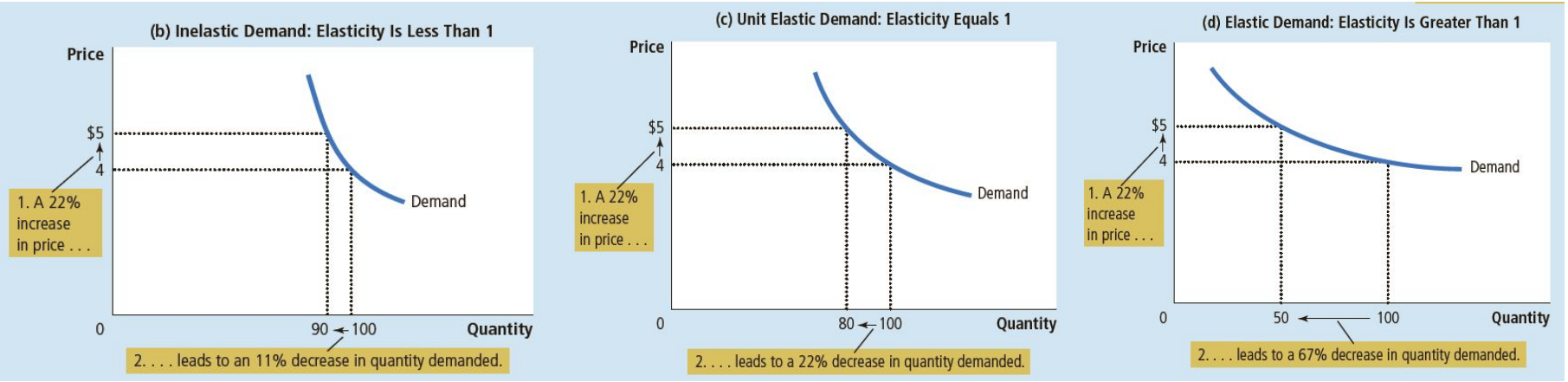
If the elasticity is exactly 1, the percentage change in quantity equals the percentage change in price, and demand is said to have **unit elasticity**.

Elasticity of demand: variety of demand curves



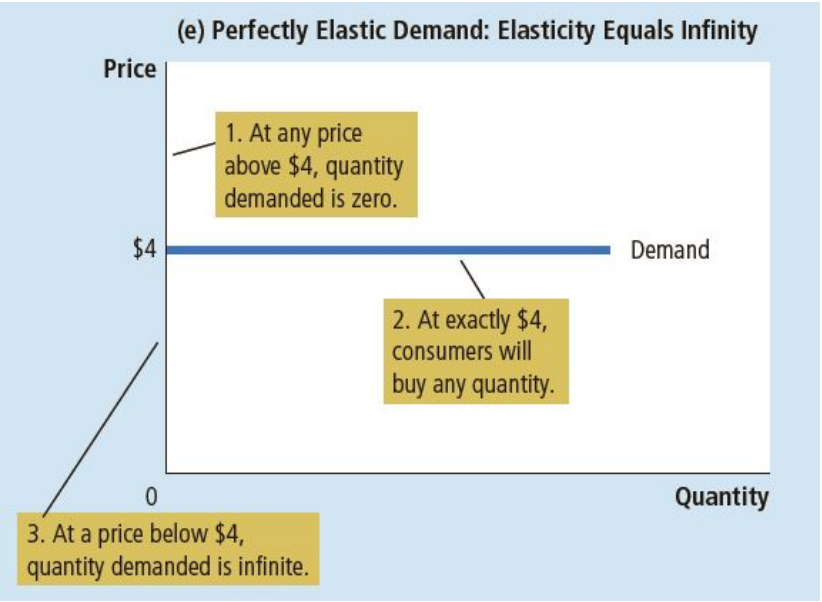
In the extreme case of a zero elasticity, shown in panel (a), demand is perfectly inelastic, and the demand curve is vertical. In this case, regardless of the price, the quantity demanded stays the same.

Elasticity of demand: variety of demand curves



As the elasticity rises, the demand curve gets flatter and flatter, as shown in panels (b), (c), and (d). The flatter the demand curve that passes through a given point, the greater the price elasticity of demand. The steeper the demand curve that passes through a given point, the smaller the price elasticity of demand.

Elasticity of demand: variety of demand curves



Shown in panel (e), demand is perfectly elastic. This occurs as the price elasticity of demand approaches infinity and the demand curve becomes horizontal, reflecting the fact that very small changes in the price lead to huge changes in the quantity demanded.

Elasticity of demand: determinants

Because a demand curve reflects the many economic, social, and psychological forces that shape consumer preferences, there is no simple, universal rule for what determines a demand curve elasticity. Based on experience, however, we can state some rules of thumb about what influences the price elasticity of demand.

Availability of Close Substitutes

Necessities versus Luxuries

Definition of the Market

Time Horizon

Elasticity of demand: determinants

Because a demand curve reflects the many economic, social, and psychological forces that shape consumer preferences, there is no simple, universal rule for what determines a demand curve elasticity. Based on experience, however, we can state some rules of thumb about what influences the price elasticity of demand.

Availability of Close Substitutes

Goods with close substitutes tend to have more elastic demand because it is easier for consumers to switch from that good to others.

Elasticity of demand: determinants

Because a demand curve reflects the many economic, social, and psychological forces that shape consumer preferences, there is no simple, universal rule for what determines a demand curve elasticity. Based on experience, however, we can state some rules of thumb about what influences the price elasticity of demand.

Necessities versus Luxuries

Necessities tend to have inelastic demands, whereas luxuries have elastic demands. However, Whether a good is a necessity or a luxury depends not on the intrinsic properties of the good but on the preferences of the buyer.

Elasticity of demand: determinants

Because a demand curve reflects the many economic, social, and psychological forces that shape consumer preferences, there is no simple, universal rule for what determines a demand curve elasticity. Based on experience, however, we can state some rules of thumb about what influences the price elasticity of demand.

Definition of the Market

The elasticity of demand in any market depends on how we draw the boundaries of the market. Narrowly defined markets tend to have more elastic demand than broadly defined markets because it is easier to find close substitutes for narrowly defined goods.

Elasticity of demand: determinants

Because a demand curve reflects the many economic, social, and psychological forces that shape consumer preferences, there is no simple, universal rule for what determines a demand curve elasticity. Based on experience, however, we can state some rules of thumb about what influences the price elasticity of demand.

Time Horizon

Goods tend to have more elastic demand over longer time horizons.

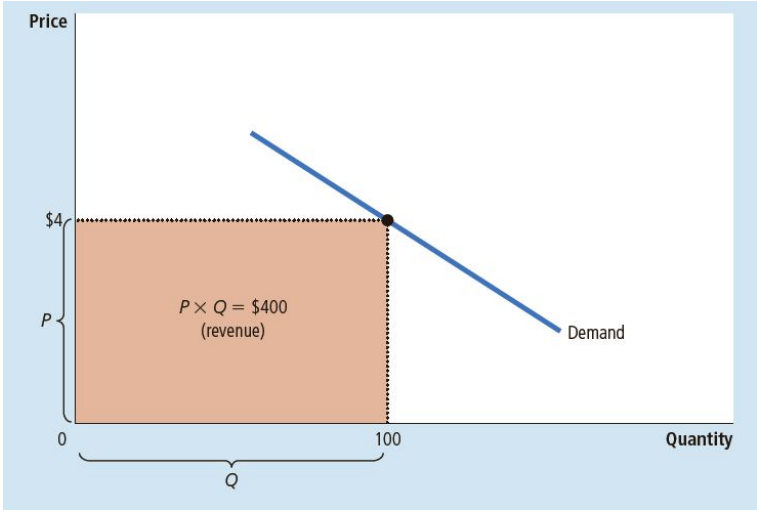
Relate to the gas price increase effect on its demand.

Elasticity of demand and total revenue

Total revenue, the amount paid by buyers and received by sellers of a good. In any market, total revenue is PxQ, the price of the good times the quantity of the good sold. The height of the box under the demand curve is P, and the width is Q. The area of this box, PxQ, equals the total revenue in this market. Where P=$4 and Q=100, total revenue is $4x100, or $400.

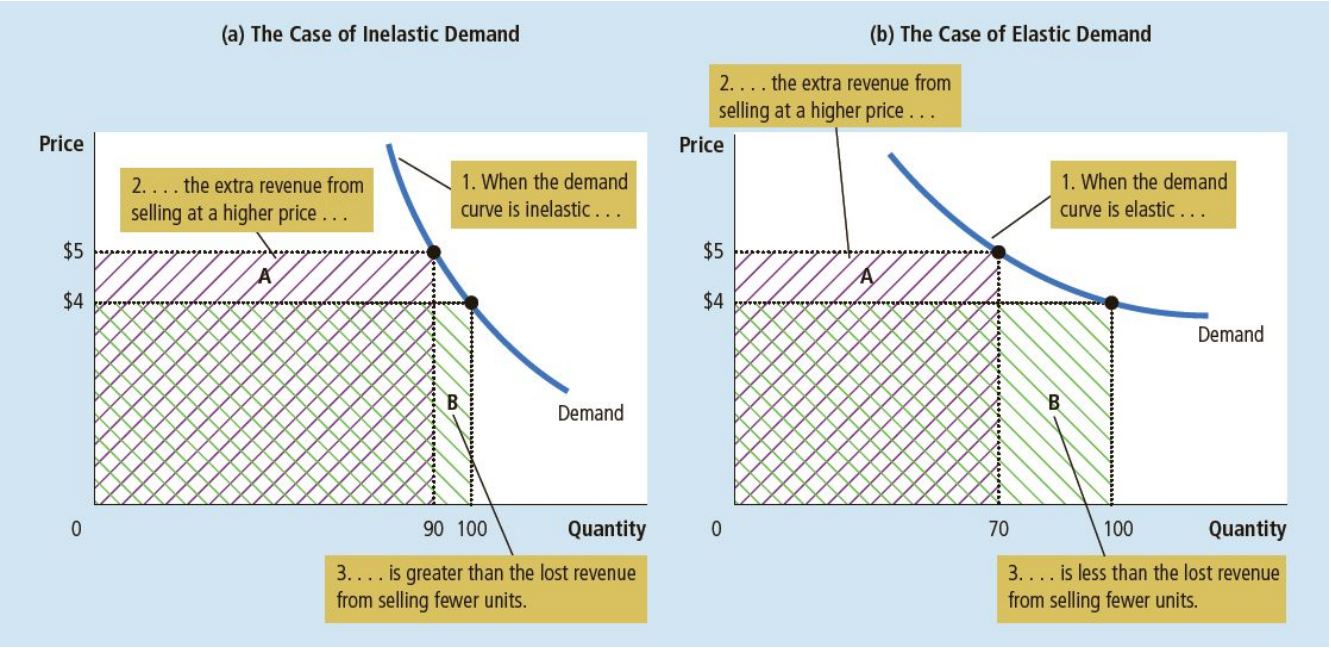
How does total revenue change as one moves along the demand curve?

- When demand is inelastic (a price elasticity less than 1), price and total revenue move in the same direction: If the price increases, total revenue also increases.
- When demand is elastic (a price elasticity greater than 1), price and total revenue move in opposite directions: If the price increases, total revenue decreases.
- If demand is unit elastic (a price elasticity exactly equal to 1), total revenue remains constant when the price changes.



Elasticity of demand and total revenue

How does total revenue change as one moves along the demand curve?



Panel a: an increase in the price from $4 to $5 causes the quantity demanded to fall from 100 to 90. Total revenue rises from $400 to $450.

Panel b: an increase in the price from $4 to $5 causes the quantity demanded to fall from 100 to 70. Total revenue falls from $400 to $350.

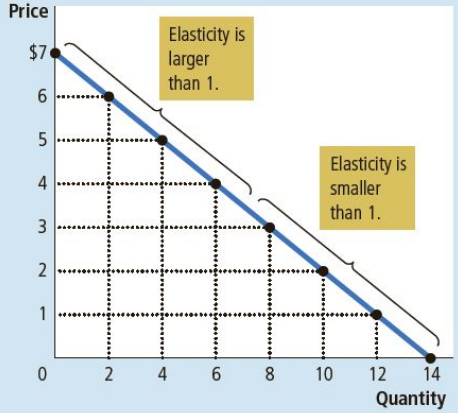
Elasticity of demand and total revenue

How does total revenue change as one moves along the demand curve?

How elasticity varies along a linear demand curve, as shown in the Figure. We know that a straight line has a constant slope. Slope is defined as "rise over run," which here is the ratio of the change in price ("rise") to the change in quantity ("run"). This particular demand curve's slope is constant because each $1 increase in price causes the same 2-unit decrease in the quantity demanded.

Even though the slope of a linear demand curve is constant, the elasticity is not. This is true because the slope is the ratio of changes in the two variables, whereas the elasticity is the ratio of percentage changes in the two variables.

Price	Quantity	Total Revenue (Price × Quantity)	Percentage Change in Price	Percentage Change in Quantity	Elasticity	Description
$7	0	$0				
			15	200	13.0	Elastic
6	2	12				
			18	67	3.7	Elastic
5	4	20				
			22	40	1.8	Elastic
4	6	24				
			29	29	1.0	Unit elastic
3	8	24				
			40	22	0.6	Inelastic
2	10	20				
			67	18	0.3	Inelastic
1	12	12				
			200	15	0.1	Inelastic
0	14	0				



Income elasticity of demand

The income elasticity of demand measures how the quantity demanded changes as consumer income changes. It is calculated as the percentage change in quantity demanded divided by the percentage change in income.

$$\text{income elasticity of demand} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

Normal goods: Higher income raises the quantity demanded. Because quantity demanded and income move in the same direction, normal goods have positive income elasticities. **Inferior goods:** Higher income lowers the quantity demanded. Because quantity demanded and income move in opposite directions, inferior goods have negative income elasticities.

Necessities, tend to have small income elasticities because consumers choose to buy some of these goods even when their incomes are low. **Luxuries**, tend to have large income elasticities because consumers feel that they can do without these goods altogether if their incomes are too low.




Cross-price elasticity of demand

The cross-price elasticity of demand measures how the quantity demanded of one good responds to a change in the price of another good. It is calculated as the percentage change in quantity demanded of good 1 divided by the percentage change in the price of good 2.

$$\text{cross-price elasticity of demand} = \frac{\text{percentage change in quantity demanded of good 1}}{\text{percentage change in the price of good 2}}$$

The cross-price elasticity is a positive or negative number depends on whether the two goods are **substitutes or complements.**
Substitutes are goods that are typically used in place of one another, **the cross-price elasticity is positive.**
Complements, the cross-price elasticity is negative, indicating that an increase in the price of good 2 reduces the quantity of good 1 demanded.

Elasticity of supply

The price elasticity of supply measures how much the quantity supplied responds to changes in the price. Supply of a good is said to be elastic if the quantity supplied responds substantially to changes in the price. Supply is said to be inelastic if the quantity supplied responds only slightly to changes in the price.

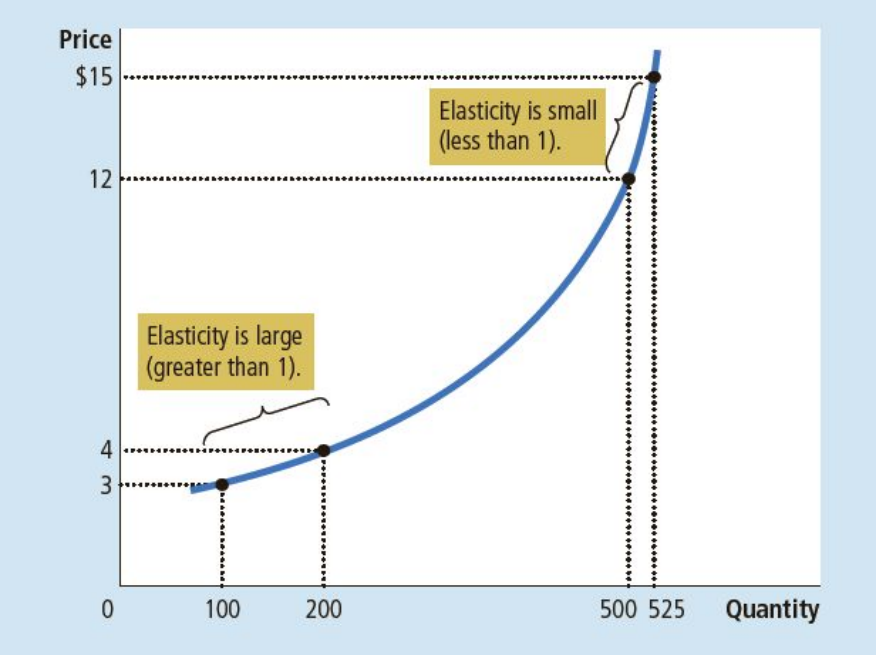
The price elasticity of supply depends on the flexibility of sellers to change the amount of the good they produce.

Supply is usually more elastic in the long run than in the short run. Over short periods of time, firms cannot easily change the size of their factories to make more or less of a good. Thus, in the short run, the quantity supplied is not very responsive to the price. Over longer periods of time, firms can build new factories or close old ones. In addition, new firms can enter a market, and old firms can exit. Thus, in the long run, the quantity supplied can respond substantially to price changes.

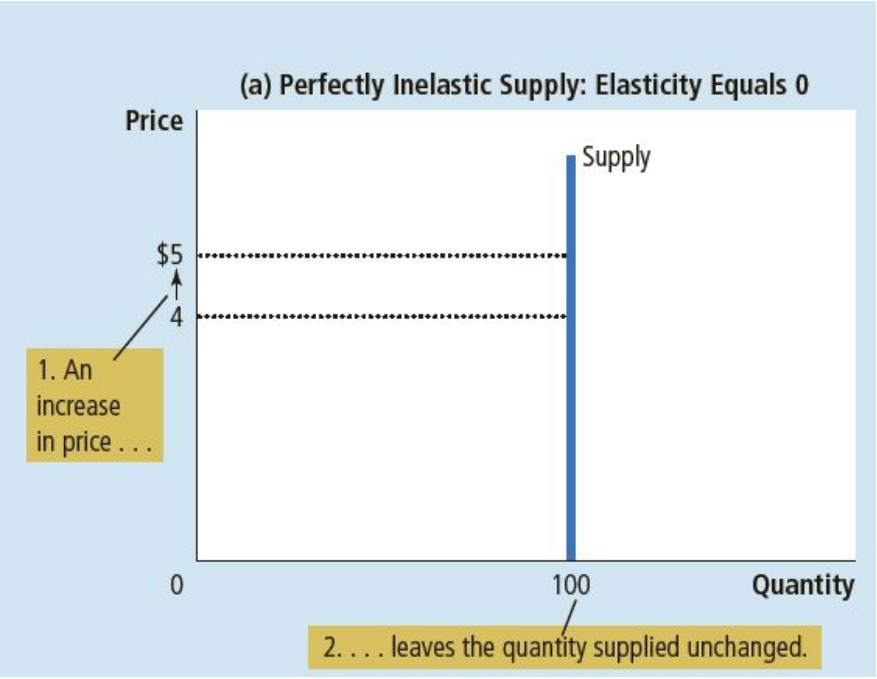
$$\text{price elasticity of supply} = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}}$$

Elasticity of supply How the Price Elasticity of Supply Can Vary

Because firms often have a maximum capacity for production, the elasticity of supply may be very high at low levels of quantity supplied and very low at high levels of quantity supplied. Here an increase in price from $3 to $4 increases the quantity supplied from 100 to 200. Because the 67 percent increase in quantity supplied (computed using the midpoint method) is larger than the 29 percent increase in price, the supply curve is elastic in this range. By contrast, when the price rises from $12 to $15, the quantity supplied rises only from 500 to 525. Because the 5 percent increase in quantity supplied is smaller than the 22 percent increase in price, the supply curve is inelastic in this range.

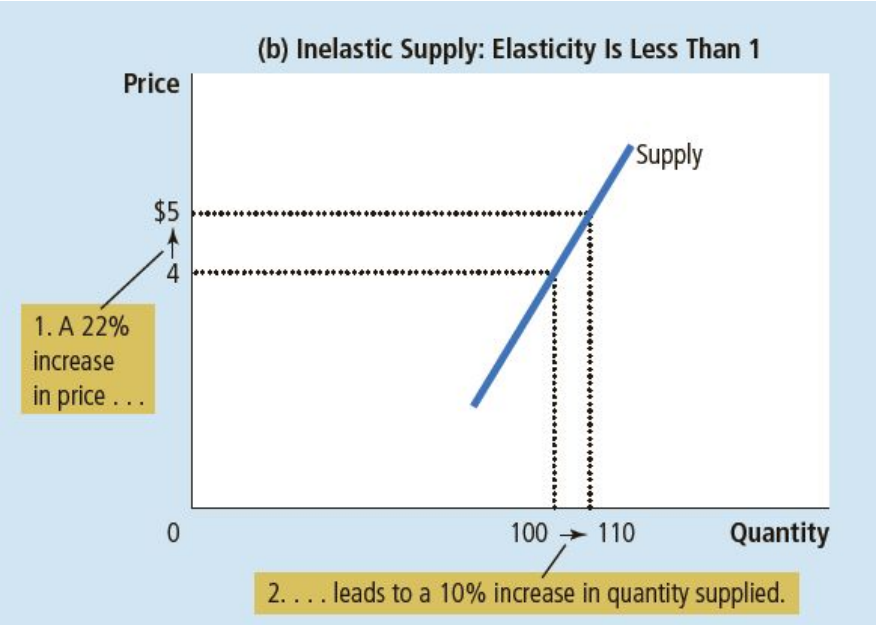


Elasticity of supply How the Price Elasticity of Supply Can Vary

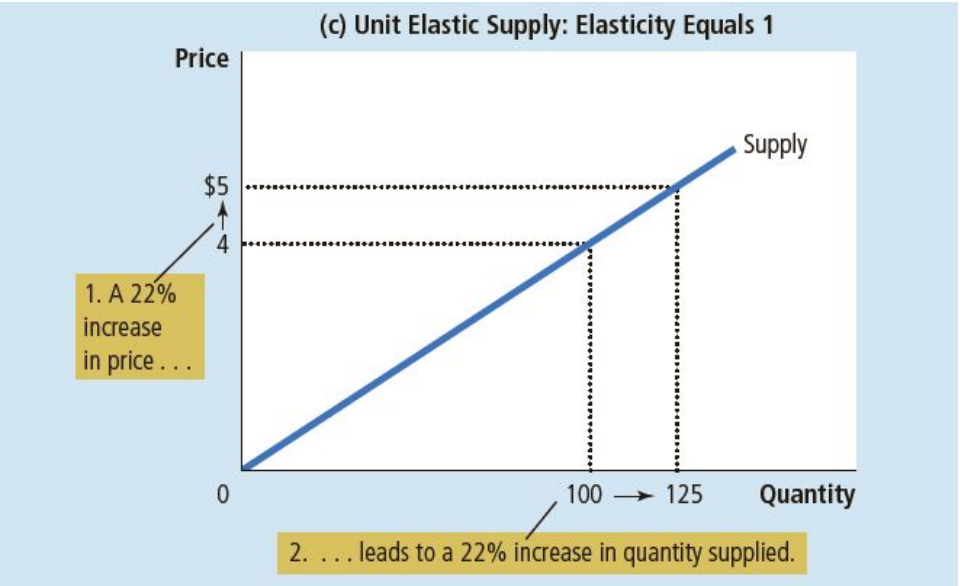


In the extreme case of zero elasticity, as shown in panel (a), supply is perfectly inelastic and the supply curve is vertical. In this case, the quantity supplied is the same regardless of the price. As the elasticity rises, the supply curve gets flatter, which shows that the quantity supplied responds more to changes in the price.

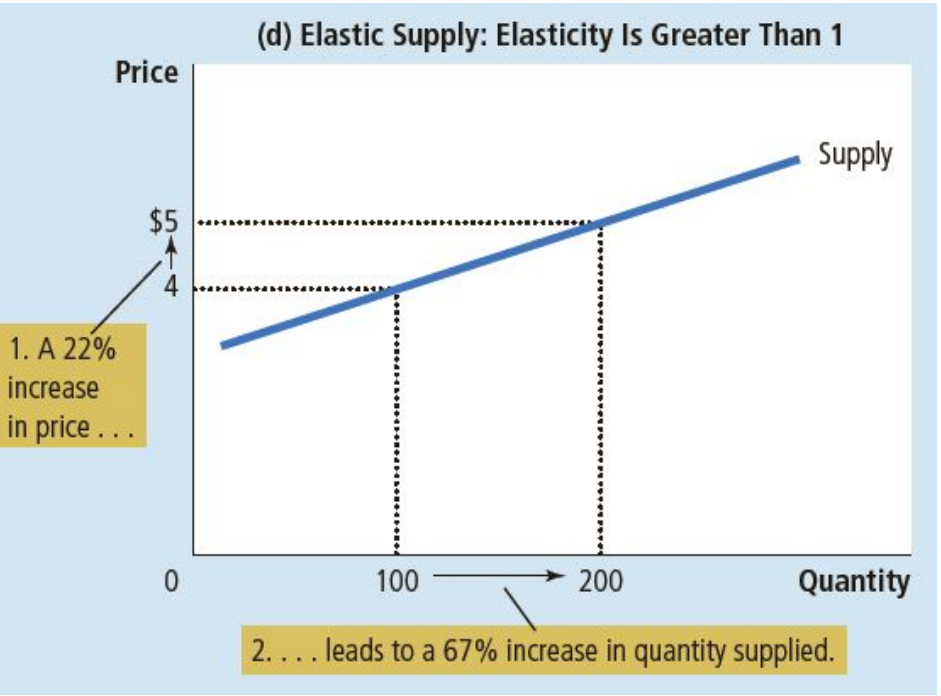
Elasticity of supply How the Price Elasticity of Supply Can Vary



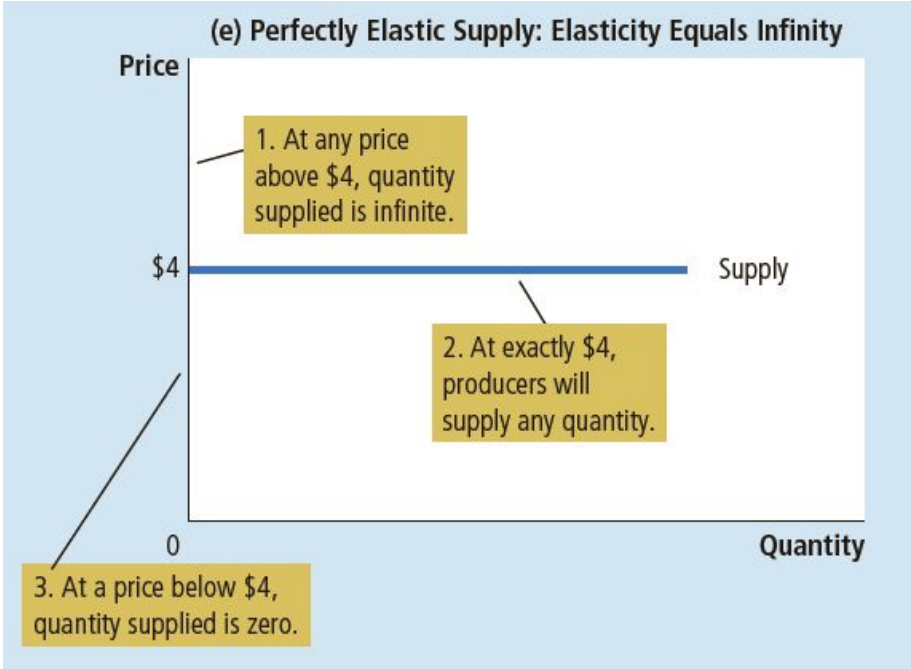
Elasticity of supply How the Price Elasticity of Supply Can Vary



Elasticity of supply How the Price Elasticity of Supply Can Vary



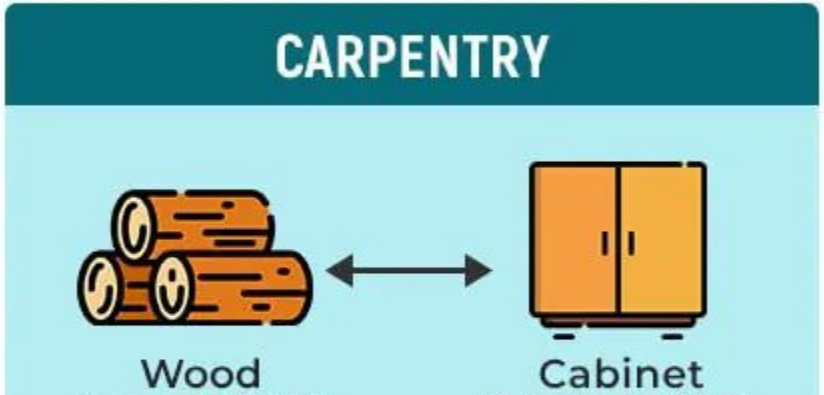
Elasticity of supply How the Price Elasticity of Supply Can Vary

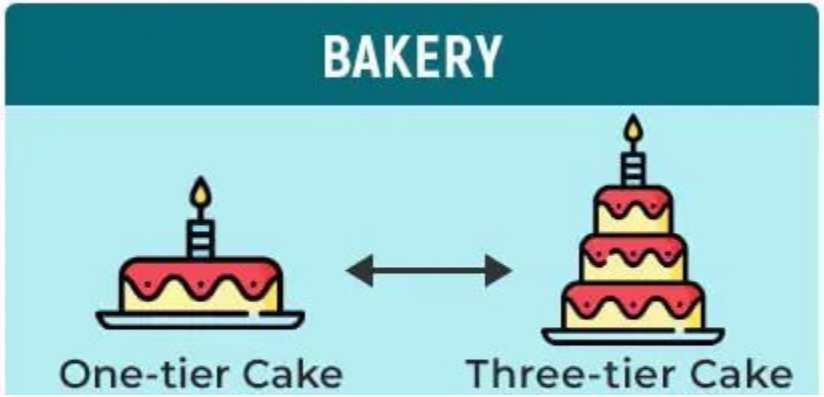


Elasticity of supply **which one is inelastic/elastic**

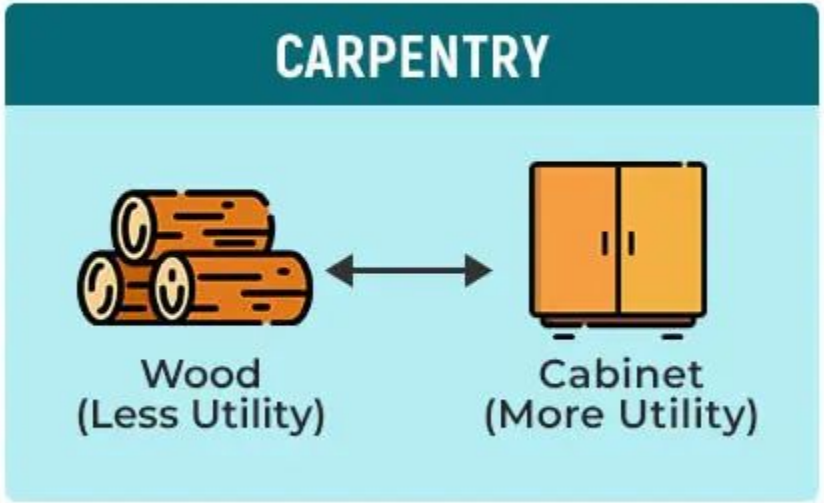
Elasticity of supply **which one is inelastic/elastic**

Let us choose…





Which one is more useful?



Utility: concept

A prominent school of thought in political philosophy is **utilitarianism**. The founders of utilitarianism are the English philosophers Jeremy Bentham (1748–1832) and John Stuart Mill (1806–1873). To a large extent, the goal of utilitarians is to apply the logic of individual decision making to questions concerning morality and public policy.

The starting point of utilitarianism is the notion of **utility**—the level of happiness or satisfaction that a person receives from his circumstances. Utility is a measure of well-being and, according to utilitarians, is the ultimate objective of all public and private actions. The proper **goal of the government, they claim, is to maximize the sum of utility achieved by everyone in society**.

The utilitarian case for redistributing income is based on **the assumption of diminishing marginal utility**. It seems reasonable that an extra dollar of income provides a poor person with more additional utility than an extra dollar would provide to a rich person. In other words, **as a person's income rises, the extra well-being derived from an additional dollar of income falls**. This plausible assumption, together with the utilitarian goal of maximizing total utility, implies that the government should try to achieve a more equal distribution of income.

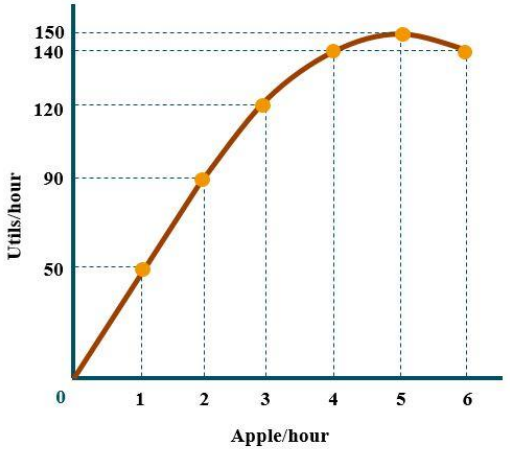
Total and marginal utility

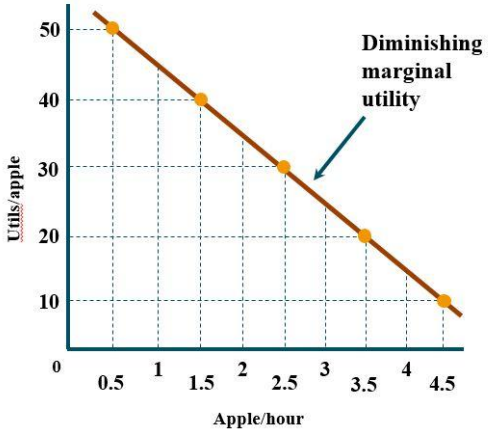
- Total utility (TU)
- The level of happiness derived from consuming the good
- Marginal utility (MU)
- The additional utility that is received when an additional unit of a good is consumed

$$\text{Marginal utility} = \frac{\text{change in total utility}}{\text{change in quantity}}$$

Total and marginal utility

Apple quantity (apple/hour)	Total utility (utils/hour)	Marginal utility (utils/apple)
0	0	—
1	50	50
2	90	40
3	120	30
4	140	20
5	150	10
6	140	-10





Diamond-water paradox

- As noted by Adam Smith, water is essential for life and has a low market price (often a price of zero) while diamonds are not as essential yet have a very high market price.
- Smith's explanation: "value in use" vs. "value in exchange"
- Water has the greatest value in use but little value in exchange.
- Value in use = total utility
- Value in exchange (price) = marginal utility
- Goods have both total and marginal utility.
- Total utility of water is high while the total utility of diamond is low.
- The marginal utility of water is low while the marginal utility of diamond is high.
- In economics the tail wags the dog. It is the tail of MU that wags the dog of prices.

Diminishing marginal utility and consumer equilibrium

The marginal utility of any good is the increase in utility that the consumer gets from an additional unit of that good. Most goods are assumed to exhibit diminishing marginal utility : The more of the good the consumer already has, the lower the marginal utility provided by an extra unit of that good.

The marginal rate of substitution between two goods depends on their marginal utilities. For example, if the marginal utility of good X is twice the marginal utility of good Y, then a person would need 2 units of good Y to compensate for losing 1 unit of good X, and the MRS equals 2. $MRS = P_X/P_Y$.

Utility analysis provides another way to describe consumer optimization. At the consumer's optimum, the marginal rate of substitution equals the ratio of prices. Optimization condition is,

$$MU_X/MU_Y = P_X/P_Y. \qquad MU_X/P_X = MU_Y/P_Y.$$

A consumer is in equilibrium when he or she derives the same marginal utility per dollar for all goods.

Two reasons: substitution effect and income effect.

Diminishing marginal utility and consumer equilibrium

$$\frac{MU_{Pizza}}{P_{Pizza}} = \frac{MU_{Coke}}{P_{Coke}}$$

Spending on pizza + Spending on Coke = Amount available to be spent