Microeconomics

Venkata Khandrika

Contents

1 Foundations of Economics

1.1 Fundamental Problem of Economics

Human beings have many wants and needs. The physical objects they want or need are called *goods* (e.g., food, clothing, books), while the non-physical activities are called *services* (e.g., education, health care, entertainment).

The study of economics arises because people's needs and wants are unlimited, but the *resources* needed to satisfy them are limited. Resources are inputs used to produce goods and services, and for this reason are also known as *factors of production*. Factors of production do not exist in abundance; they are *scarce*.

Definition 1.1: Scarcity

Scarcity is the situation in which available resources, or factors of production, are finite, whereas wants are infinite. There are not enough resources to produce everything that human beings need and want.

As a result of scarcity, choices need to be made. Resource scarcity forces society to make a choice between available alternatives. Another important consequence of scarcity is avoiding waste in using resources. If resources are not used effectively and are wasted, they will end up producing less. Finally, scarcity gives rise to *opportunity cost*.

Definition 1.2: Opportunity Cost

Opportunity cost is defined as the value of the next best alternative that must be given up or sacrificed in order to obtain something else.

When a consumer chooses to use her \$100 to buy a pair of shoes, she is also choosing not to use this money to buy books. The foregone books are the opportunity cost.

1.2 Assumptions in Model-Building

Economists primarily make two assumptions when building models:

1. Ceteris Paribus

2. Rational Agents

Definition 1.3: Ceteris Paribus

A Latin expression that means 'other things equal'. In the context of economics, it is saying that all other things are assumed to be constant or unchanging in order to study the effect of one independent variable on a dependent variable.

Definition 1.4: Rational Agents

Rational economic decision-making. This means that individuals are assumed to act in their best self-interest, trying to maximise (make as large as possible) the satisfaction they expect to receive from their decisions.

1.3 What is Microeconomics?

Definition 1.5: Microeconomics

Microeconomics is concerned with the behaviour of consumers, firms and resource owners, who are the most important economic decision-makers in a market economy.

2 Demand and Supply

2.1 What is a Market?

It is easiest to understand what a market is and how it works by dividing individual economic units into two broad groups, according to function, *buyers* and *sellers*. Buyers purchase goods and services. Usually, there are two types of buyers: consumers and firms. Consumers purchase regular goods and services while firms purchase labor, capital, and raw materials that they use to produce goods and services. Sellers sell goods and services. Usually, there are three types of sellers: firms, resource owners, and workers. Firms sell their goods and services, resource owners rent land or sell mineral resources to firms, and workers sell their labor services.

Definition 2.1: Market

A market is an arrangement where buyers and sellers meet to carry out an exchange which determines the price of a product.

2.2 Competitive and Non-Competitive Markets

A *perfectly competitive market* has many buyers and sellers, so that no single buyer or seller has any impact on price. Most agricultural markets are close to being perfectly competitive. This should be contrasted with *market power* (a.k.a *monopoly power*), which refers to the control that a seller has over the price of the product they sell. To make analysis easier, we begin the study of microeconomics by assuming perfectly competitive markets.

Some markets contain many producers but are *non-competitive*; that is, individual firms can jointly affect the price. The world oil market is one such example. Since the early 1970s, that market has been dominated by the OPEC cartel.

2.3 Demand

Definition 2.2: Demand

The demand represents how much of a good consumers are *willing* and *able* to buy at different possible prices in a particular time period.

There are two keywords in the definition; willing and able. 'Willing' means that consumers want to buy the product. 'Able' means they can afford the product. For instance, consider the demand for Ferraris. You may want to buy a Ferrari, but can you afford it? If not, your desire to buy one will not show up as demand for Ferraris. The demand for a product is usually represented by a curve with the possible prices on the y-axis and the quantity demanded on the x-axis.

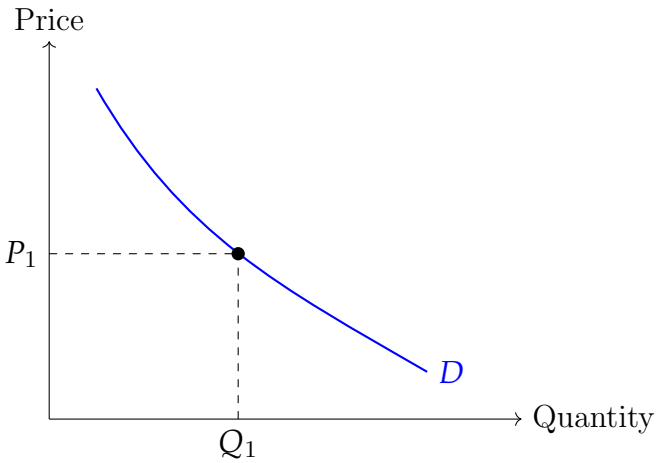


Figure 1: Demand Curve

2.3.1 Why Does the Demand Curve Slope Downward?

There are two explanations for the downward slope of the demand curve:

1. Law of Demand
2. Law of Diminishing Marginal Benefit

Definition 2.3: Law of Demand

There exists a negative causal relationship between price and quantity demanded. As the price of a good decreases, the quantity of the good demanded increases, ceteris paribus.

Definition 2.4: Law of Diminishing Marginal Benefit

Consumers buy goods because it provides them with some benefit or satisfaction known as *utility*. The greater the quantity of a good consumed, the greater the utility. However, the extra benefit provided by each additional unit increases by smaller and smaller amounts. The extra benefit that you get from each additional unit of something you buy is called the *marginal benefit* or *marginal utility* (marginal means extra or additional). Since each successive unit of the good you consume produces less and less benefit, you will be willing to buy each extra unit only if it has a lower and lower price.

2.3.2 Non-Price Determinants of Demand

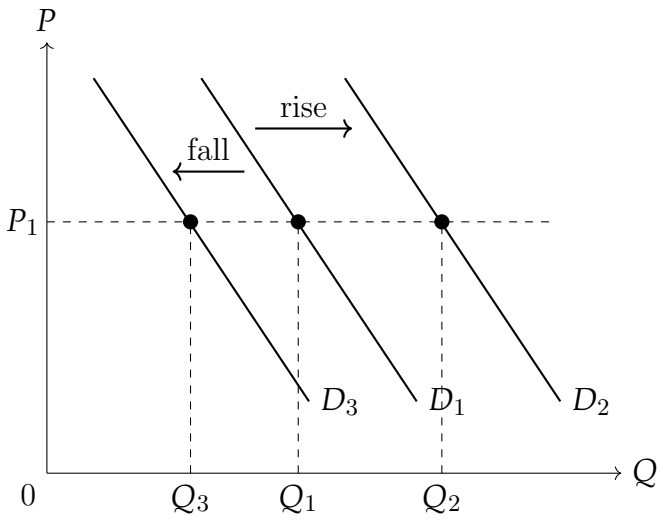


Figure 2: Shift in Demand

The non-price determinants of demand are factors other than price which influence demand. These are the factors assumed to be constant by the ceteris paribus assumption in the law of demand. Changes in the determinants of demand cause shifts in the demand curve; the entire demand curve moves to the right or left. The factors that cause a shift in the demand curve are:

1. Income (Normal Goods)
2. Income (Inferior Goods)
3. Preferences
4. Price of Substitute Goods
5. Price of Complementary Goods
6. Demographic Changes

Definition 2.5: Normal Goods

A good is a normal good when demand for it increases in response to an increase in consumer income. Most goods are normal goods.

Definition 2.6: Inferior Goods

A good is an inferior good when demand for it decreases in response to an increase in consumer income. Examples of inferior goods are second-hand clothes, used cars, and bus tickets.

Definition 2.7: Substitute Goods

Goods are substitutes when an increase in the price of one leads to an increase in the quantity demanded of the other. Coca-cola and Pepsi are examples of substitute goods.

Definition 2.8: Complementary Goods

Goods are complements when an increase in the price of one leads to a decrease in the quantity demanded of the other. Petroleum and automobiles are examples of complementary goods.

It is important to distinguish between movements on or along a demand curve, and shifts of a demand curve. Whenever the price of a good changes, ceteris paribus, it leads to a movement along the demand curve, this is called *change in quantity demanded*. By contrast, any change in a non-price determinant of demand results in a shift in the entire demand curve, this is called a *change in demand*. To distinguish between these two changes, different terminology is used. The phrase *change in demand* refers to shifts in the demand curve, while the phrase *change in the quantity demanded* refers to movements along the demand curve.

2.4 Supply

Definition 2.9: Supply

The supply represents how much of a good producers are *willing* and *able* to produce at different possible prices in a particular time period.

The supply of a product is usually represented by a curve with the possible prices on the y-axis and the quantity supplied on the x-axis.

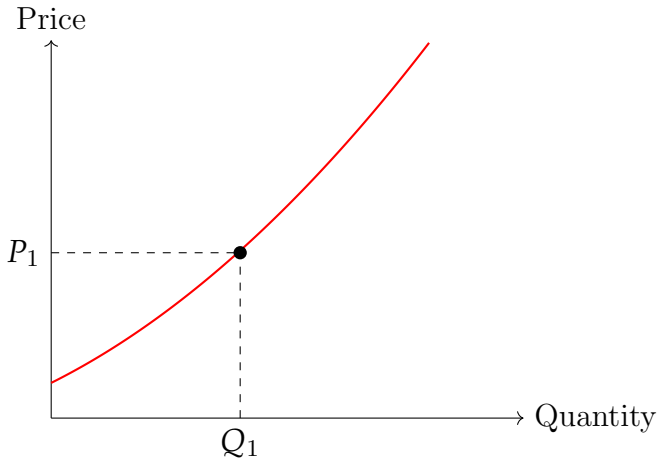


Figure 3: Supply Curve

2.4.1 Why Does the Supply Curve Slope Upward?

Higher prices generally mean that a firm's profits increase, and so the firm faces an incentive to produce more output. Lower prices mean lower profitability, and the incentive facing the firm is to produce less. Therefore, there results a positive relationship between price and quantity supplied: the higher the price, the greater the quantity supplied.

2.4.2 Vertical Supply Curve

While it is true that the supply curve generally slopes upward, a few important exceptions remain wherein the supply curve is vertical.

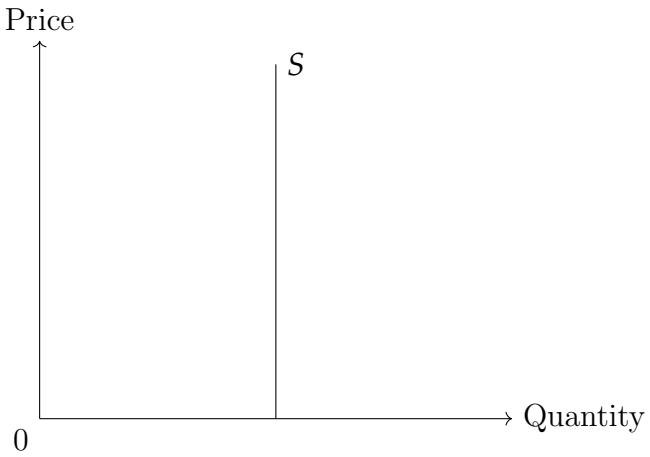


Figure 4: Supply Curve

Consider a movie theatre. No matter what happens, the number of people a theatre can accomodate remains fixed. No matter how high the price, it is not possible to increase the number of seats in a short period of time. Another example for this is original antiques and paintings. There is a fixed quantity of the good because there is no possibility of ever producing more of it.

2.4.3 Non-Price Determinants of Supply

1. Cost of Resources
2. Technology
3. Taxes
    - A *tax* is a mandatory fee levied on individuals and firms by the government to improve infrastructure and quality of life
    - Therefore, the imposition of a new tax (or an increase of an existing tax) is equivalent to an increase in production cost
4. Subsidies
    - A *subsidy* is a payment made to a firm by the government, and so has the opposite effect of a tax
    - The introduction of a subsidy (or an increase of an existing subsidy) is equivalent to a fall in production costs
5. Price of Related Goods (Competitive Supply)
    - Competitive supply of two products refers to them competing for the use of the same resources, and producing more of one means producing less of the other
    - For example, a farmer, who can grow wheat or corn, chooses to grow wheat. If the price of corn increases, the farmer may switch to corn production as this is now more profitable, resulting in a fall in wheat supply and a leftward shift of the supply curve
6. Price of Related Goods (Joint Supply)
    - Joint supply of two or more products refers to production of goods that are derived from a single product. Hence, it is not possible to produce more of either product without producing more of its source

- For example, butter and skimmed milk are both produced from whole milk; petrol and diesel are produced from crude oil

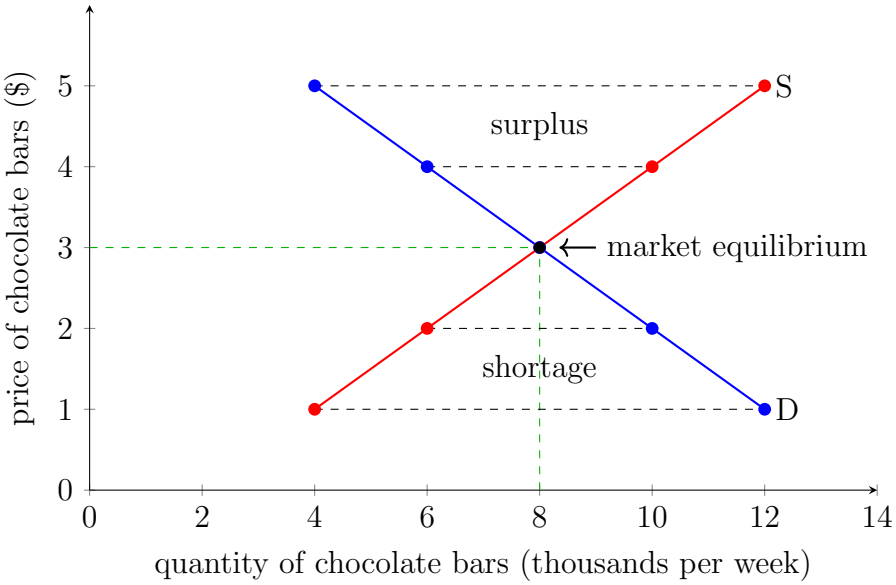
7. Number of Firms
8. 'Shocks' or Unpredictable Events
9. Producer Expectations

Similar to demand, any change in price produces a *change in quantity supplied*, shown as a movement on the supply curve. Any change in a determinant of supply (other than price) produces a *change in supply*, represented by a shift of the whole supply curve.

2.5 Market Equilibrium

Until now, market demand and market supply have been considered separately to show the quantities consumers and firms are willing and able to buy and sell at each price. However, this is not how much they actually buy and sell. Consider the following *demand and supply schedule* showing various prices and the quantities of chocolate bars bought and sold at those prices:

Price of chocolate bars ($)	**Quantity of chocolate bars demanded (per week)**	**Quantity of chocolate bars supplied (per week)**
5	4000	12000
4	6000	10000
3	8000	8000
2	10000	6000
1	12000	4000



Here, there are three important observations:

1. There is only one price at which the quantity demanded is equal to the quantity supplied: \$3. Here, the quantity demanded (Q_d) is 8000 units and quantity supplied (Q_s) is also 8000 units.

2. At a higher price, say \$4, quantity supplied (10000 bars) is greater than quantity demanded (6000 bars). Hence, there is a *surplus* (*excess supply*) of 4000 bars.

3. At a lower price, say \$2, quantity demanded (10000 bars) is larger than quantity supplied (6000 bars). Hence, there is a *shortage* (*excess demand*) of 4000 bars.

Suppose that the price is initially \$5. What will happen? If the price is \$5, then Q_d is 4000 bars while the Q_s is 12000 bars. There is a surplus of 8000 bars. With unsold output of 8000 bars, producers will lower prices to encourage consumers to buy more. As the price falls, Q_d becomes larger. Furthermore, there is downward pressure on the price which falls until Q_d equals Q_s and the surplus is eliminated. The opposite happens if the price is initially \$1. The producers notice that the supply is quickly sold, and so they begin raising the prices.

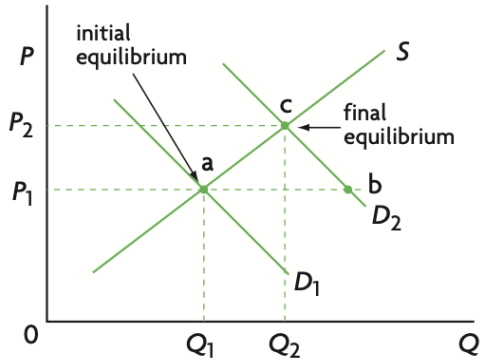
It is, therefore, imperative to understand that the existence of a shortage or surplus in a free market will cause the price to change so that Q_d is equal to Q_s.

Definition 2.10: Market Equilibrium

Equilibrium is a market phenomenon wherein the quantity demanded is equal to the quantity supplied (Q_d equals Q_s) and there is no tendency for the price to change. In a *market disequilibrium*, there is excess demand (shortage) or excess supply (surplus), and the forces of demand and supply cause the price to change until the market reaches equilibrium.

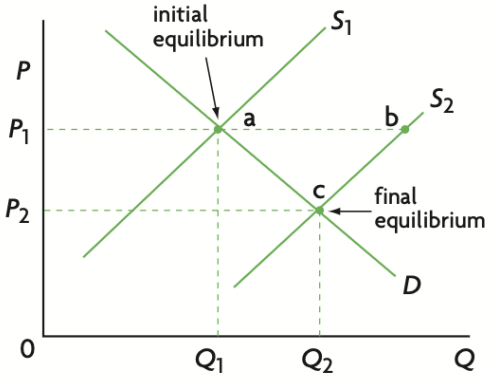
2.5.1 Changes in Market Equilibrium

1. Increase in Demand

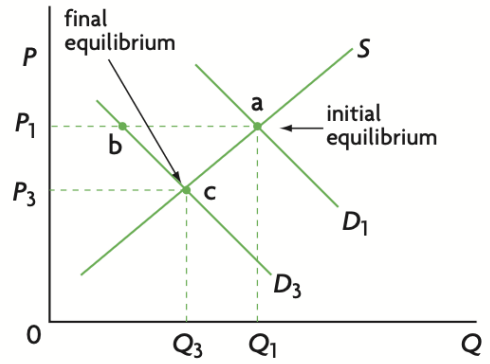


Initially, the market is in equilibrium at point A. Then, a change in a non-price determinant of demand causes an increase in demand shifting the demand curve to the right. As demand increases and price remains the same, there is a shift to point B. There is excess demand (equal to $b-a$) at the current price P_1. Point B is a disequilibrium which causes a shortage, thus exerting upward pressure on price. Hence, the price increases causing a movement along D_2 and the excess demand is eliminated. Finally, the market reaches equilibrium at point C. At C, there is a higher equilibrium quantity (Q_2) and a higher equilibrium price (P_2).

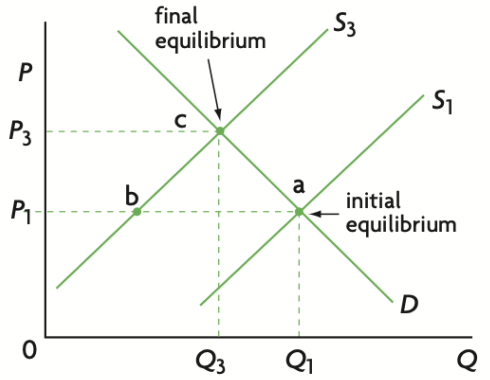
2. Increase in Supply



3. Decrease in Demand



4. Decrease in Supply



2.6 Linear Demand and Supply Functions

2.6.1 Linear Demand Function and Its Graph

A demand function has the form:

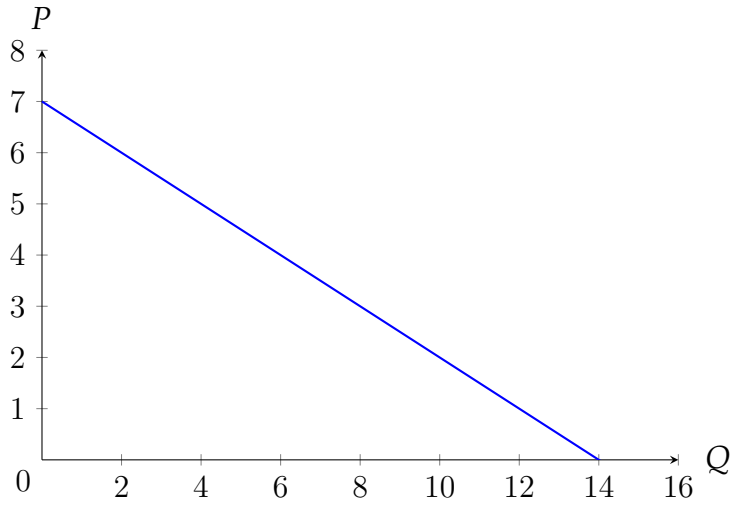
$$Q_d = a - bP$$

where Q_d is the quantity demanded, a is the *x-intercept*, b is the slope, and P is the price.

Note that a is the *x-intercept* not the *y-intercept* and it represents all the variables that are held constant under the ceteris paribus assumption, i.e. the non-price determinants of demand.

The slope is calculated as: $\Delta Q_d \div \Delta P$. It's interpretation is that for every 1 unit change in the price (P), the quantity demanded (Q_d) changes by b units.

Suppose that the demand function $Q_d = 14 - 2P$ is given. It can be plotted as:



Now, we can analyse the parameters a and b. Firstly, a represents the non-price determinants of demand. Therefore, if there is a change in any of the non-price determinants of demand (a), then the curve will shift left or right parallelly.

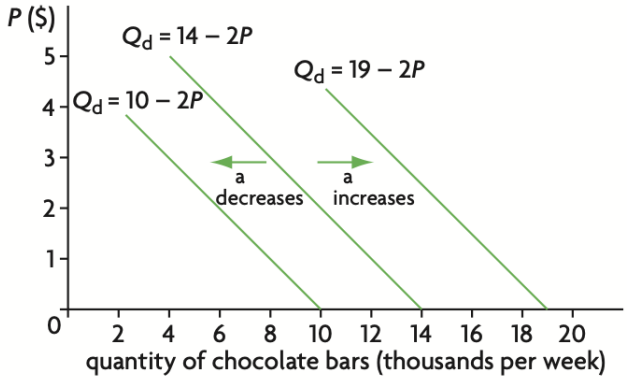


Figure 5: Change in a causing a shift of the demand curve

Finally, b represents the slope of the demand curve. The demand curve becomes flatter as the absolute value of b increases. Why? Shouldn't it become steeper? No. It needs to be understood that the graph is not of the form $y = mx + c$, it is of the form $x = a - by$. When the absolute value of b increases from b_1 to b_2, it means that for a 1 unit change in price, the quantity demanded now changes by b_2 units rather than b_1 units where $|b_2| > |b_1|$; Q_d changes by an amount more than before.
Consider the following example where the demand function changes from $Q_d = 14 - 2P$ to $Q_d = 14 - 4P$:

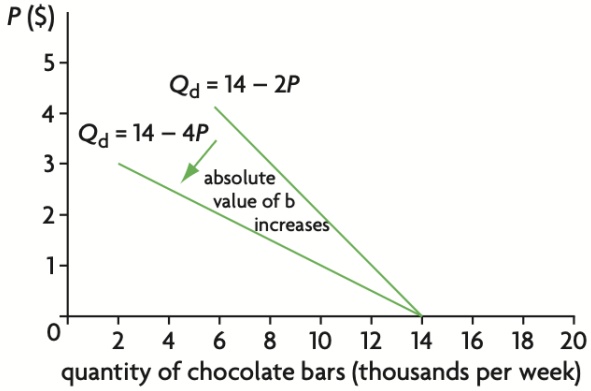


Figure 6: Change in b causing a change in the slope of the demand curve

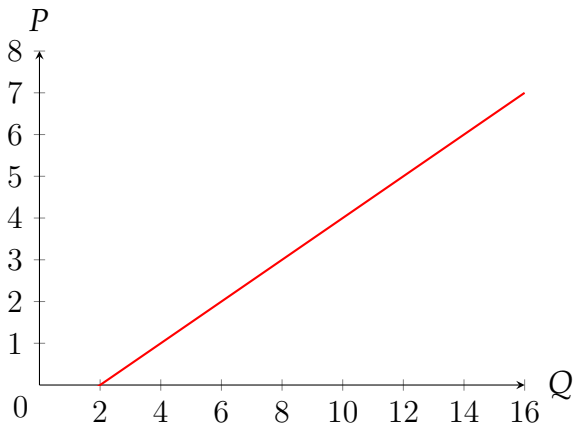
2.6.2 Linear Supply Function and Its Graph

The supply function has the form:

$$Q_s = c - dP$$

where Q_s is the quantity supplied, c is the *x-intercept*, d is the slope, and P is the price.

Suppose the supply function $Q_s = 2 + 2P$ is given. It can be plotted as:



Here, the parameters c and d represent the same things as a and b in the demand function. Firstly, c is the *x-intercept* and represents all of the non-price determinants of supply. If there is a change in any of the non-price determinants of supply, then c changes and this causes a shift of the supply curve left or right parallelly.

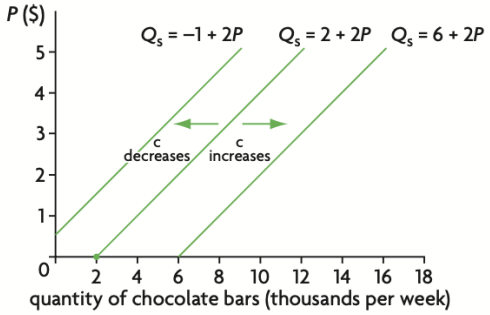


Figure 7: Change in c causing a shift of the supply curve

Then, d is the slope of the supply curve. The supply curve becomes flatter as the absolute value of d increases. Why? Shouldn't it become steeper? No. It needs to be understood that the graph is not of the form $y = mx + c$, it is of the form $x = a - by$. When the absolute value of d increases from d_1 to d_2, it means that for a 1 unit change in price, the quantity demanded now changes by d_2 units rather than d_1 units where $|d_2| > |d_1|$; Q_s changes by an amount more than before for the same change in price.

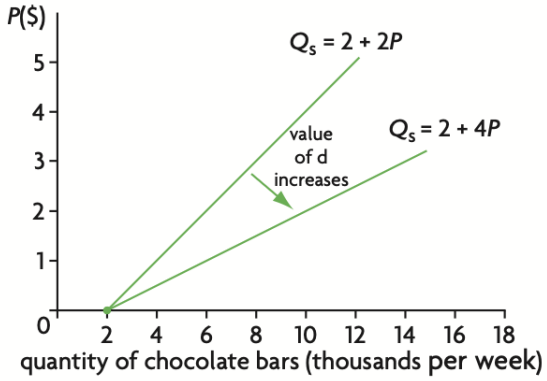


Figure 8: Change in d causing a change in the slope of the supply curve

2.6.3 Market Equilibrium

The demand and supply functions can be combined to find market equilibrium:

$$Q_d = 14 - 2P$$
$$Q_s = 2 + 2P$$

$$\boxed{\text{Equilibrium Condition: } Q_d = Q_s}$$

$$14 - 2P = 2 + 2P \Rightarrow 4P = 12 \Rightarrow P^* = 3$$

$$Q^* = 14 - 2(3) = 2 + 2(3) \Rightarrow Q^* = 8$$

2.7 Market Efficiency

Definition 2.11: Allocative Efficiency

Refers to producing the combination of goods mostly wanted by society. Hence, nobody can be better off without making others worse off; the benefits from consumption are maximised for the whole of society.

Definition 2.12: Productive Efficiency

Refers to producing goods by using the fewest possible resources (producing at the lowest possible cost).

Productive efficiency is a *necessary condition* for allocative efficiency. It means that if there is no productive efficiency, there is no allocative efficiency. These conditions are known as *economic efficiency* or *Pareto Optimality*.

2.7.1 Consumer Surplus and Producer Surplus

Definition 2.13: Consumer Surplus

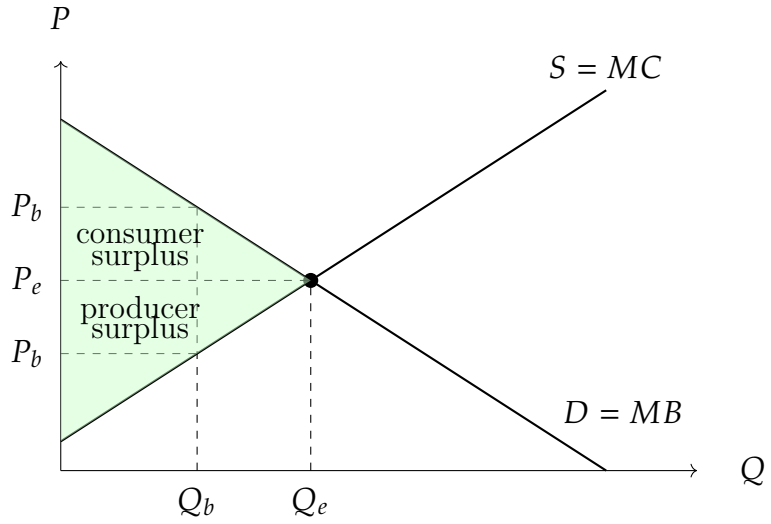
Consumer surplus is defined as the highest price consumers are willing to pay for a good minus the price actually paid.

Definition 2.14: Producer Surplus

Producer surplus is defined as the price received by firms for selling their good minus the lowest price that they are willing to accept to produce the good.

Before understanding the concept of surplus, it is important to understand why the supply curve is called the marginal cost curve. Recall that the demand curve is also known as the marginal benefit (MB) curve. Now, imagine that you are firm producing in a perfectly competitive market. If you are a firm, and you need to make one more unit of a good, then the cost to you of an additional good is the marginal cost of that good. To make the good, you need to recover, at a minimum, your marginal cost. Therefore, the supply curve is the marginal cost curve because

the supply curve is a relationship that tells us the minimum amount that a firm is willing to accept for selling a unit of a good.



At the point of competitive market equilibrium, *social surplus*, defined as the sum of consumer and producer surplus, is maximum. If Q_b were produced, then the sum of consumer surplus and producer surplus would be smaller as Q_b would be the cut-off of the surplus.

If we interpret the demand curve as the marginal benefit curve and the supply curve as the marginal cost curve, then the point of equilibrium would be reached where $MB = MC$. The equality of MB with MC tells us that the extra benefit to society of getting one more unit of the good is equal to the extra cost to society of producing one more unit of the good. Here, society has allocated the "correct" amount of resources to produce the good, and is producing the quantity of the good that is mostly wanted by society. Therefore, allocative efficiency is achieved.

If $MB > MC$, then the benefit from producing an additional unit of the good is greater than the cost of producing the additional unit. Hence, the additional unit must be produced to achieve the maximum benefit. Vice-versa when $MB < MC$.

3 Elasticity

Definition 3.1: Elasticity

Elasticity is a measure of the responsiveness of a variable to changes in price or any of the variable's determinants.

3.1 Price Elasticity of Demand

Definition 3.2: Price Elasticity of Demand (PED)

PED is a measure of the responsiveness of quantity demanded of a good to a change in its price. In general, if there is a large responsiveness of quantity demanded, demand is referred to as being *price elastic*; if there is a small responsiveness, demand is *price inelastic*.

From the law of demand, we know that the higher the price, the lower the quantity demanded. We now examine *by how much* quantity responds to change in price.

Formula 3.1 (Price Elasticity of Demand)

$$\begin{aligned}\text{PED} &= \frac{\text{percentage change in quantity demanded of good X}}{\text{percentage change in price of good X}} \\ &= \frac{\frac{\Delta Q_x}{Q_x} \times 100}{\frac{\Delta P_x}{P_x} \times 100} = \frac{\Delta Q_x}{Q_x} \cdot \frac{P_x}{\Delta P_x}\end{aligned}$$

Since price and quantity demanded are negatively (indirectly) related, the PED is a negative number. Why? Any increase in price results in a decrease in quantity demanded. However, it is common practice to *drop the sign and consider PED as a positive number.*

It is important to understand that PED measures changes in percentages, as it would be meaningless to think about changes in prices or quantities in absolute terms. Therefore, it outputs information on the relative size of the change.

Example 3.1 (Calculating PED)

Suppose consumers buy 6000 DVD players when the price is \$255 per unit, and they buy 5000 DVD players when the price is \$300. What is the PED?

Solution

$$\text{PED} = \frac{\frac{6000-5000}{5000}}{\frac{255-300}{300}} = \frac{\frac{1}{5}}{-\frac{45}{300}} = -1.33 \text{ or } 1.33$$

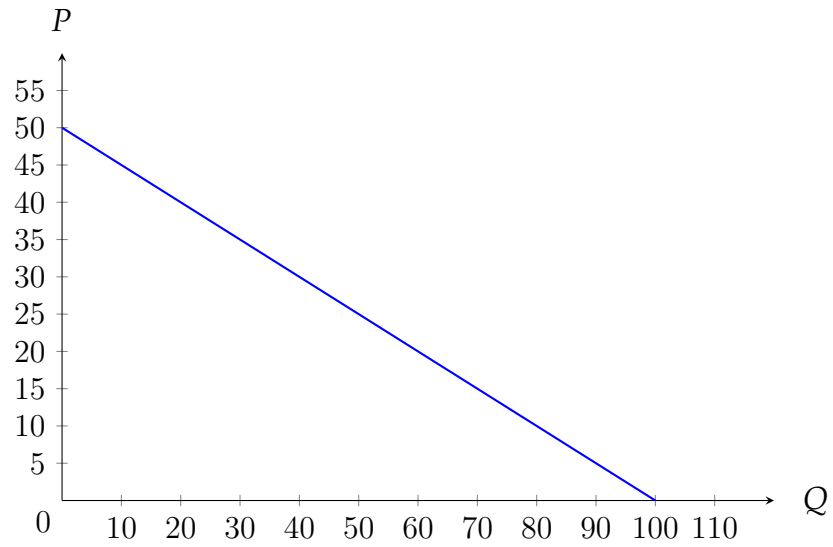
3.2 Range of PED

Value of *PED*	**Classification**	**Interpretation**
Frequently encountered cases		
$0 < PED < 1$	inelastic demand	quantity demanded is relatively unresponsive to price
$1 < PED < \infty$	elastic demand	quantity demanded is relatively responsive to price
Special cases		
$PED = 1$	unit elastic demand	percentage change in quantity demanded equals percentage change in price
$PED = 0$	perfectly inelastic demand	quantity demanded is completely unresponsive to price
$PED = \infty$	perfectly elastic demand	quantity demanded is infinitely responsive to price

In general, the larger the absolute value of PED, the greater the responsiveness of quantity demanded to a change in price. PED for most goods and services is greater than zero and less than infinite, and other than exactly one. The cases of unit elastic, perfectly inelastic and perfectly elastic demand are rarely encountered in practice; however, they have important applications in economic theory.

3.3 PED along a Linear Demand Curve

Along any downward-sloping, straight-line demand curve, the PED varies (changes) as we move along the curve. Consider the following linear demand curve:



The function representing the curve is: $Q = 100 - 2P$. When price is low and quantity is high, demand is inelastic; as we move up the demand curve towards higher prices and lower quantities, demand becomes more and more elastic. The reason behind the changing PED along a linear demand curve is the amounts of quantity and price. When the price is \$45, the Q_d is 10 units, and at \$40, Q_d is 20 units. Therefore, PED is 4. Then, moving from \$30 to \$25 results in a 10 unit change, hence PED is 1. Finally, moving from \$15 to \$10 results in a 10 unit decrease, which results in a PED of 0.25.

3.3.1 Slope vs. PED

The PED needs to be contrasted with the slope of a demand curve. Since we define a demand curve as $Q = A - bP$, the slope is $\frac{\Delta Q}{\Delta P} = -b$. However, PED is (from Formula 3.1) $\frac{\Delta Q}{Q} \cdot \frac{P}{\Delta P} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = \text{slope} \times \frac{P}{Q}$.

3.4 PED and Total Revenue

Total revenue (TR) is defined as the total amount of money a firm receives by selling its product; it is calculated as:

$$\text{TR} = \text{Price} \times \text{Quantity Sold} = P \times Q$$

The relationship between PED and total revenue is important for firms when making pricing decisions to maximise revenue.

To begin, we know that P and Q_d are inversely related. Therefore, when the price increases, Q_d falls. Here, one variable increases while the other decreases. The effect on total revenue depends on the relative size of the change in each variable, which is exactly the PED. Hence, we have:

1. If demand is *elastic* ($PED > 1$), a decrease in price leads to an increase in total revenue, and an increase in price leads to a decrease in total revenue.
2. If demand is *inelastic* ($PED < 1$), a decrease in price leads to a decrease in total revenue, and an increase in price leads to an increase in total revenue.
3. If demand is *unit elastic* ($PED = 1$), a change in price does not affect total revenue.

Let's understand this by using Calculus. Total revenue is given by:

$$\text{TR} = P \times Q_d(P)$$

Taking the derivative of total revenue with respect to price, we get marginal revenue:

$$MR = \frac{dTR}{dP} = 1 \cdot Q_d + P \cdot \frac{dQ_d}{dP}$$

$$MR = Q_d + P \cdot \frac{dQ_d}{dP} = Q_d \left(1 + \frac{dQ_d}{dP} \cdot \frac{P}{Q_d}\right)$$

Notice that $\frac{dQ_d}{dP} \cdot \frac{P}{Q_d}$ is just the PED. Furthermore, $\frac{dQ_d}{dP}$ will be negative because it is the slope of the demand curve. Therefore,

$$MR = Q_d(1 - PED)$$

Here, we can see that when $PED > 1$ (elastic demand), MR is negative; when $PED < 1$ (inelastic demand), MR is positive; and when $PED = 1$ (unit elastic demand), MR is zero. This is precisely why total revenue behaves the way it does with respect to changes in price. To summarise:

	P–Q_D relationship	**Impact on total revenue**
Inelastic	$1\% \uparrow P \implies < 1\% \downarrow$ in Q_D	TR $\uparrow$
Elastic	$1\% \uparrow P \implies > 1\% \downarrow$ in Q_D	TR $\downarrow$
Unit elastic	$1\% \uparrow P \implies 1\% \downarrow$ in Q_D	TR unchanged

4 Government Intervention

4.1 Indirect Taxes

4.1.1 Introduction to Indirect Taxes

Indirect taxes are imposed on spending (spending to buy goods and services). They are paid by producers to the government, but consumers contribute a part of the *tax burden*. For this reason, the tax is called 'indirect' tax. There are two types of indirect taxes:

1. Excise Duties: These are taxes on specific goods, such as cigarettes, alcohol, and petrol.
2. Taxes on all (or most) spending, such as Value Added Tax (VAT) or Goods and Services Tax (GST).

Indirect taxes differ from direct taxes, which are imposed on income, wealth, or profits. Direct taxes are paid directly by taxpayers to the government, unlike indirect taxes, which are collected by producers on behalf of the government.

4.1.2 Why do Governments Impose Excise Taxes?

Governments impose excise taxes for several reasons:

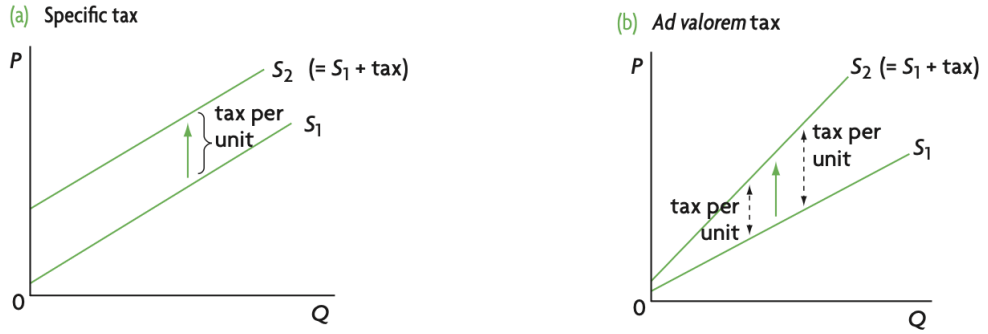
- Excise taxes are a source of government revenue. Especially for goods that are inelastic in demand, such as tobacco and alcohol, excise taxes can generate significant revenue.
- Excise taxes can be used to discourage the consumption of certain goods that have *negative externalities*, such as tobacco and alcohol.
- Excise taxes can also be used to correct market failures.
- Excise taxes can be used to redistribute income. Taxes on luxury goods like yachts, private jets, and high-end cars can lower after-tax income, reducing income inequality.

4.1.3 Specific vs. Ad Valorem Taxes

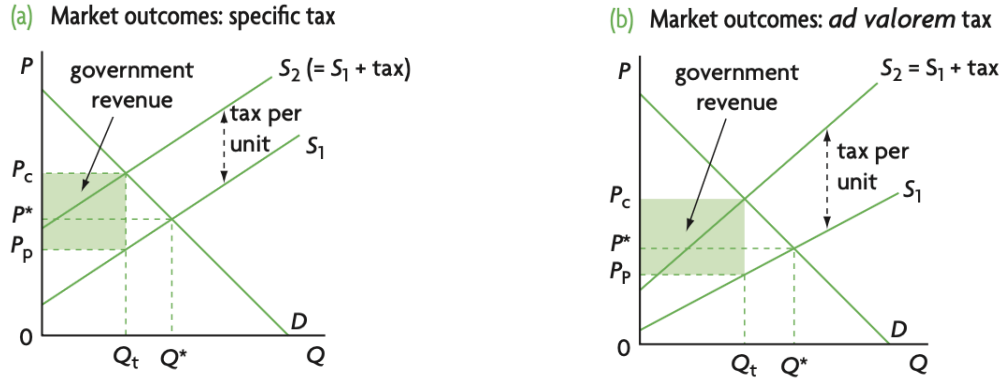
There are two main types of excise taxes:

- Specific Taxes: These are fixed amounts of tax per unit of the good sold. For example, a tax of €1 per pack of cigarettes.
- Ad Valorem Taxes: These are taxes based on a percentage of the price of the good sold. For example, a VAT of 20% on most goods and services in the UK.

These taxes have different effects on prices and quantities sold. Specific taxes tend to increase the price by a fixed amount, while ad valorem taxes increase the price by a percentage, which can lead to larger price increases for higher-priced goods. Consider the following supply curves:



Here, (a) shows the effect of a specific tax and (b) shows the effect of an ad valorem tax. Now, we can observe the impact of these taxes on government revenue.



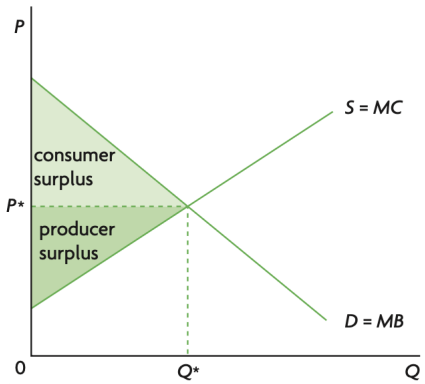
In both cases:

- equilibrium quantity produced and consumed falls from Q^* to Q_t
- equilibrium price paid by consumers rises from P^* to P_c
- price received by producers falls from P^* to P_p, which is $P_p = P_c - \text{tax}$
- producers' revenue falls from $P^* \times Q^*$ to $P_p \times Q_t$
- government revenue from the tax is $(P_c - P_p) \times Q_t$
- there is an underallocation of resources to the production of the good; Q_t is less than the free market equilibrium quantity Q^*

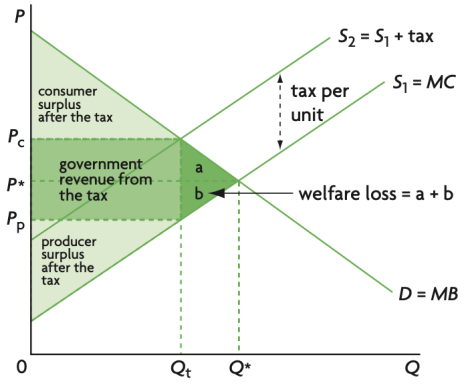
4.2 Impact of Indirect Taxes

4.2.1 Impact of Specific Tax on Social Welfare

Recall that social surplus (or social welfare) is the sum of consumer surplus and producer surplus. In a competitive market without government intervention, social surplus is maximized at the equilibrium quantity Q^*, indicating that allocative efficiency is achieved. What happens to social surplus and allocative efficiency after the imposition of a specific tax?



(a) Consumer and producer surplus in a competitive free market: maximum social surplus



(b) Consumer and producer surplus with an indirect (excise) tax: welfare loss

As shown above, the imposition of a specific tax reduces consumer surplus and producer surplus. A portion of consumer surplus becomes government revenue, while the rest is lost as triangle a. A portion of producer surplus also becomes government revenue, while the rest is lost as triangle b.

The consumer and producer surplus that is transformed into government tax revenue comes back to society in the form of government spending. Therefore, the after-tax social surplus in Figure 4.4(b) is equal to after-tax consumer and producer surplus plus government revenue.

However, after-tax social surplus is less than pre-tax social surplus by the amount of triangles a + b. The areas a + b represent social surplus that is completely lost, and is called welfare loss or deadweight loss (DWL).

Definition 4.1: Deadweight Loss (Welfare Loss)

Represents welfare benefits that are lost to society because resources are not allocated efficiently.

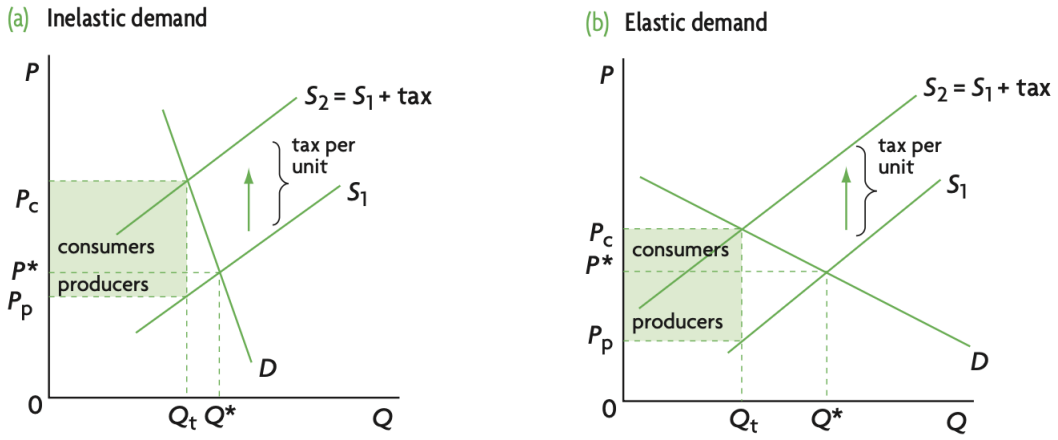
The welfare loss in this case is the result of underallocation of resources to the production of the good (underproduction). This is also indicated by MB > MC: too little of the good is produced and consumed relative to the social optimum.

4.2.2 Tax Burden, PED, and PES

The tax burden (or incidence) refers to how the burden of paying a tax is divided between consumers and producers. The division of the tax burden depends on the price elasticities of demand and supply for the good being taxed.

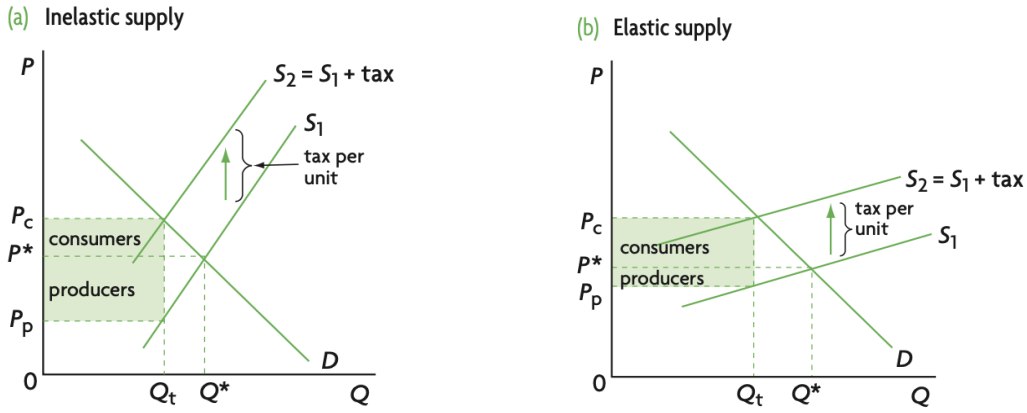
The total tax revenue generated by the tax is: $(P_c - P_p) \times Q_t$.
Tax burden of consumers = $(P_c - P^*) \times Q_t$
Tax burden of producers = $(P^* - P_p) \times Q_t$

The division of the tax burden depends on the relative price elasticities of demand and supply. First, we consider the incidence of the tax on consumers and producers with different price elasticities of demand.



When demand is relatively inelastic ($0 < PED < 1$), consumers bear a larger share of the tax burden. Conversely, when demand is relatively elastic ($PED > 1$), producers bear a larger share of the tax burden. Why does this happen?

When demand is inelastic, consumers are less responsive to price changes, so they continue to buy the good even at higher prices (like food), leading to a larger tax burden on them. When demand is elastic, consumers are more responsive to price changes, so they reduce their quantity demanded significantly when the price rises (like luxury goods), leading to a larger tax burden on producers.



When supply is relatively inelastic ($0 < PES < 1$), producers bear a larger share of the tax burden. Conversely, when supply is relatively elastic ($PES > 1$), consumers bear a larger share of the tax burden.

4.3 Subsidies

4.4 Impact of Subsidies

4.5 Price Controls