Part 2

Demand, supply, and applications

Principles of Microeconomics
August 2019

Introduction

This section analyzes market as a whole before moving on to studying incentive analysis of each economic agent. Market must be firstly defined clearly.

Definition 2-1: Market

Market is a context where trade occurs. Buyers (consumers), sellers (producers), good or service and price are mandatory components in a market.

Each component, mentioned above, in a market should be clearly identified because it defines market structure. For instance, varieties of pineapple markets can be

- Pineapple (fresh from the field) market.

- Canned pineapple market.

- International pineapple market

Content

2.1 - Demand

Definition of demand, law of demand, demand determiners and changes in demand.

2.2 - Supply

Definition of supply, law of supply, supply determiners and changes in supply.

2.3 – Equilibrium

Definition of equilibrium, changes in equilibrium and adjustments to both initial equilibrium and new equilibrium in order to understand price and quantity determination in a market.

2.4 - Elasticity

Study and measure changes in price that affect changes in quantity demanded and supplied. Also price elasticity determiners and formulae.

2.5 - Surplus

Define a social welfare gained from trade, set up a framework to study gain and loss due to demand, supply, and equilibrium changes.

2.6 - Market intervention

Utilize all the concepts studied above to analyze gain and loss for each economic agent from market intervention or public policy.

Before we move on, some assumptions must be posed.

(1) Static analysis

We are studying only a single change at a time. No intertemporal chain-reaction effects to be included.

(2) 'Ceteris Paribus'

'Other things being equal'. Meaning that other than a change we are focus on, other factors are kept constant.

(3) Perfect competitive market

General characteristics of a perfect competitive market is that there are many number of buyers and sellers, in which no single entity can take control over price or quantity. More information of perfect competitive market will be in the market structure section.

Definition 2-2: Demand

Demand refers to **quantity** or amount of good or service demanded by consumers at different prices in given period of time.

To constitute demand, it takes both **want** and **affordability**. Demand can be expressed in many mathematical ways.

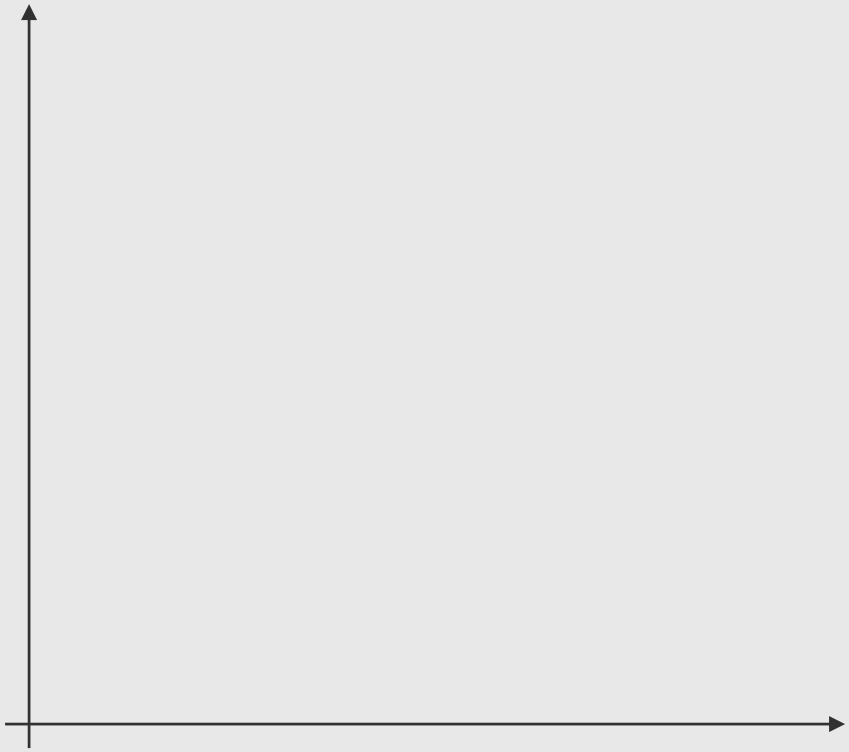
Demand Function:

- $q_a = f(P)$
- $q_a(P)$
- $q_a = 10 - 2P$

Demand table:

P	q_a

Demand curve/line.



Let's draw a demand line from the given demand function.

$$q_a = 10 - 2P$$

- Never forget to put label on each axis.

Definition 2-3: Law of Demand

A claim that when price of a goods or service rises, its quantity demanded will fall and vice versa, when all other factors that can affect demand are held constant.

When price changes and affects quantity demanded, the result is called **price effect (PE)** which consists of two sub-effects.

- **Substitution effect (SE)** is the effect of relative price of substitutable good. For example, if A and B are substitutable and price of good A increases (decreases), good B will relatively become cheaper (more expensive) comparing to the relative price before price change.

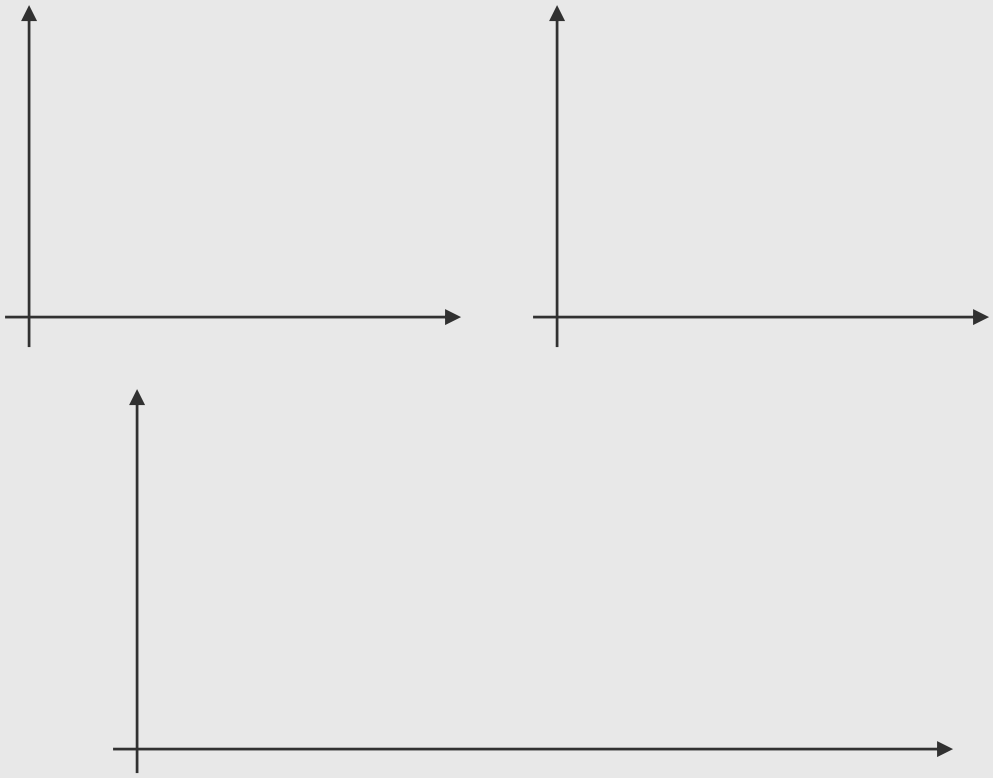
- **Income effect (IE)** is the effect of consumers' real income. For example, if price of good A rises (drops), consumers are considered become poorer (richer) because they lose (gain) purchasing power.

(1) Individual and market demand

Individual demands can be horizontally added as a market demand.

P	q_a	q_b	Q
10	12	20	
20	10	16	
30	8	12	
40	6	8	
50	3	4	
60	0	0	

Adding individual demands



Adding individual demands can be done horizontally.

- Market demand (Q) is totaled from all buyers in a market.

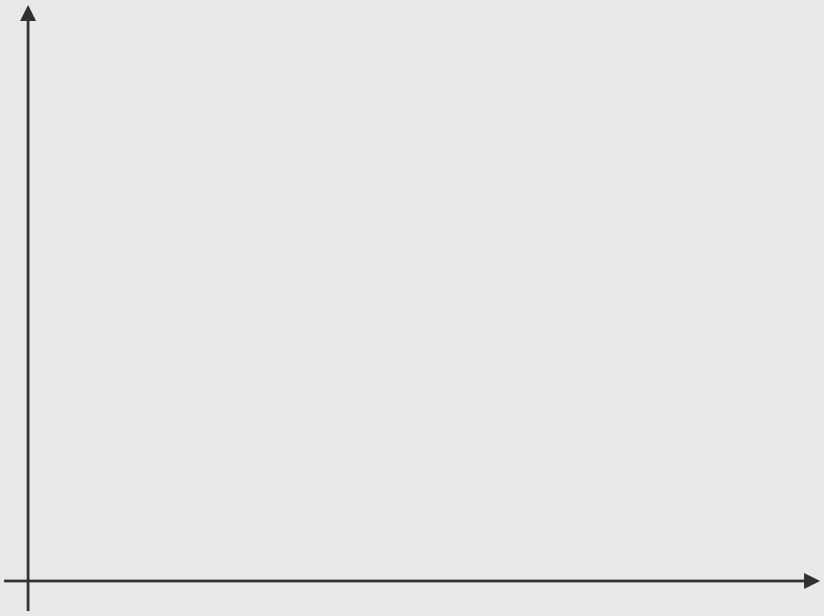
- Market demand is less steep than horizontal demand, since it is the addition of quantity demanded, not price.

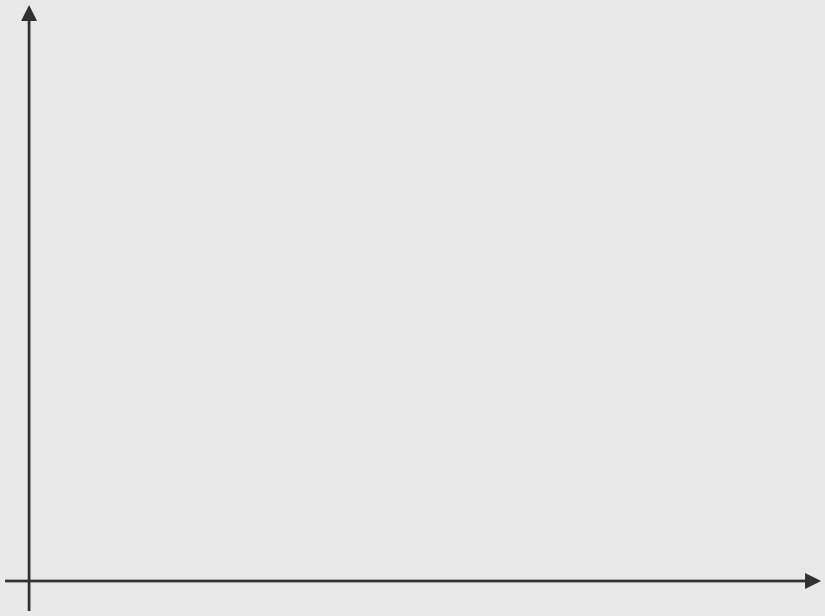
(2) Demand move and shift

Changes in demand can be divided into 2 cases.

- **Moving along the curve**: caused by changes in price.

- **Shifting demand**: caused by external factors that are not price.

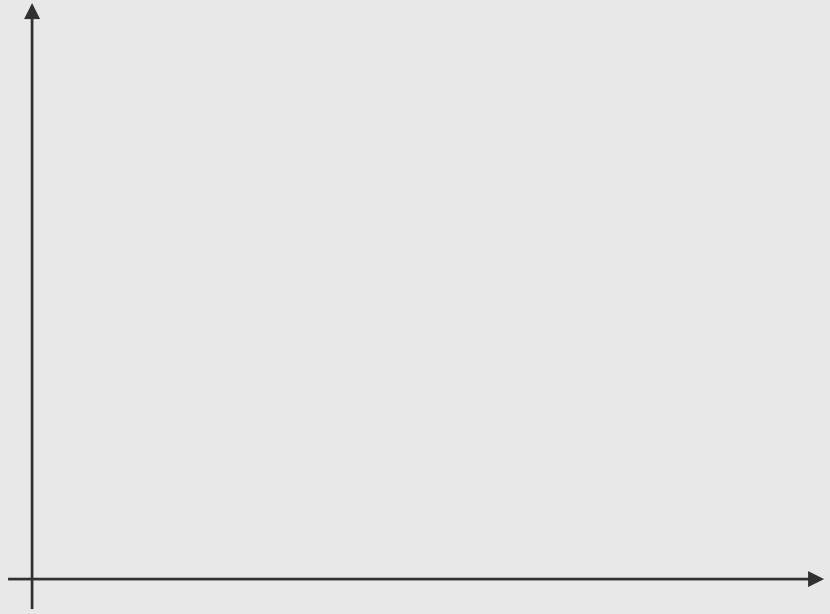




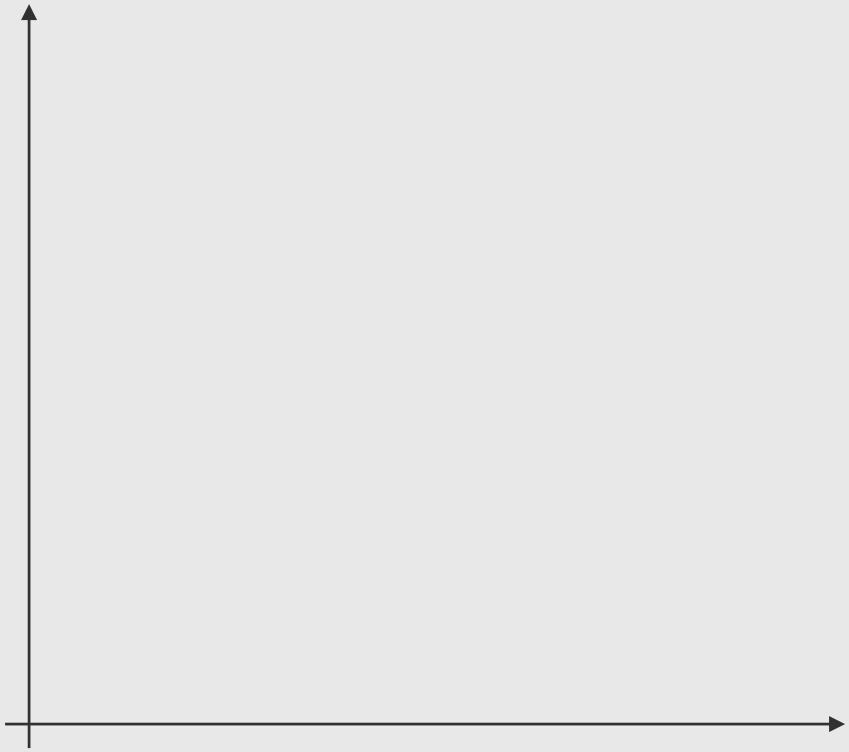
(3) Demand determiners

In which direction do these factors need to shift to in order to shift market demand to the right or increasing demand.

- Consumer income
- Consumer preference
- Price of complementary goods
- Price of substitutable goods
- Price speculation



Other types of demand

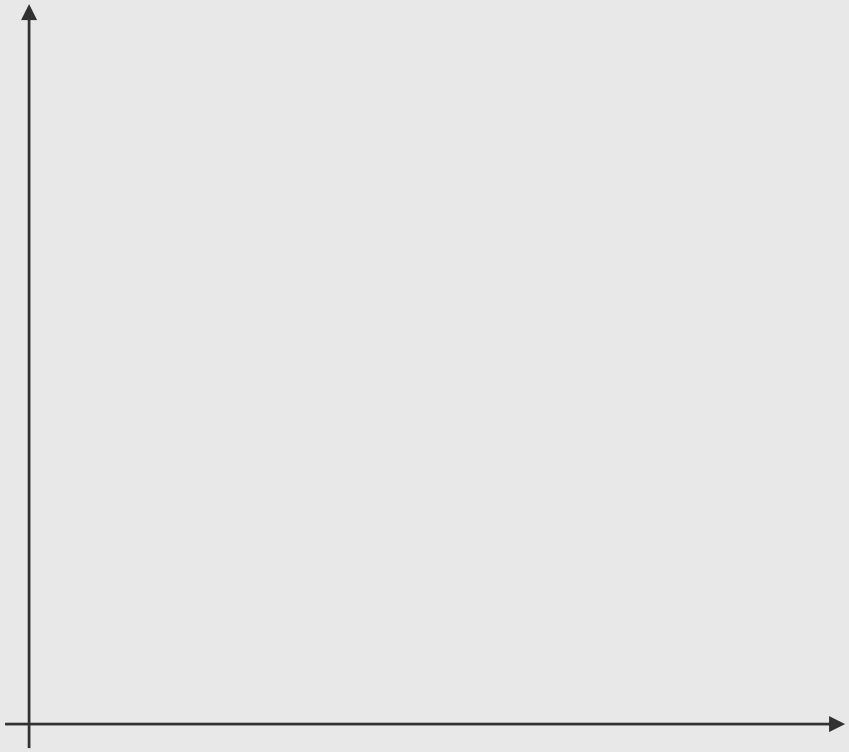


Demand can be plotted against other variables.

- If income replaces price, we call it **income demand**.

- How would the demand look like for **normal goods**?

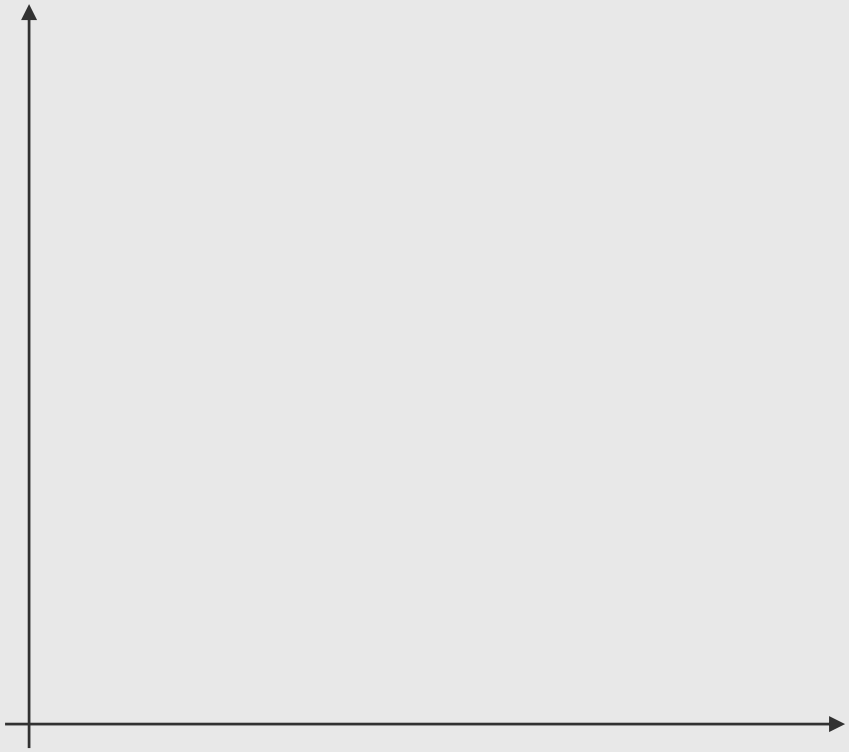
Other types of demand



Demand can be plotted against other variables.

- What about income demand for **inferior goods**?

Other types of demand

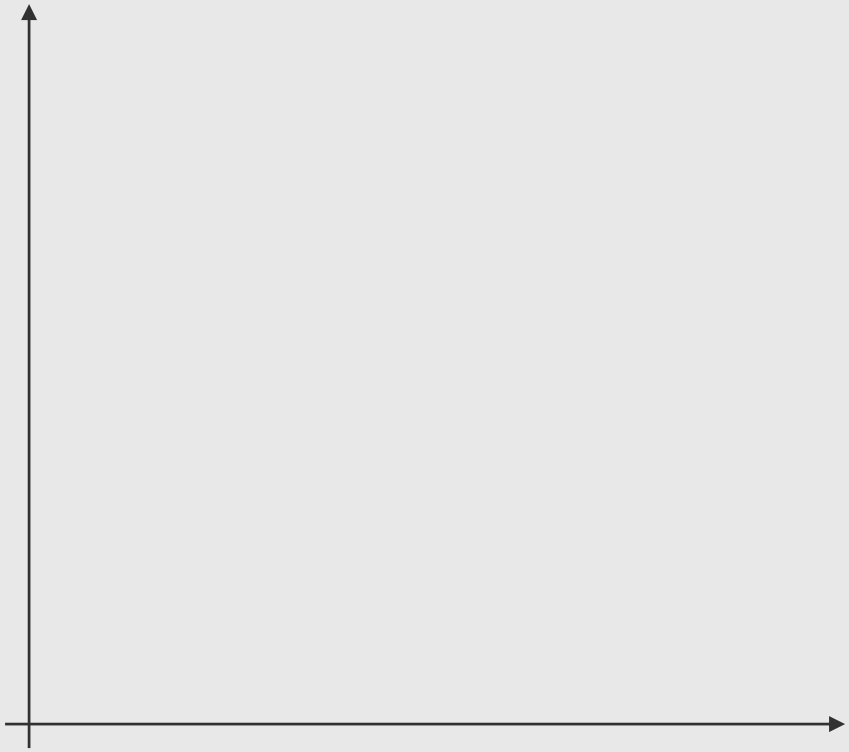


Also demand of good A versus price of good B.

- This is called **cross-price demand**.

- How would this line look like if A and B are **substitutable goods**?

Other types of demand



Also demand of good A versus price of good B.

- What if A and B are **complementary goods**?

Definition 2-4: Supply

Supply refers to quantity or amount of good or service supplied by producers at different prices in given period of time.

Alike demand, supply can be expressed in many mathematical ways.

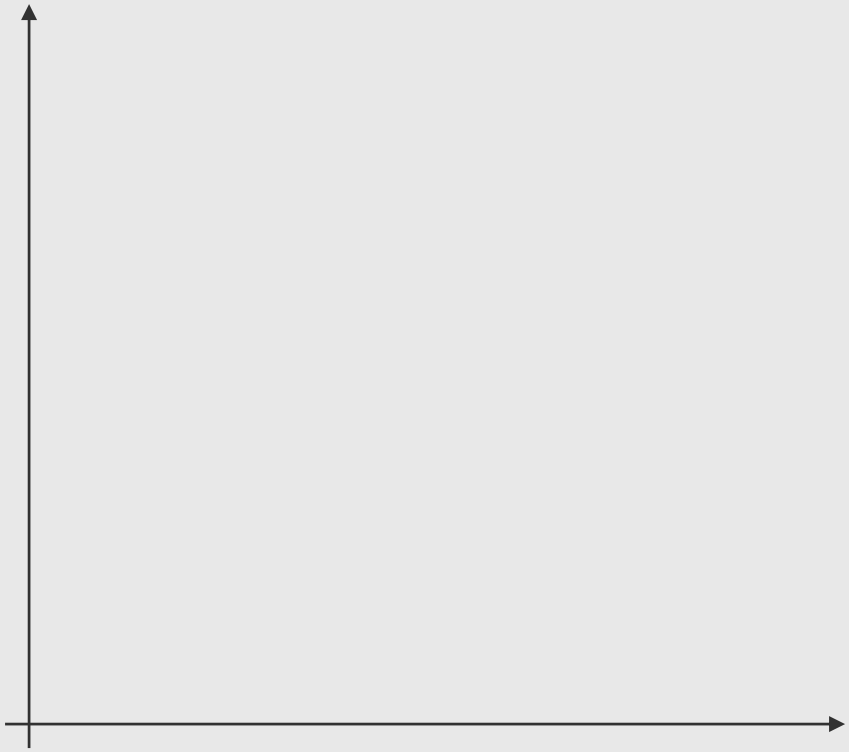
Supply function:

- $q_k = f(P)$
- $q_k(P)$
- $q_k = 4P$

Supply table:

P	q_a

Supply curve/line.



Let's draw a supply line from the given supply function.

$$q_k = 4P$$

- Never forget to put label on each axis.

Definition 2-5: Law of Supply

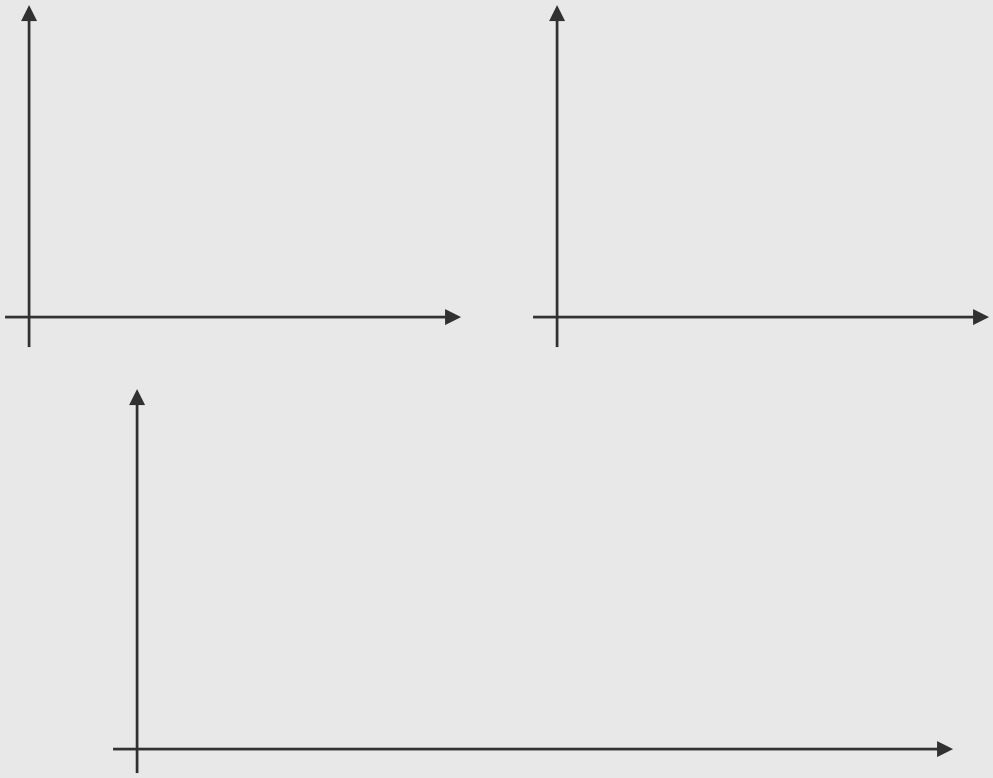
A claim that when price of a goods or service rises, its quantity supplied will also rises and vice versa, when all other factors that can affect supply are held constant.

(1) Individual and market supply

Individual supplies can be horizontally added as a market supply, similarly to demand

P	q_k	q_l	Q
10	0	1	
20	3	3	
30	6	5	
40	9	7	
50	12	9	
60	15	11	

Adding individual supplies



Adding individual supplies can also be done horizontally.

- Market supply (Q) is totaled from all sellers in a market.

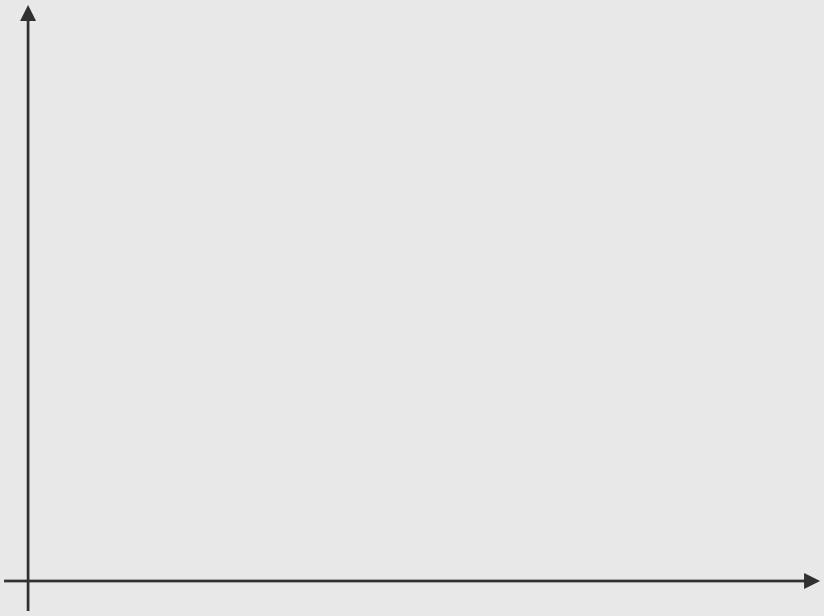
- Market supply is less steep than individual supply, since it is the addition of quantity, not price.

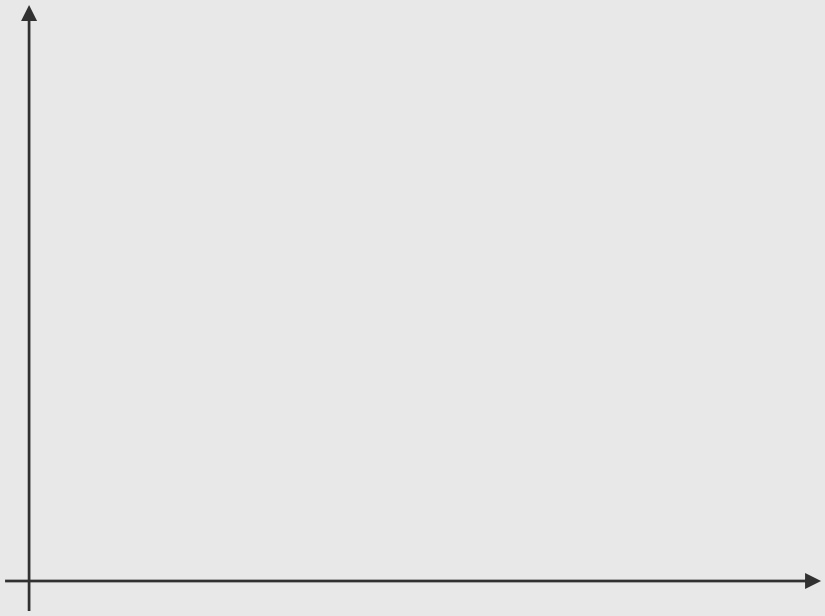
(2) Supply move and shift

Changes in supply can be divided into 2 cases.

- **Moving along the curve**: caused by changes in price.

- **Shifting supply**: caused by external factors that are not price.





(3) Supply determiners

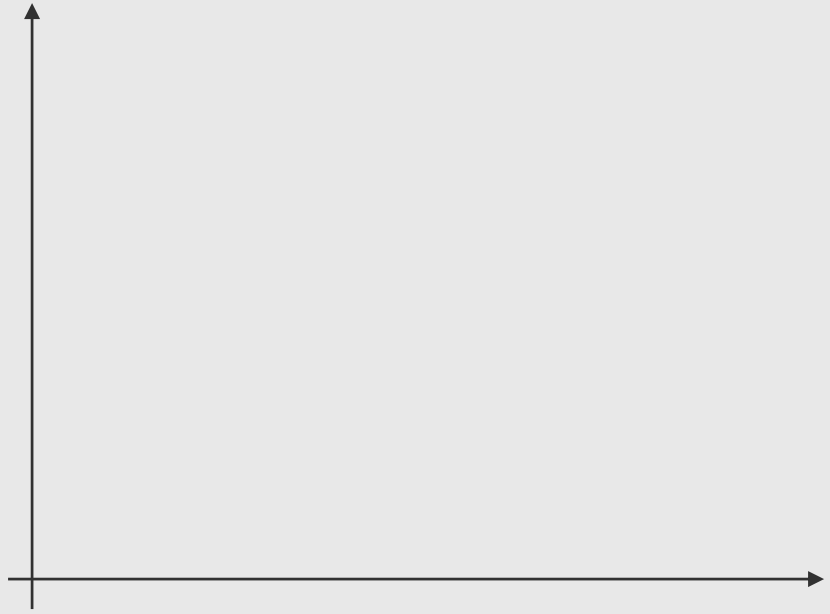
In which direction do these factors need to shift to in order to shift market supply to the right or increasing supply.

- Factors of production price

- Technological progress

- Number of sellers

- Price speculation



Definition 2-6: Equilibrium

There exists **equilibrium** price and quantity in a market, when quantity demanded and supplied are equal. Without exogenous force, equilibrium price and quantity remains stable.

Solving for equilibrium price and quantity can be done with exact graph plot or demand and supply functions. Try solving this market equilibrium.

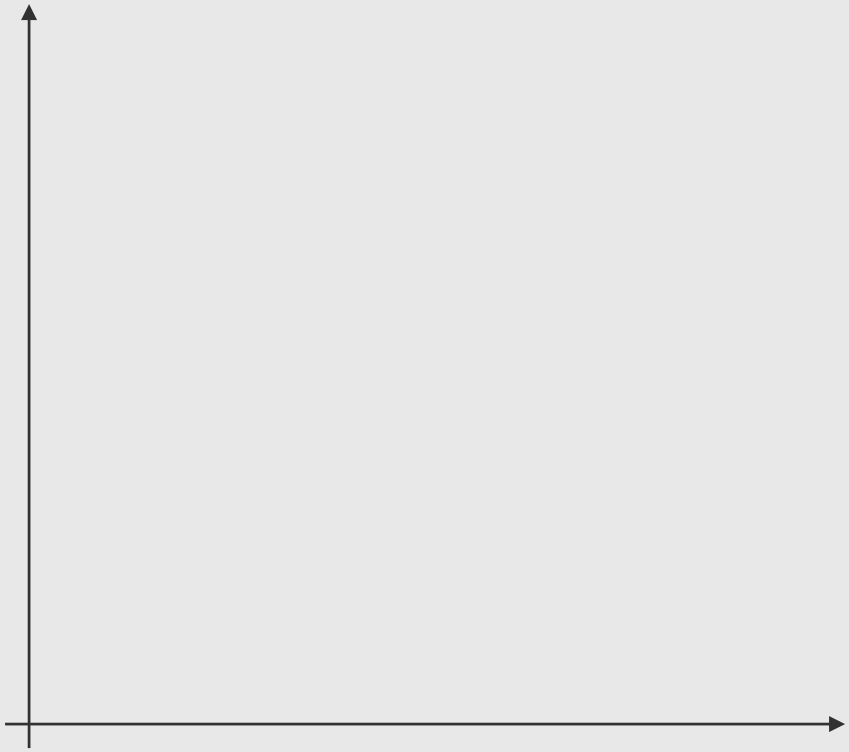
Demand function:

$$Q_d = 10 - 2P$$

Supply function:

$$Q_s = 4P$$

Equilibrium in a graph



Now try plotting both demand and supply to see the equilibrium.

- Never forget to put label on each axis.

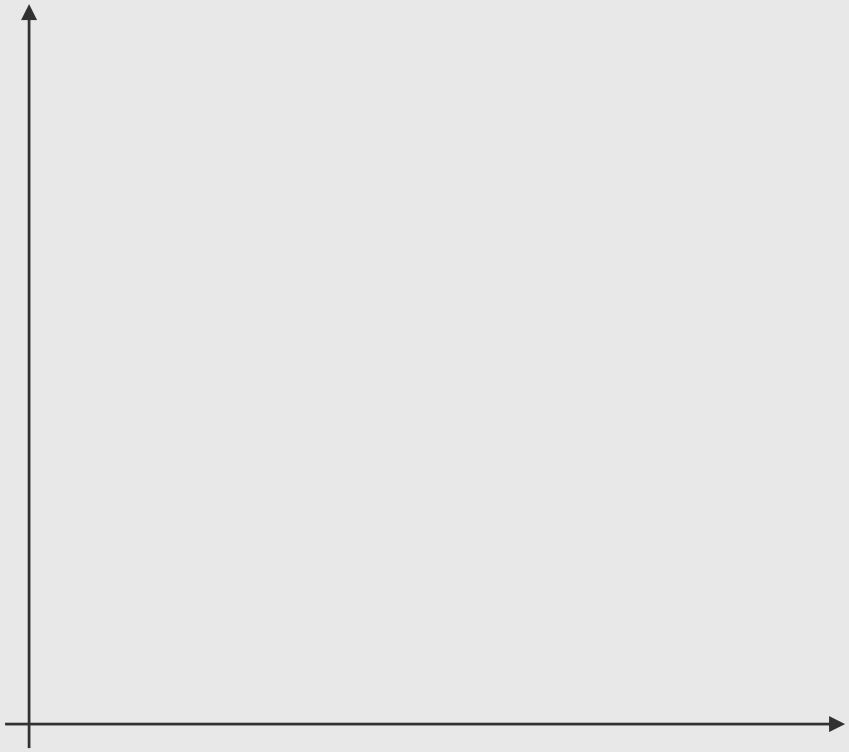
If there is no external force driving demand or supply, this equilibrium quantity is the total amount of good or service bought and sold in this market at the equilibrium price.

Therefore, if price is temporarily fluctuated 'other things being equal', it may cause **excess demand or supply** but the market would adjust itself and return to its original position.

Definition 2-7: Excess demand (supply)

Excess demand (supply) is the quantity demanded (supplied) exceeded equilibrium quantity at equilibrium price.

When price drops

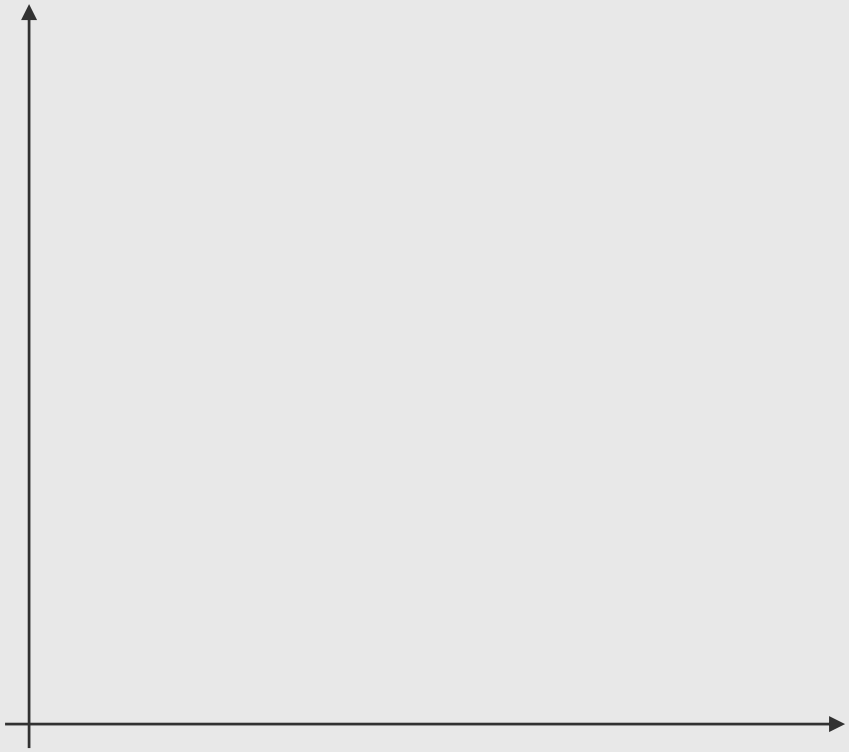


Let's see what would happen when price drops.

- Will there be excess demand or supply?

- How would the market adjust and why?

When price hikes

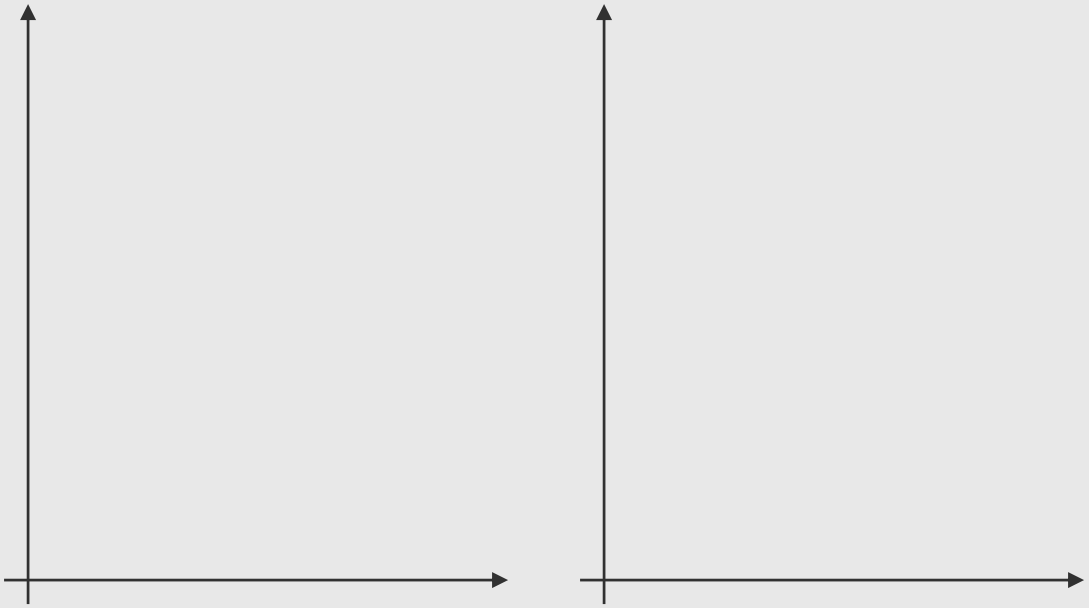


Let's see what would happen when price hikes.

- Will there be excess demand or supply?

- How would the market adjust and why?

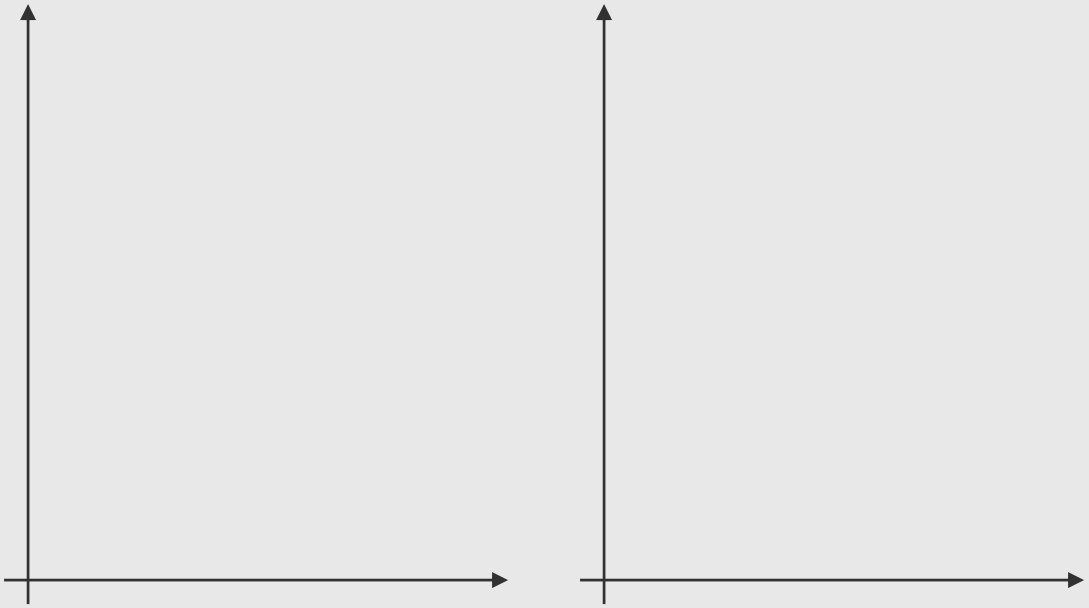
Demand shifts



Now on the other hand if an external factor causes demand shifts

- How would it affect equilibrium price when demand increase or decrease?

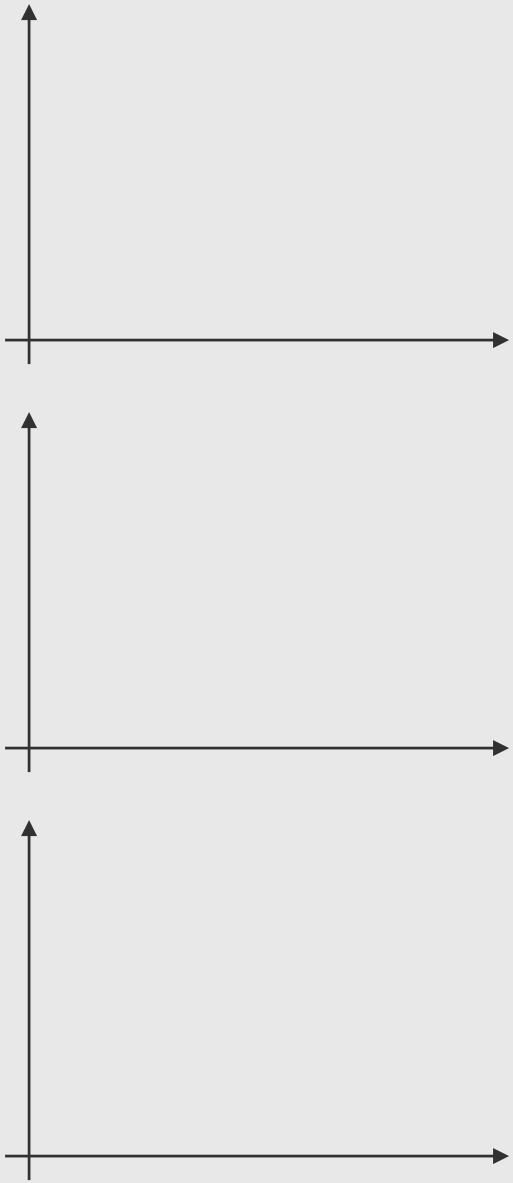
Supply shifts



What if an external factor causes supply shifts

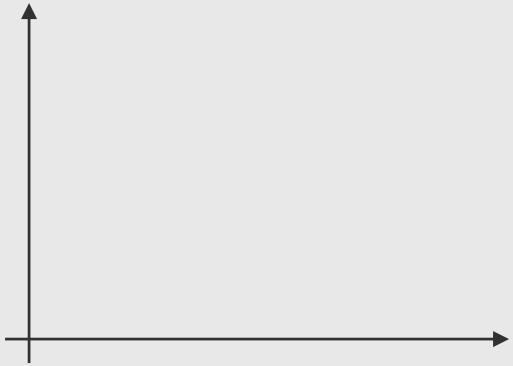
- How would it affect equilibrium price when supply increase or decrease?

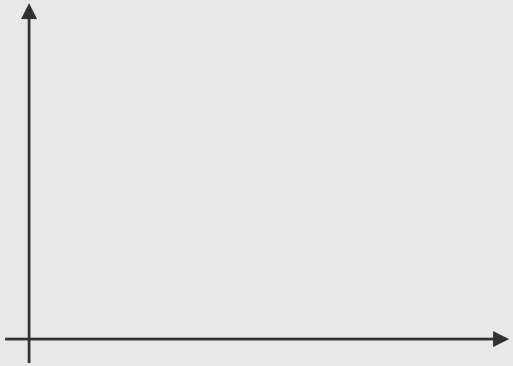
When both increase

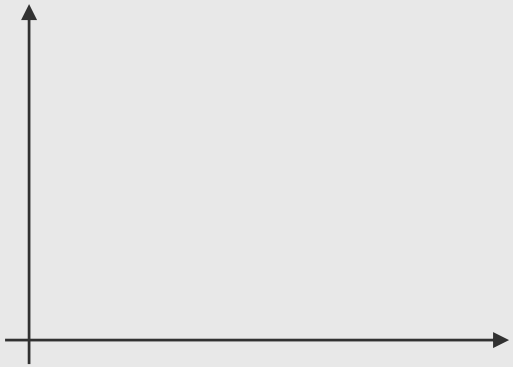


Now let's see if both demand and supply increase, how many possibilities of the outcome?

When demand surges but supply drops.







Play with another scenario.

Summary: equilibrium

- Equilibrium price and quantity remain the same if there is no external factor shifting demand or supply.

- Shifting demand or supply can vary in multitude. Different results of equilibrium price and quantity may be expected.

- However, an economic logic that supports the shift must be correct!

Since economists mostly interested in price change and price determination from equilibrium, problems arise when they try to compare changes in different markets.

Supposed that there are two markets of interest, fuel oil and mobile phones market, both markets price drop 20 baht equally per unit. We can immediately see that quantity change in two markets would respond differently because there is a big gap in present prices between two goods.

Changes in quantity is also problematic. Fuel oil, in litre term, quantity maybe sold a lot more per day compared to mobile phone daily sales, in unit term.

Definition 2-8: Elasticity

Elasticity is a measure of sensitivity of one variable to a change in another variable. General formula takes the form of

$$\varepsilon = \frac{\%\text{ change in dependent variable}}{\%\text{ change in independent variable}}$$

(1) Price elasticity of demand

Definition 2-9: Price Elasticity of Demand

Price elasticity of demand is percentage change in quantity demanded for 1 percent price increase.

$$\varepsilon = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in price}}$$

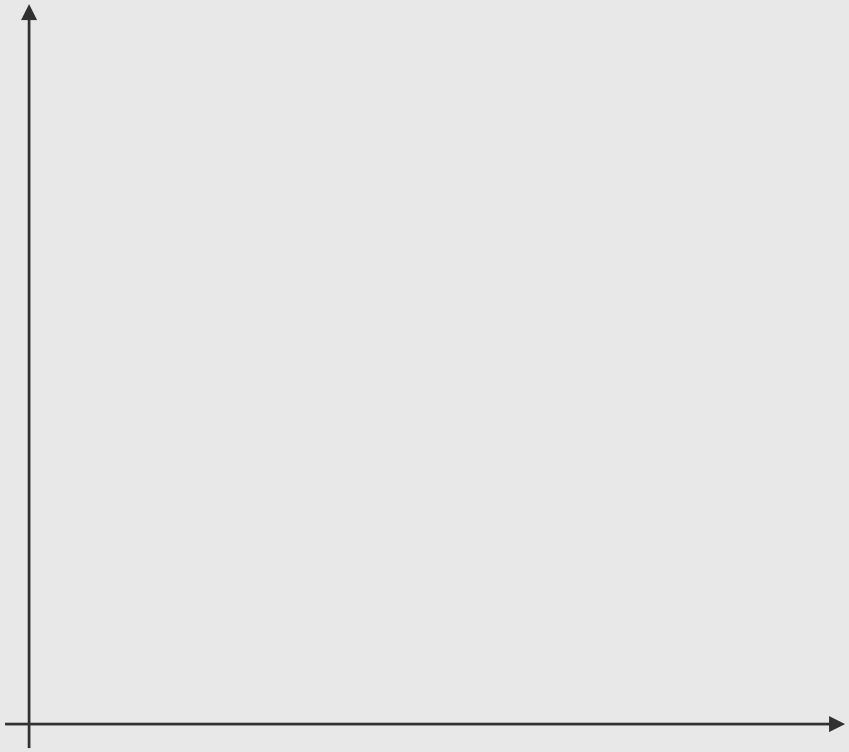
Point elasticity

$$\varepsilon_d = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Arc elasticity

$$\varepsilon_d = \frac{\Delta Q}{\Delta P} \cdot \frac{P_1 + P_2}{Q_1 + Q_2}$$

Demand curve



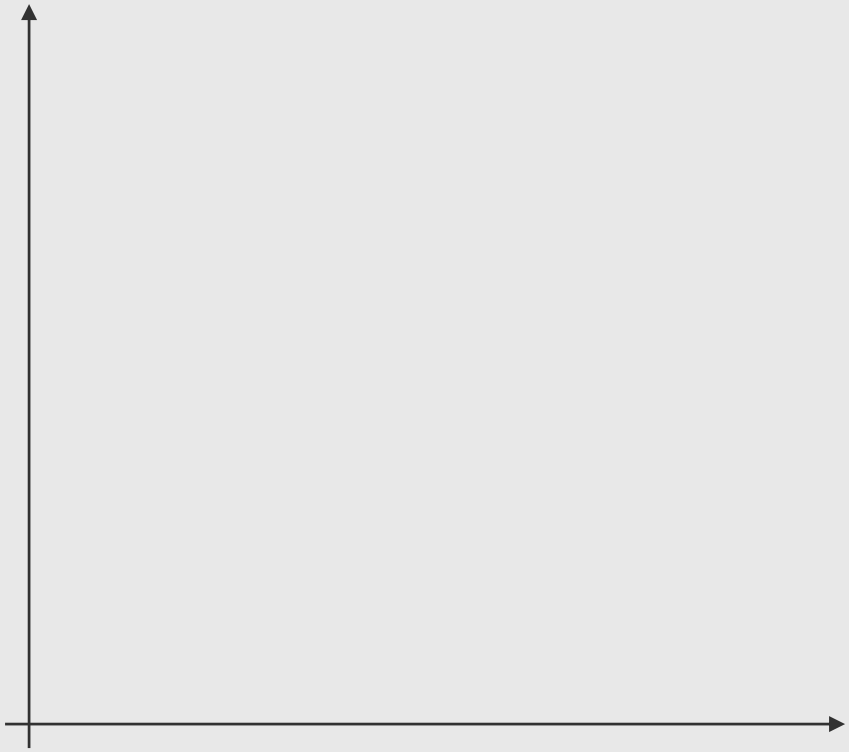
Using the same demand function, figure out elasticity on each point.

- $\varepsilon_{d(a)} =$

- $\varepsilon_{d(b)} =$

Quick question: we always incorporate $\frac{\Delta Q}{\Delta P}$ in the formula. What is this part?

Demand curve



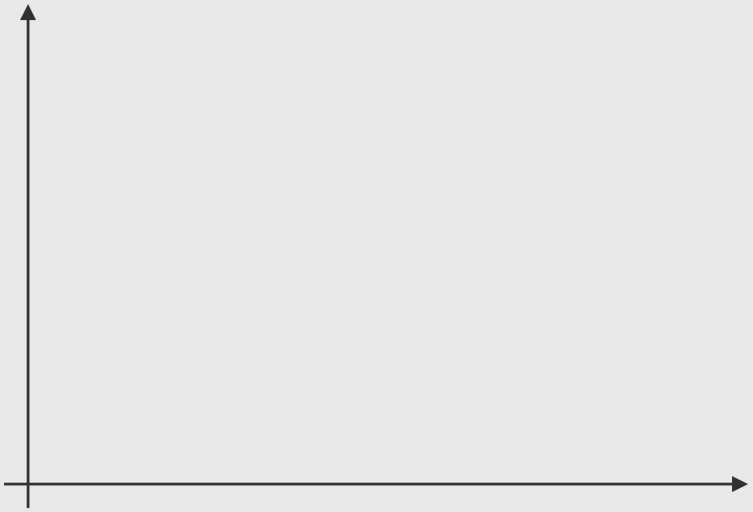
Using the same demand function, figure out elasticity on each point.

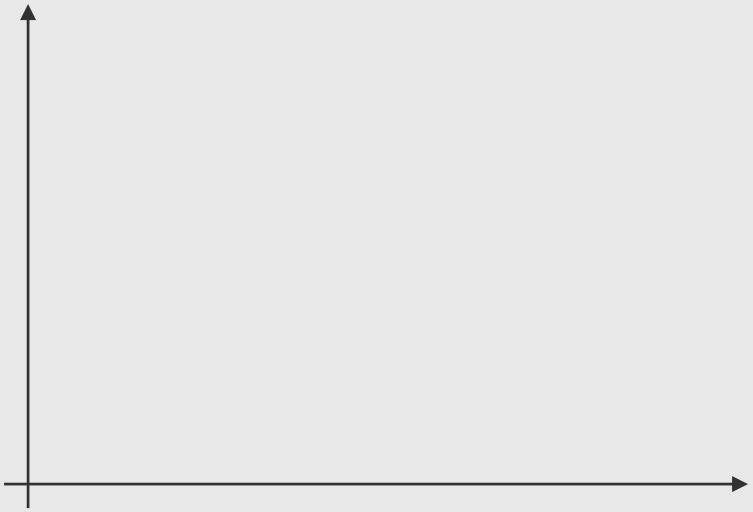
- $\varepsilon_{d(c)} =$

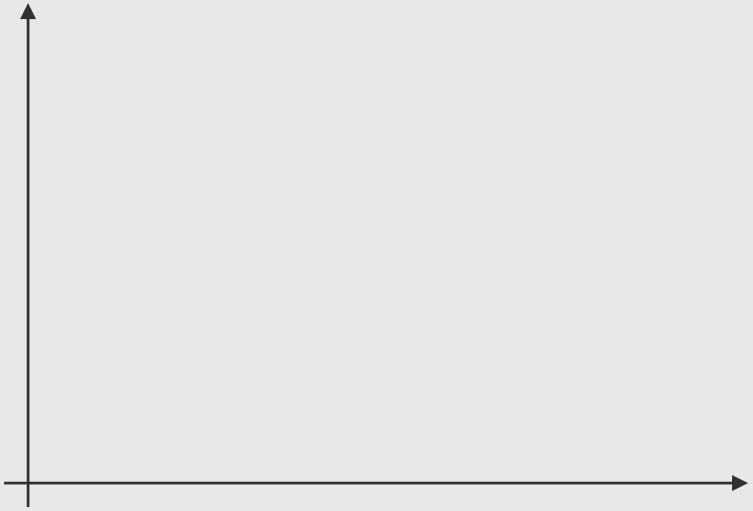
- $\varepsilon_{d(d)} =$

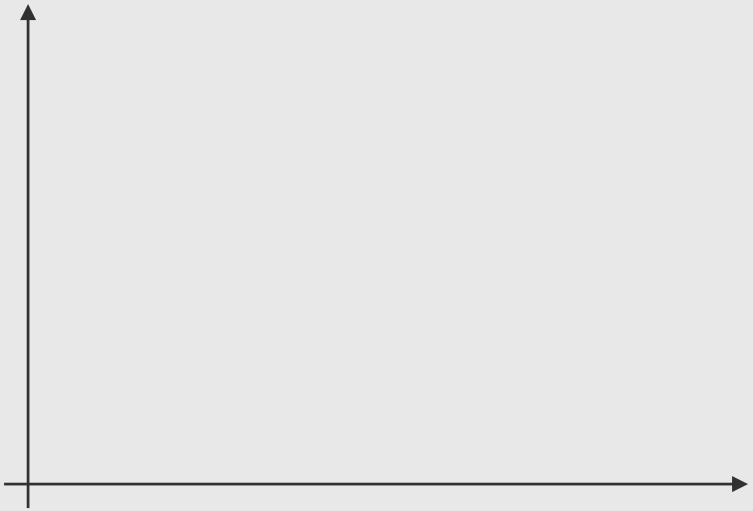
Quick question: what is the unit of elasticity? And how much is considered elastic/inelastic?

Relative elasticity by slope









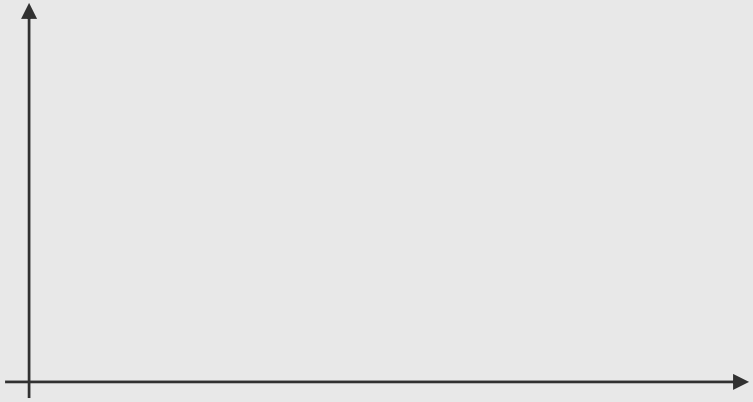
Example and determiners

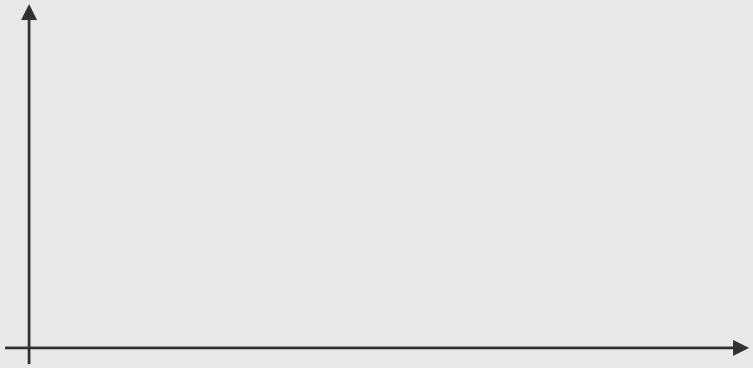
Good/service	Elasticity
Cigarette	-0.06
Electricity (for accommodations)	-0.13
Rice	-0.15
Pesticide	-0.21
Express toll	-0.29
Fuel oil (imported)	-0.60
Rice whiskey	-1.31
Vehicle and components (imported)	-1.52

Which direction of these determiners make demand elastic?

- Number of substitutable goods
- Necessity
- Time frame

Demand elasticity and total revenue





Mathematical proof

Summing up the proof

(2) Income elasticity of demand

Definition 2-10: Income Elasticity of Demand

Income elasticity of demand is percentage change in quantity demanded for 1 percent of consumers' income increase.

$$\varepsilon_I = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in income}}$$

Point elasticity

$$\varepsilon_I = \frac{\Delta Q}{\Delta I} \cdot \frac{I}{Q}$$

Arc elasticity

$$\varepsilon_I = \frac{\Delta Q}{\Delta I} \cdot \frac{I_1 + I_2}{Q_1 + Q_2}$$

(3) Cross-price elasticity of demand

Definition 2-11: Cross-Price Elasticity of Demand

Cross-price elasticity of demand is percentage change in quantity demanded for 1 percent of price of another good or service change.

$$\varepsilon_c = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in another item's price}}$$

Point elasticity

$$\varepsilon_c = \frac{\Delta Q_a}{\Delta P_b} \cdot \frac{P_b}{Q_a}$$

Arc elasticity

$$\varepsilon_c = \frac{\Delta Q_a}{\Delta P_b} \cdot \frac{P_b^1 + P_b^2}{Q_a^1 + Q_a^2}$$

(4) Price elasticity of supply

Definition 2-12: Price Elasticity of Supply

Price elasticity of supply is percentage change in quantity supplied for 1 percent price increase.

$$\varepsilon_s = \frac{\%\text{ change in quantity supplied}}{\%\text{ change in price}}$$

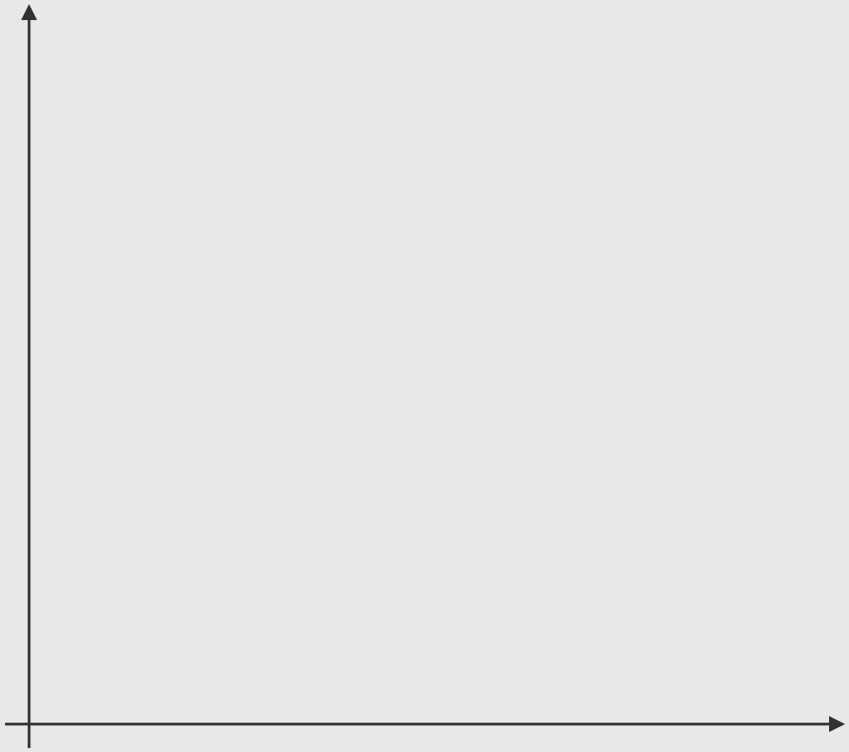
Point elasticity

$$\varepsilon_s = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Arc elasticity

$$\varepsilon_s = \frac{\Delta Q}{\Delta P} \cdot \frac{P_1 + P_2}{Q_1 + Q_2}$$

Supply curve



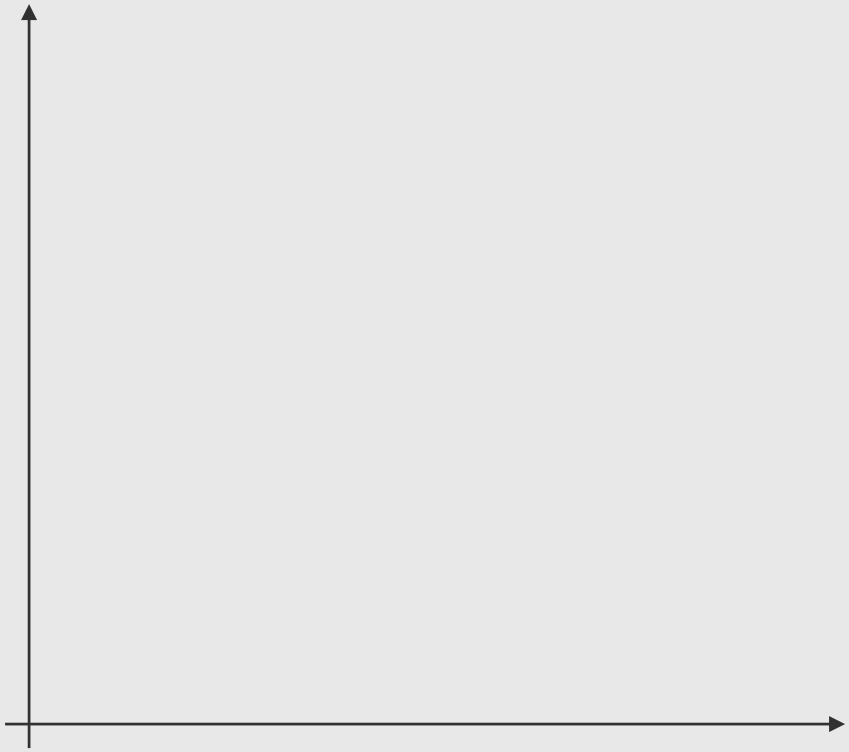
Using the same supply function, figure out elasticity on each point.

- $\varepsilon_{s(a)} =$

- $\varepsilon_{s(b)} =$

Quick question: what is the difference in demand and supply elasticity on the same curve?

Supply curve



Now try another supply curve.

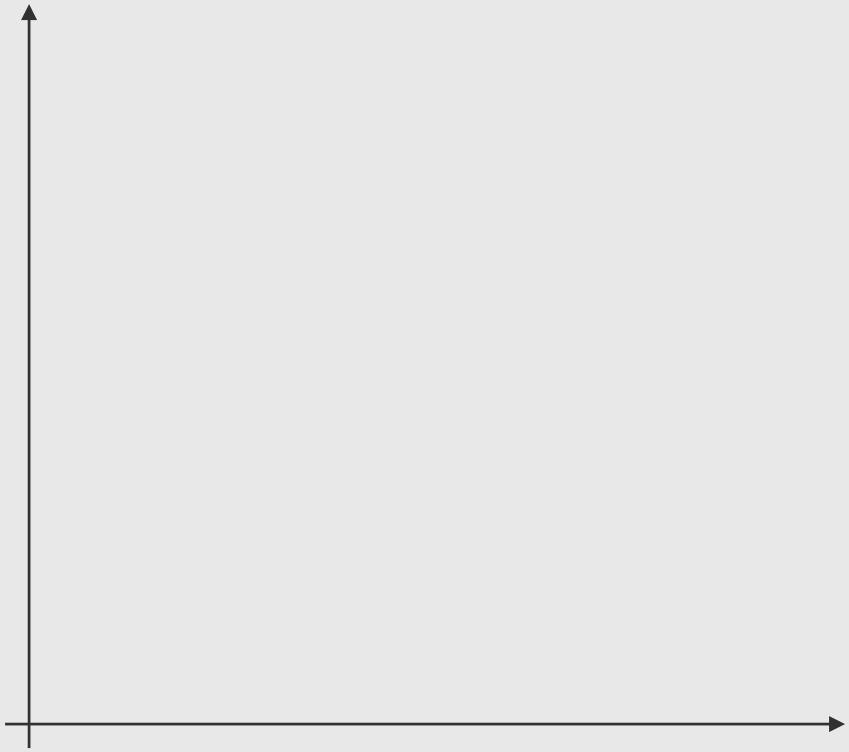
$$Q_s = P + 2$$

- $\varepsilon_{s(a)} =$

- $\varepsilon_{s(b)} =$

Quick question: what is the characteristic of this supply elasticity?

Supply curve



Try again.

$$Q_s = 4P - 2$$

- $\varepsilon_{s(a)} =$

- $\varepsilon_{s(b)} =$

Quick question: what is the characteristic of this supply elasticity?

Price elasticity of supply determiners

Good or service features also play important role determining price elasticity of supply. Unlike demand, those characteristics are mostly those are related to production.

Which direction of these determiners make supply elastic?

- Cost of production

- Duration of production

- Time frame

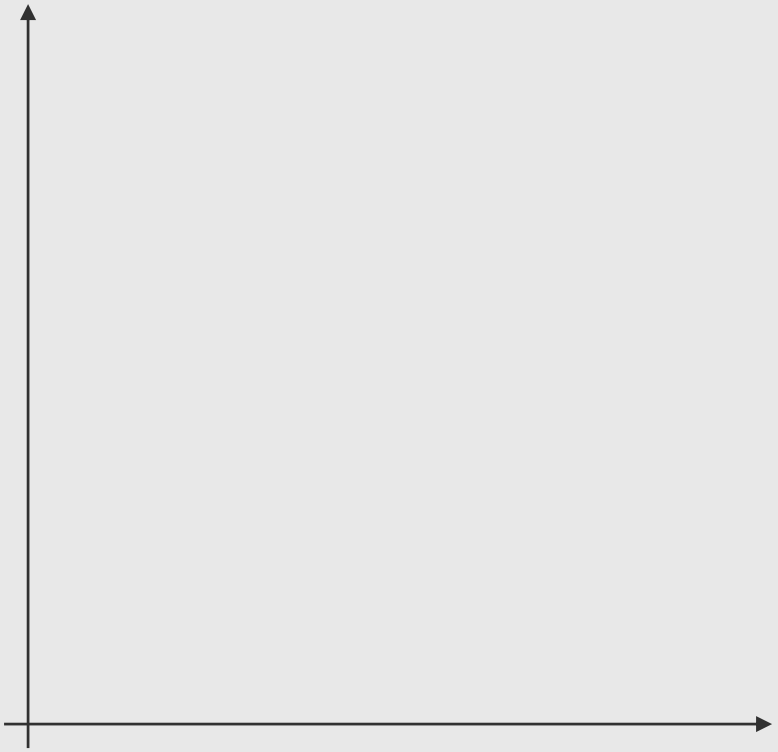
Surplus is a concept that measures social welfare gained from trade in a market, which also used to imply **'market efficiency'** compared to market intervention.

In a market, there are many groups of buyers and sellers. Buyers' preference and sellers' cost vary while market price is singular.

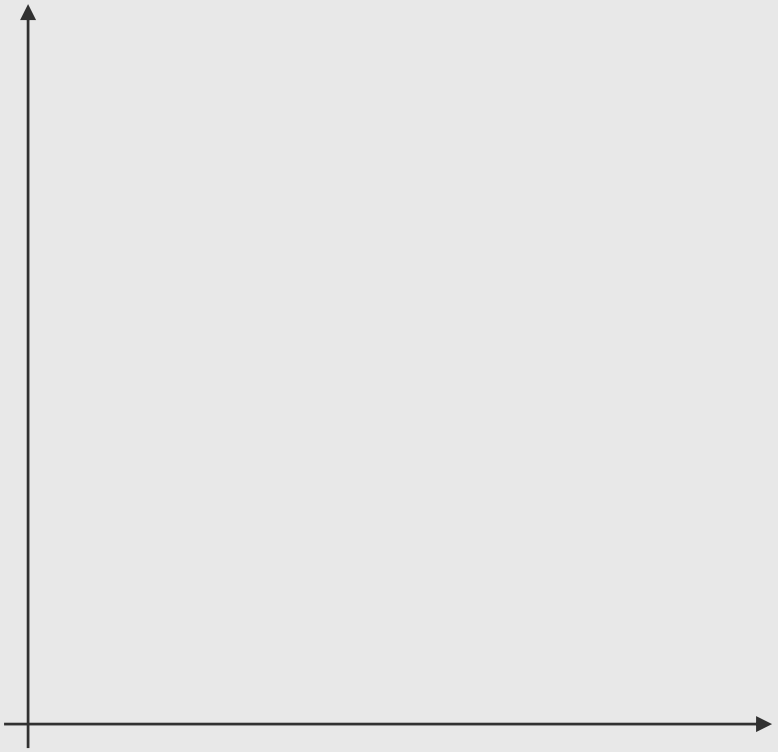
Definition 2-13: Consumer surplus

Consumer surplus is net gain or benefit of all consumers in a market. (Total willingness to buy minus market price)

Willingness to pay



Consumer surplus



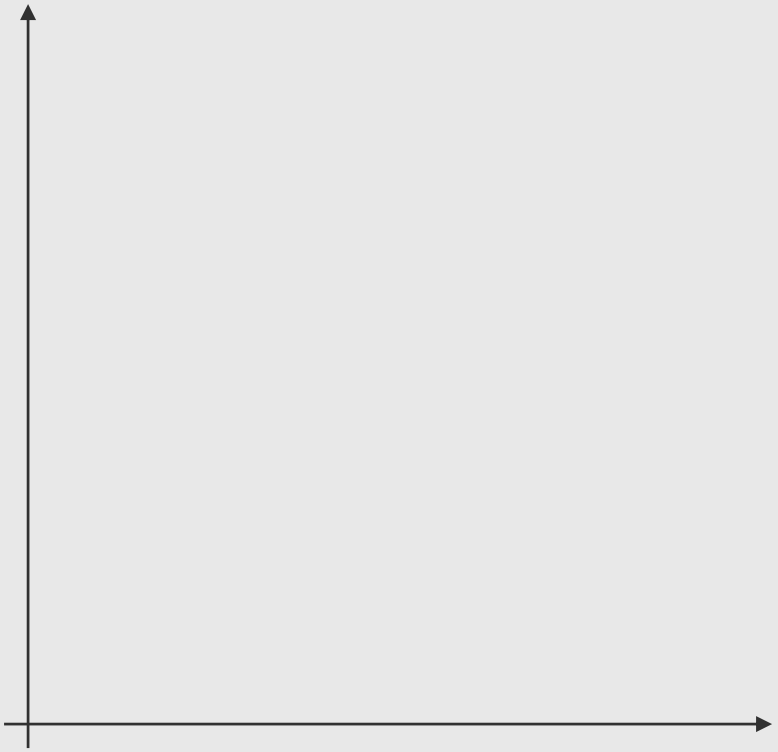
Similarly to consumers', sellers also have an amount surplus in a market.

Definition 2-14: Producer surplus

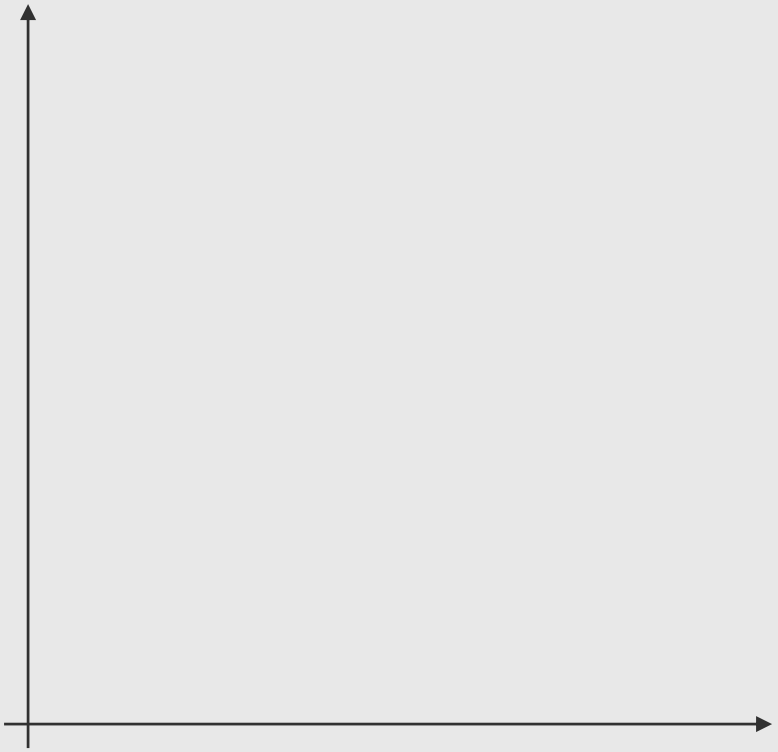
Producer surplus is net gain or benefit of all producers in a market. (Total market price minus willingness to sell)

If the market is perfectly competitive without any intervention, total surplus can be referred as **'welfare'**. This social welfare is used throughout the analyses when equilibrium shifts. Note that this 'welfare' only means welfare gained from trade.

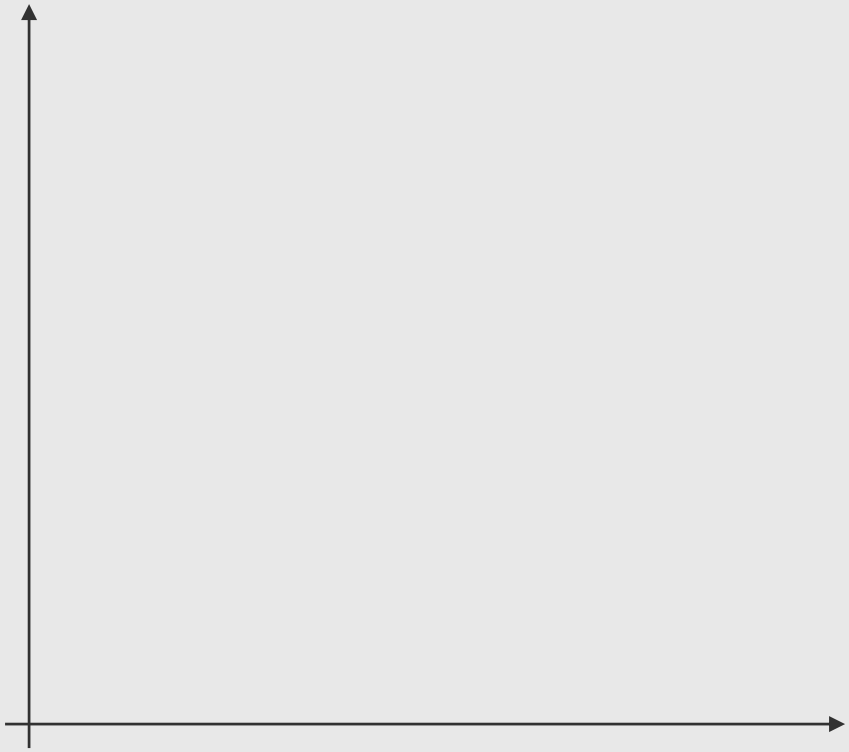
Willingness to sell



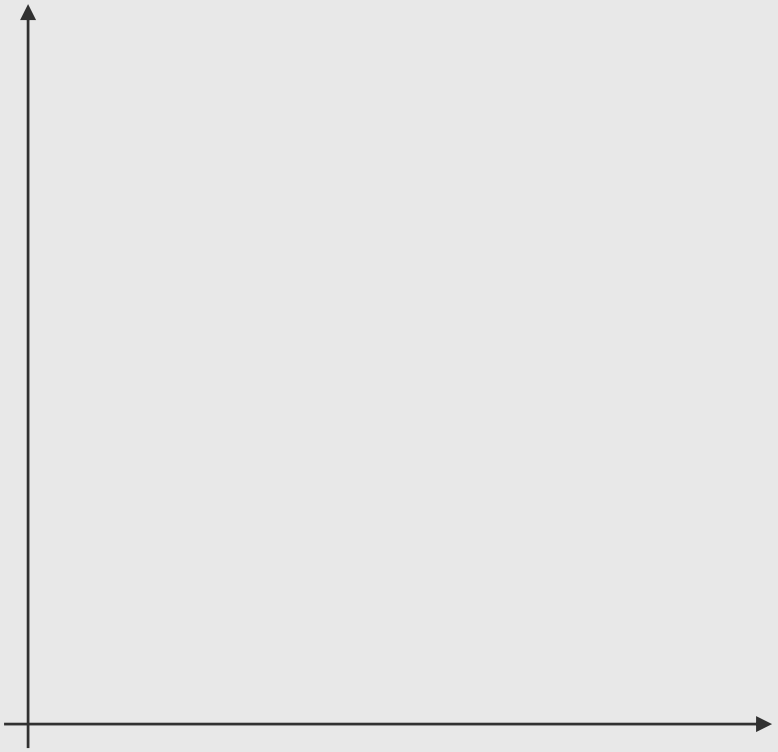
Producer surplus



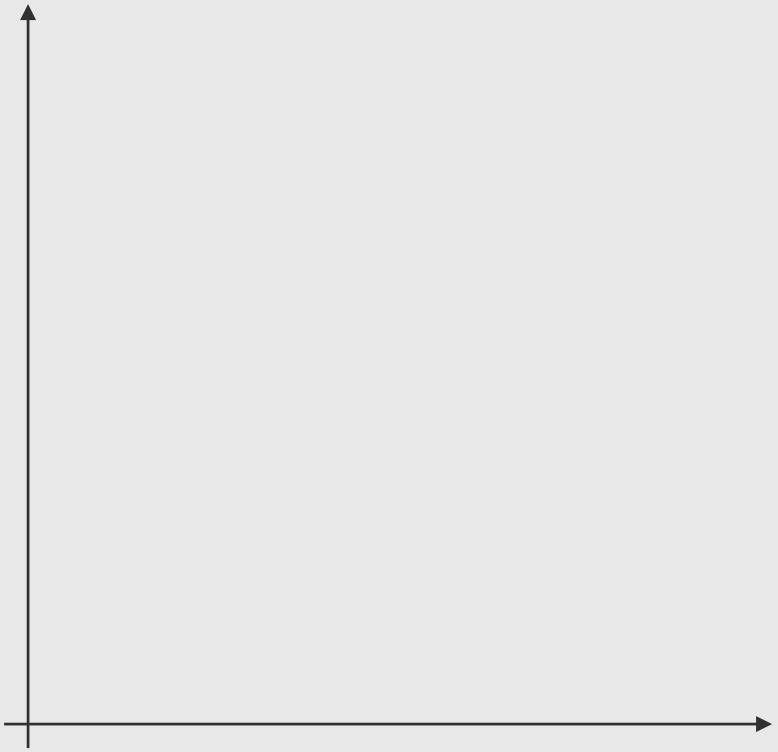
Total surplus at the equilibrium



Demand increase



Supply increase



Quick question: how would demand and supply shift affect surplus for each party?

No such country relies solely on market for resource distribution. A central institution, mostly called government, or economic and political institutions are founded to intervene markets for many circumstances such as:

- when markets fail.
- trying to stabilize price for essential goods or services
- maintaining political and economic stability
- building infrastructures and public goods

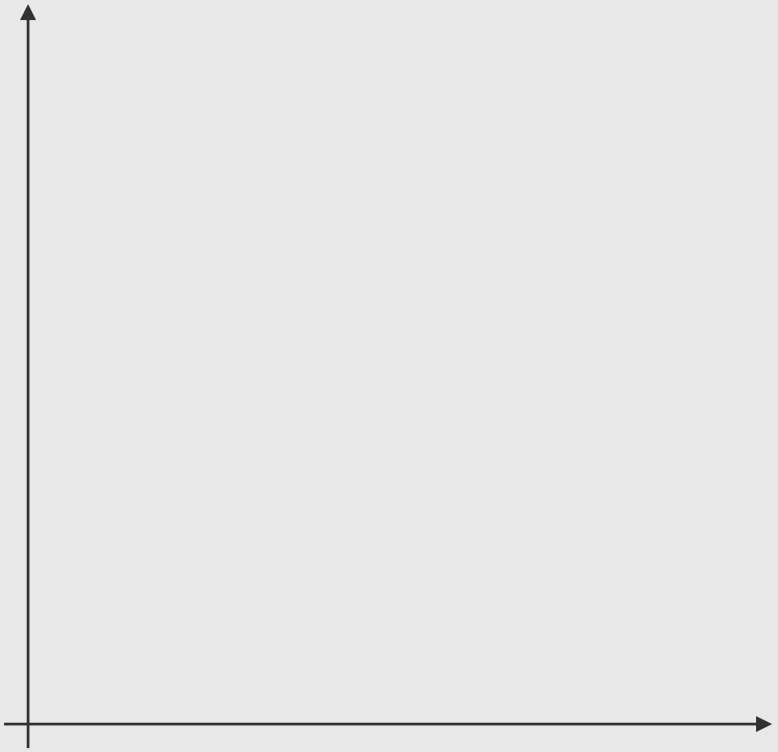
There are many tools to intervene market such as price setting, taxing which we will analyze the consequences using surplus framework. The first one is price settings.

(1) Price settings

Definition 2-15: Price ceiling

Ceiling price is set for a good or service set not to be traded above set price. Such price is mostly set via legal channel or issued as a specialized policy.)

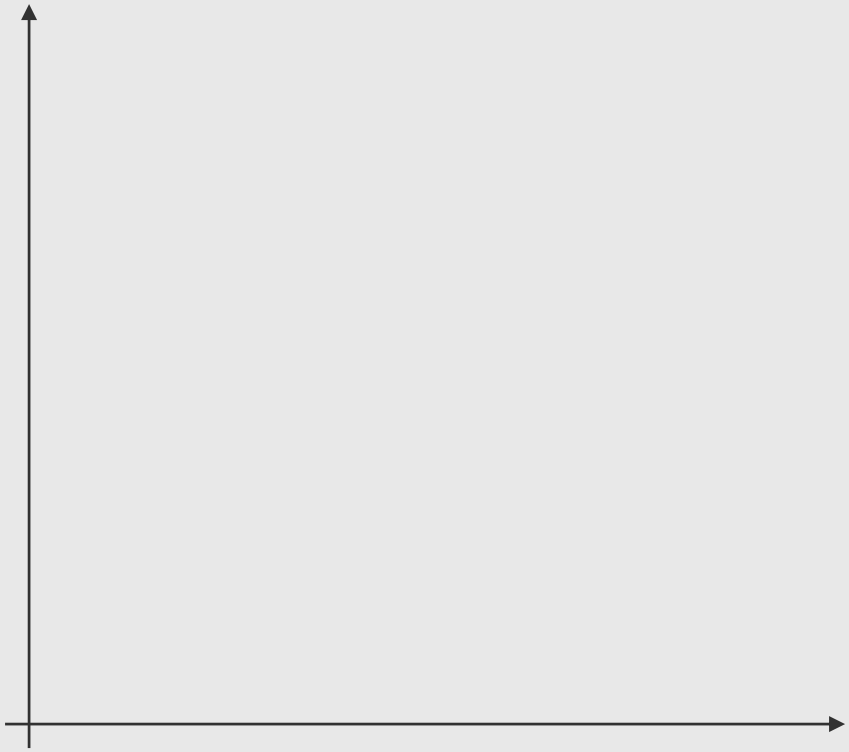
Set above market price



Set below market price

Quick question: how would ceiling price affect market?

Consider the surplus

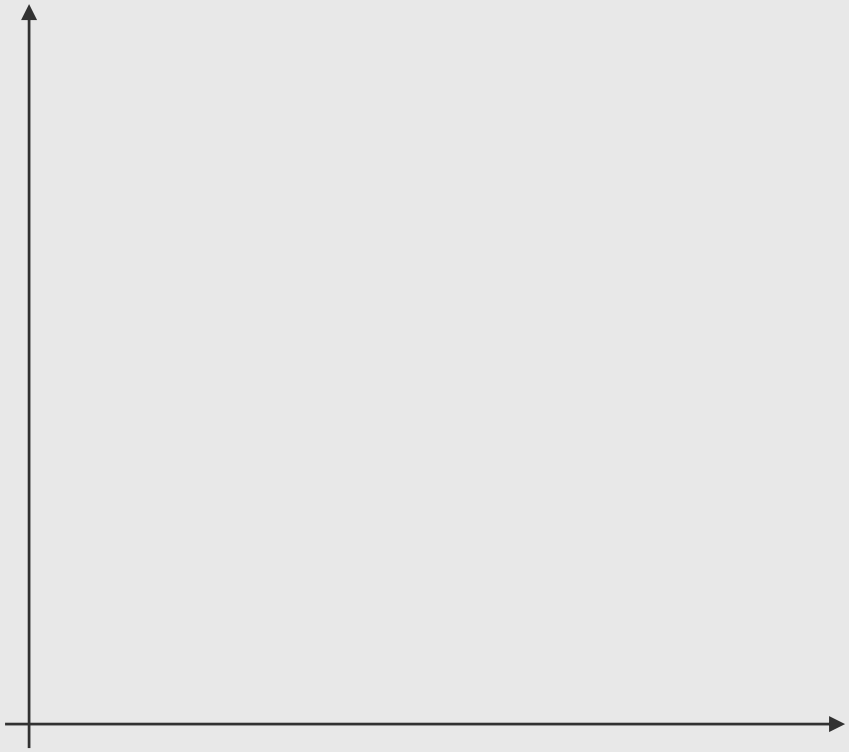


Surplus	Before	After	Diff
CS			
PS			
Total			

Definition 2-16: Deadweight loss

Deadweight loss, also known as excess burden or allocative inefficiency, is a loss of economic efficiency that can occur when the free market equilibrium for a good or a service is not achieved.

Ceiling price on inelastic demand

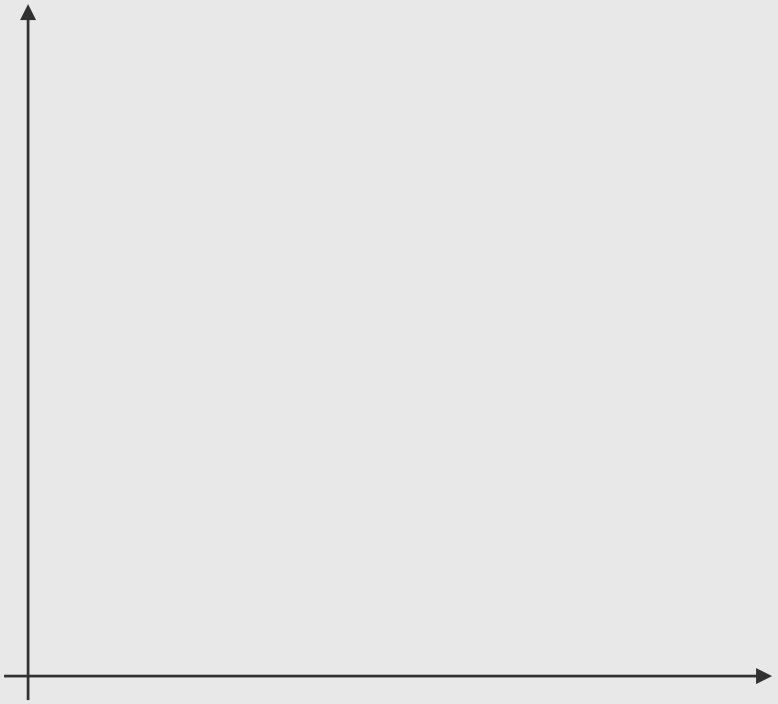


Surplus	Before	After	Diff
CS			
PS			
Total			

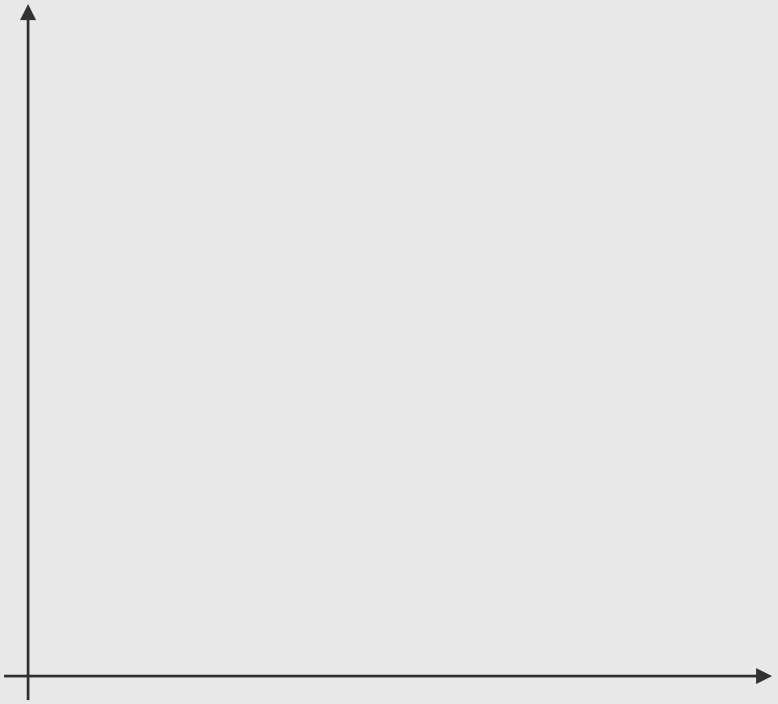
Definition 2-17: Price floor

Floor price is set for a good or service set not to be traded below set price.

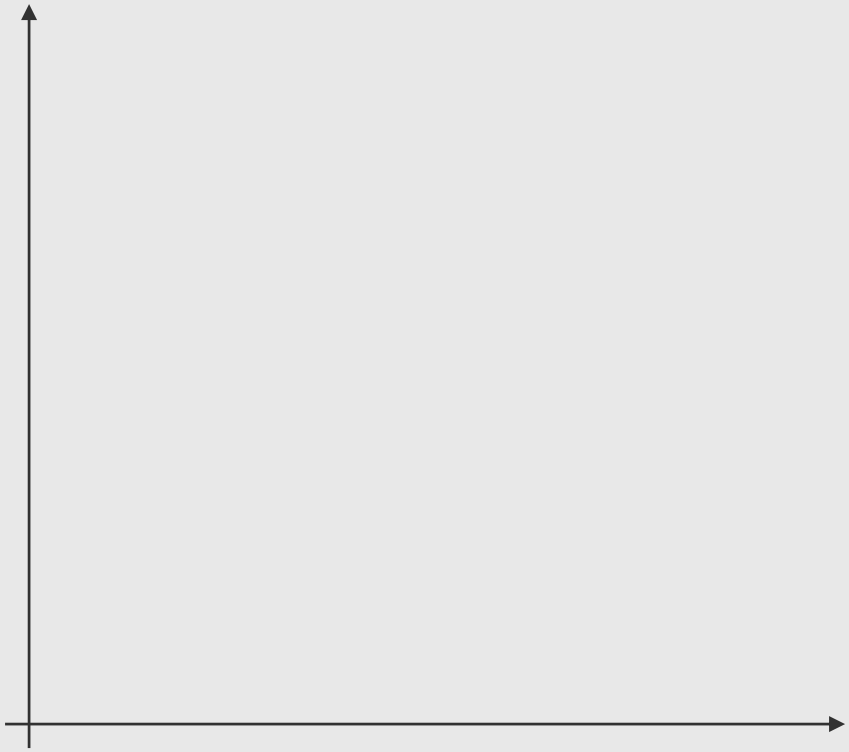
Set above market price



Set below market price



Consider the surplus



Surplus	Before	After	Diff
CS			
PS			
Total			

(2) Price support

There are many sub-schemes for price support but they share the same goal that is to raise market price. Each scheme has different assumptions that would differ government burden (expenditure) and surplus.

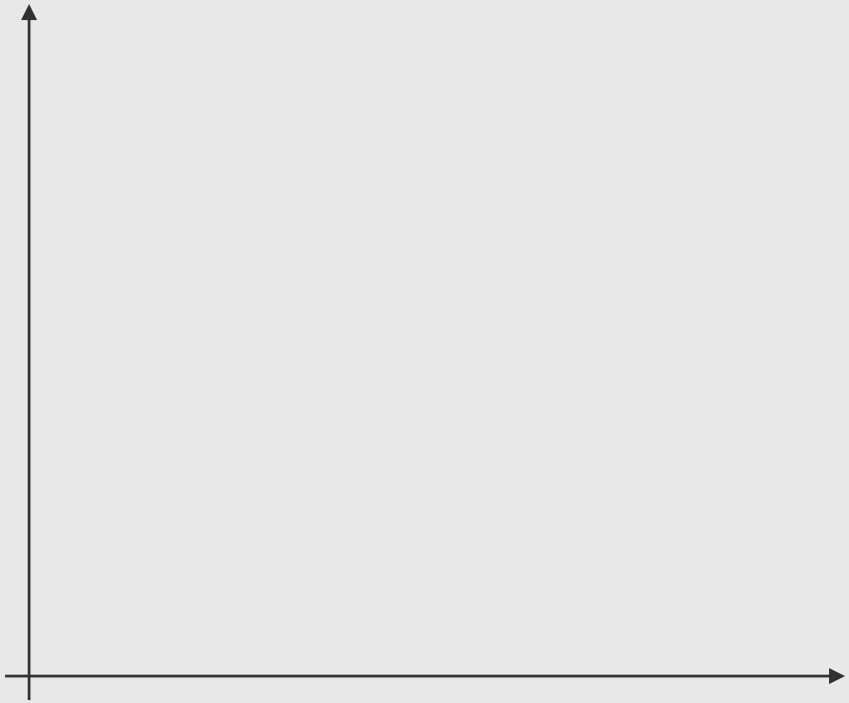
The first one is called **'Government purchasing program'** which assumptions are imposed as follows:

- The government set floor price above market, raising the price upward.

- There is some excess supply in the market since producer see this opportunity.

- The government buys out all the excess supply.

Consider the surplus: government purchasing program



Surplus	Before	After	Diff
CS			
PS			
Gov. expenditure			
Total			

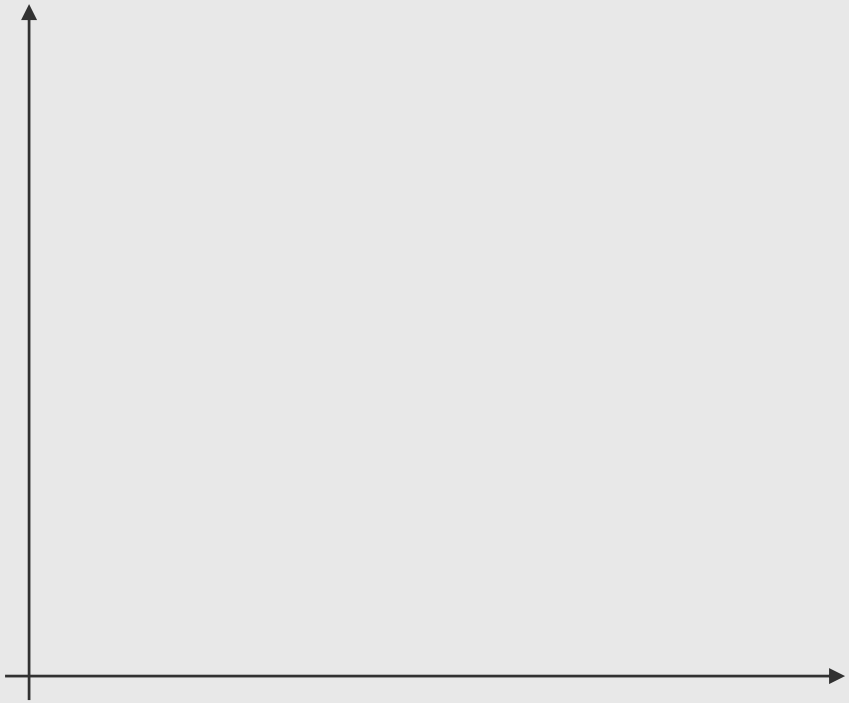
The second one is called **'Acreage limitation program'** or **'Quota'** which assumptions are imposed as follows:

- The government chooses a limited quantity supplied, corresponding to the price that they want to raise.

- At that price, producers are signaled to produce more.

- The government pays the producers as if they can sell at that price to compensate lost producers' surplus.

Consider the surplus: acreage limitation program



Surplus	Before	After	Diff
CS			
PS			
Gov. expenditure			
Total			

The third one is called **'Deficiency payment'** which assumptions are imposed as follows:

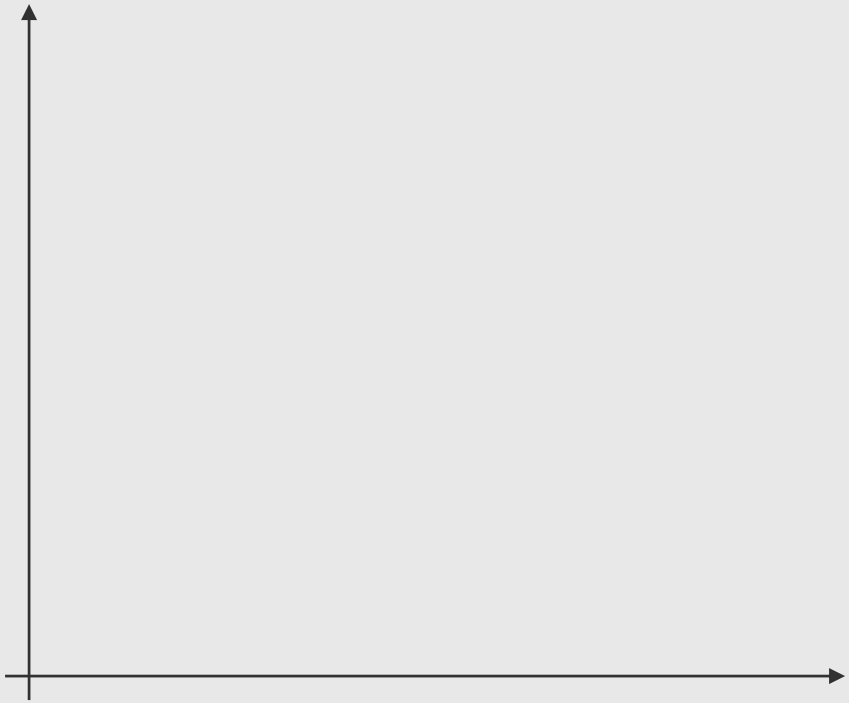
- The government signals targeted price, which is above market price.

- At that price, producers are signaled to produce more, leading to excess supply.

- Let the exchange be as the price set. Excess supply would cause price drop.

- The government pays deficiency payment to the producers as a compensation.

Consider the surplus: deficiency payment



Surplus	Before	After	Diff
CS			
PS			
Gov. expenditure			
Total			

(3) Taxing

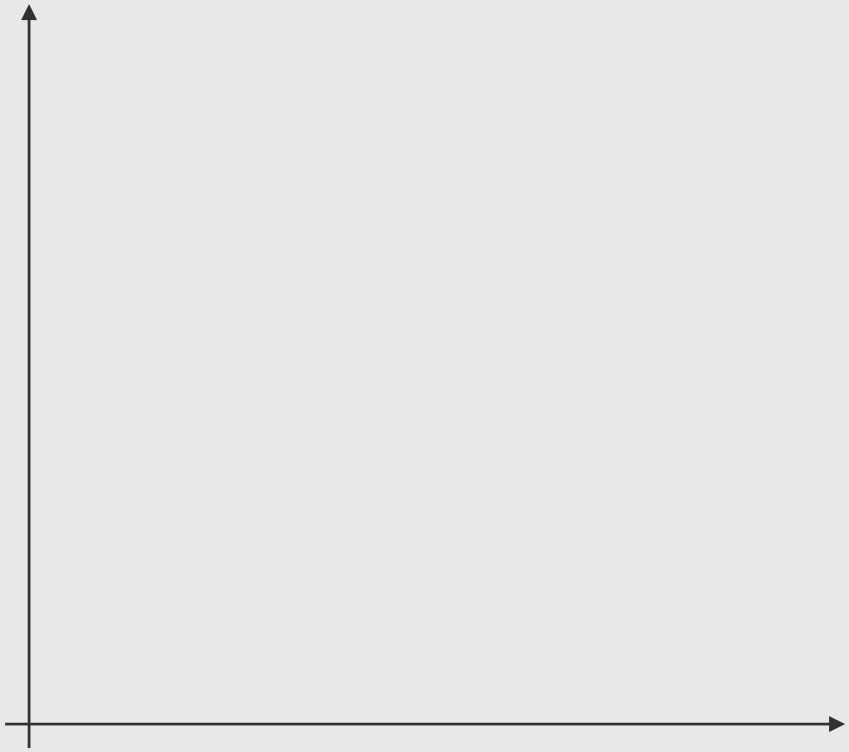
Taxing is also considered market intervention to redistribute wealth for public goods or infrastructures.

The first one is called **'Unit tax'**, which is collected equally on each unit of good or service sold in a market such as excise tax. This can be imposed on both buyers or sellers.

The second one is called **'Ad valorem tax'**, which its amount is collected based on value of transaction in a market such as sales tax, value added tax, property tax, etc.

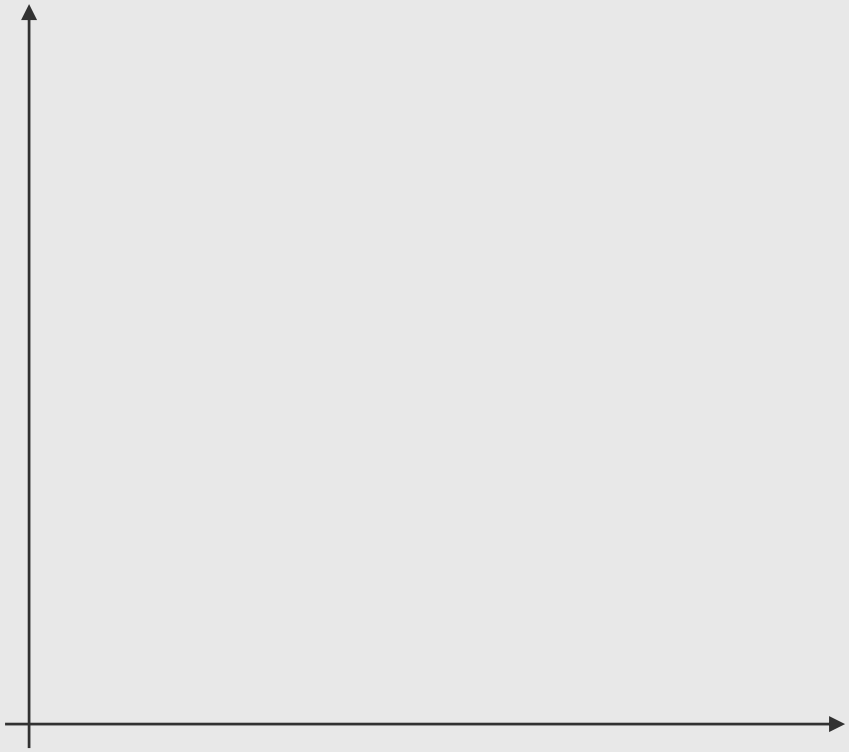
Results to be analyzed include government revenue and tax burden on each party of the market. Here we are only covering unit tax, but the same principle can be applied to analyze the result of ad valorem tax.

Tax on producers



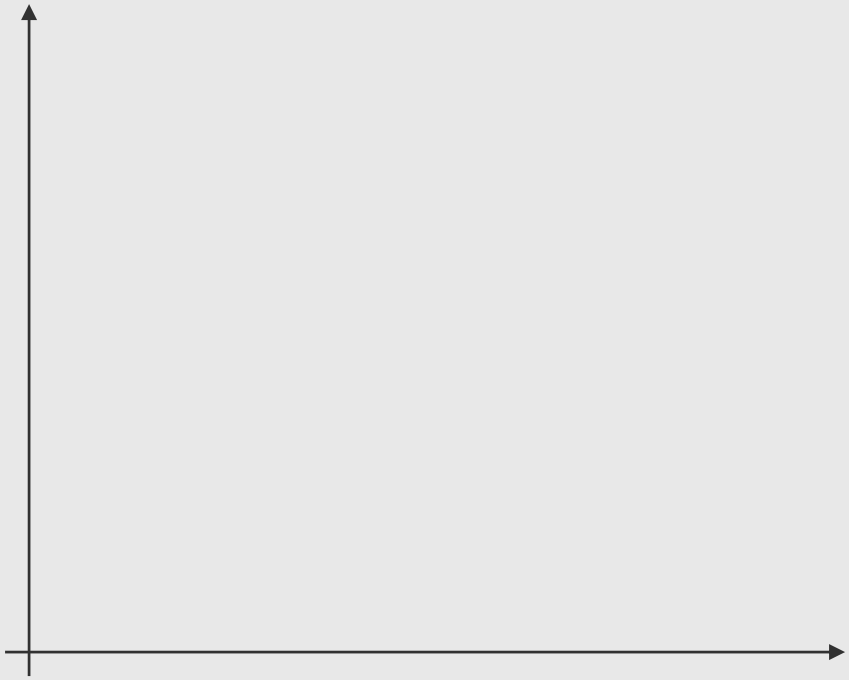
Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				

Tax on producer with inelastic demand



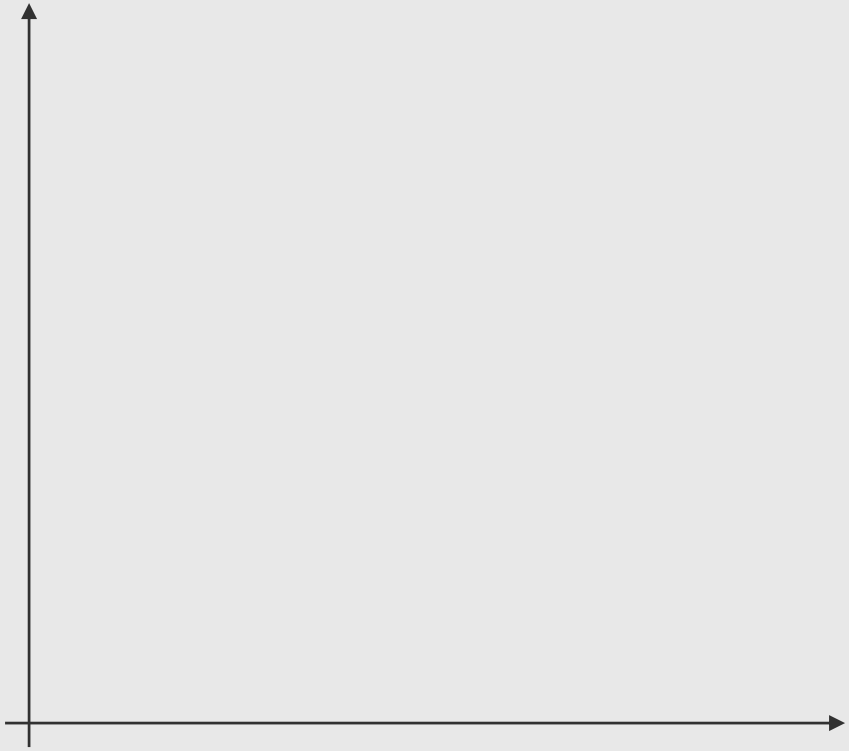
Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				

Tax on producer with perfectly elastic demand



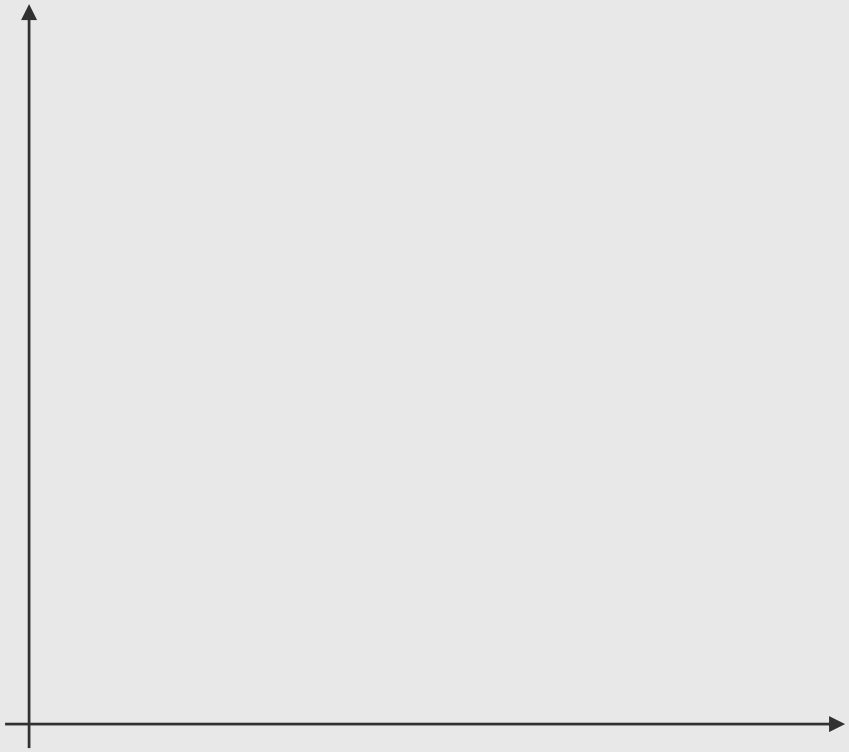
Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				

Tax on consumers



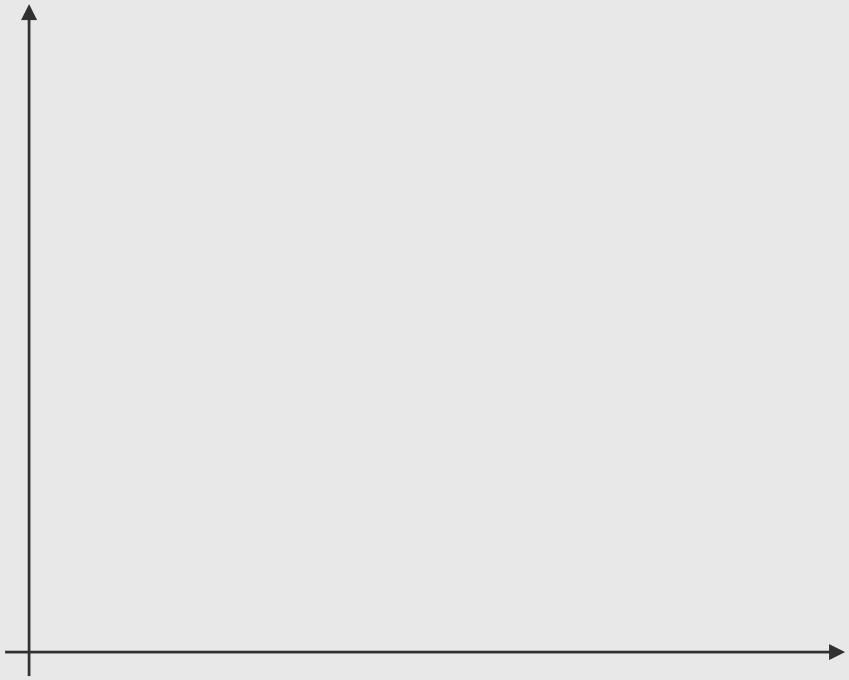
Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				

Tax on consumer with inelastic supply



Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				

Tax on producer with perfectly elastic supply



Surplus	Before	After	Diff	Tax burden
CS				
PS				
Government				
Total				