



## BUSS 1040 Notes year 2020-2021 weeks 1-13

Economics for Business Decision Making (University of Sydney)



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## 1 - 02/27 INTRODUCTION CLASS

- Economics is the study of choice under scarcity
  - scarcity is faced by consumers, businesses, government, countries, and so on
- THREE ECONOMIC QUESTIONS
  - what to produce
  - how to produce it
  - who should get what we make
- Market - a place where buyers and sellers of a particular good or service meet
- even in market economies, governments play a critical role in markets
  - because of “market failures” and/or distributional issues
  - for example, by imposing regulations and taxes

### NW Ch1&4 (2 on your own!)

- Resources are limited so that not all wants can be met - this is scarcity
  - Because of scarcity, any choice involves a trade-off or opportunity cost
    - = what we give up when we make that choice, or “the value of the next best forgone alternative”.
    - applies to any resource used when making a choice: how an individual spends their time and other resources
  - opportunity costs include both explicit costs and implicit costs
    - explicit costs are costs that involve direct payment (would be considered as costs by an accountant)
    - implicit costs are opportunities that are foregone that do not involve an explicit cost
  - Opportunity cost does not include unrecoverable or sunk costs (costs that have been incurred and cannot be recovered no matter what)
  - Marginal means additional or extra
    - **marginal benefit** - benefit of an extra unit consumed for an individual
    - **marginal cost** - additional cost of buying one more unit
  - Marginal analysis is useful as it allows us to examine the behavior of the market
  - **Correlation** - when two or more factors are observed to be moving up or down together, or in the opposite directions
  - **Causation** - a change in one variable brings about, causes change in another variable
  - **Ceteris paribus** - examine the impact of one change at a time *holding everything else constant*: this is called ceteris paribus (or ‘other things equal’)
- 
- Production possibility frontier (PPF)
    - PPF graphs the output that an individual (or a country) can produce with a particular set of resources
    - A country's PPF shows all the combinations of goods and services that a country can produce given its resources and its current state of technology

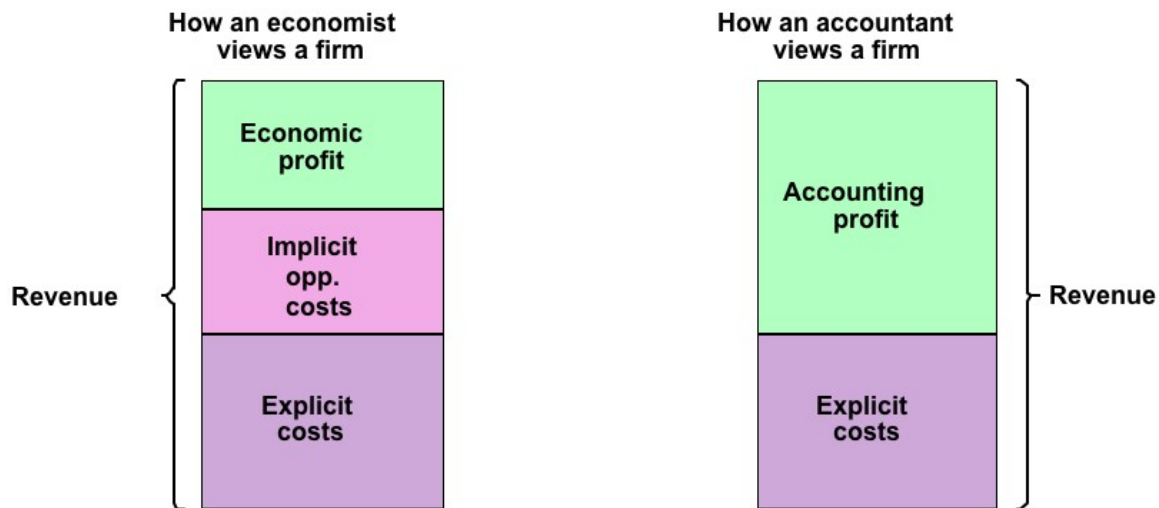
- If either the amount of resources available or the state of technology changes, the shape of the PPF can change
  - technological improvement will shift the PPF curve outwards
  - If there is a shock that boosts the productions of X only, the PPF will shift outwards from origin along x-axis only
- The slope of the PPF is the opportunity cost between the two goods or services

#### The gains from trade (or exchange)

- a crucial idea in economics is that trade can make everyone better off
  - trade = economic interaction
  - sometimes a country cannot produce a good, so they're better off trading for product variety
  - trade helps allocate goods to those who value them most. This is the gains from exchange
  - Gains from exchange can involve improvements in income
- A Pareto improving trade - both agents are better off
- Key is that exchange is voluntary
  - leaves both parties better off
  - whether the Pareto improving trade is weak or strong depends on the valuations of each of the parties
  - how much individuals benefit will depend on the terms under which trade occurs
- Specializing lowers cost of production, can make both better off (specialization)
- **Absolute advantage** is when you can produce a greater number
- **Comparative advantage** is when the opportunity cost of producing that good is lower

## 2 - 03/05 Firm Behavior (NW Chapter 7 & 8)

- We assume that firms aim to maximise profits, where profit = economic profit
- Economic profit may differ from accounting profit
  - Accounting profits are revenues minus all explicit costs
  - Economic profits are revenues minus total opportunity cost
- **Profit** - total revenue minus total costs
  - $\pi = TR - TC$
- **Total revenue** - the amount a firm receives for the sale of its output
- **Total cost** - the amount a firm pays to buy the inputs of production + foregone opportunities
  - = total opportunity cost of producing goods/services
  - Opportunity cost includes
    - Explicit costs (direct payments for inputs or factors of production)
    - Implicit costs (forgone wages, interest earnings)
- **Zero economic profit** - revenues just cover opportunity costs

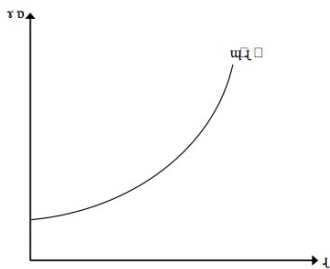


- What is a firm?
  - Using available technology, converts inputs - labor, machinery (capital), natural resources (land) - into output that is sold in a marketplace
  - Typically, a firm will require more than one input to produce its final output
- We define the short run and the long run of a firm in relation to whether or not any of the factors of production are fixed
  - An input is 'fixed' if it cannot be changed regardless of the output produced
- **Short run** - the period of time during which at least one of the factors of production is fixed
- **Long run** - all factors of production are variable (that is, not fixed)
- Short run and the long run is not defined in relation to a set period of time, but rather in relation to how long it takes for all of a firm's inputs to become variable
- A firm requires inputs or factors of production in order to produce its final output
- A *production function* shows the relationship between quantity of inputs used and the (maximum) quantity of output produced, given the state of technology
- The **Marginal Product** is the change in output when one or more input is used
- MP is the slope of the production function
  - MP of an input changes as we increase the use of that input
  - If the MP becomes progressively smaller, this is called diminishing marginal product
- Diminishing MP is very common
  - In the short run there is a fixed input of some kind which creates a capacity constraint
  - This will mean that each additional worker will contribute to output less and less than those hired before
- DIMINISHING MP IS A SHORT RUN CONCEPT
  - Relies on the idea that at least one input is fixed

## Production in the LONG RUN

- Allow all inputs into the production process to be variable
- **Returns to scale** - refers to how the quantity of output changes when there is a proportional change in the quantity of all inputs
  - If output increase by the same proportional change, there are constant returns to scale
  - If output increase by more than the proportional increase in all inputs we have increasing returns of scale
  - If output increases by less than the proportional increase in all inputs, there are decreasing returns to scale
- It is possible that a firm has diminishing MP in the short run, and still has increasing returns to scale in the long run
- A **cost function** is an equation that links the quantity of output with its associated production cost
  - For example,  $TC = f(q)$  where TC represents total cost and q represents the quantity of output

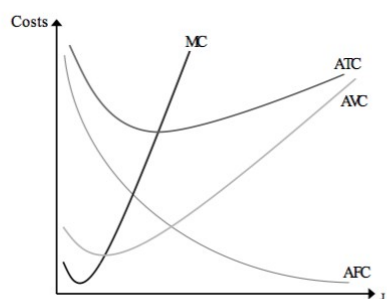
## A typical short-run total cost function



- When output is zero, total cost is positive
    - This is because in the short run some factors of production are fixed and must be paid for
  - The total cost curve rises as output increases
    - Costs increase when more inputs are required
  - The total cost curve rises at an increasing rate
    - Captures diminishing MP
- 
- In the short run, some inputs will be fixed and some inputs will be variable; as a consequence, a firm will have some fixed costs and some variable costs
  - **Fixed costs** - costs that do not vary with output. When output is zero, all the costs are fixed costs
  - **Variable costs** - are costs that vary with output. All costs that are not fixed costs will be variable costs
    - $VC = TC - FC$
  - **Total costs** consist of fixed and variable costs
    - $TC = VC + FC$
  - **Average fixed cost (AFC)** is fixed cost per unit of output:  $AFC = FC/q$
  - **Average variable costs (AVC)** is variable cost per unit of output: that is,  $AVC = VC/q$
  - **Average total cost (ATC)** is total cost per unit of output;  $ATC = TC/q$ 
    - As  $ATC = AFC + AVC$ , its shape is affected by both

- At very low levels of output, ATC is usually the decline in AFC dominates, but at higher levels of output, it is usually upward sloping because the increasing AVC dominates
- Together this will give the ATC curve a U-shape
- **Marginal cost** is the increase in total cost from an extra unit of output
  - Due to diminishing MP, a typical MC curve will eventually be increasing in output; MC often has a positive slope
    - The extra cost of producing another unit of output (MC) must go up
    - In the short run *diminishing MP implies increasing MC*

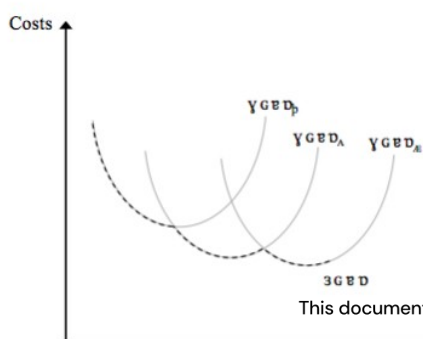
## A typical firm's short-run costs curves



### Relationship between ATC, AVC, and MC

- As a rule, MC passes through the minimum of ATC and AVC
  - Think of a student's test scores: if the next test score (the marginal score) is higher than the student's average, the average rises; if the next test score (the marginal score) is lower than the average, average falls
- The same logic applies to costs: if MC is above ATC, ATC rises; if MC is less than ATC, ATC is falling; it follows then that MC intersects ATC at the minimum of ATC
- In the long run, all inputs are variable
- All production factors are variable
  - If a firm does not want to produce anything, its costs are zero
  - A firm producing a positive output has more flexibility to adjust all of its inputs
  - So long run costs should not be higher than short-run costs
- **Long run marginal cost** is the marginal cost of increasing output by one unit
  - Must take into account the fact that all inputs can be varied to achieve this increase
- As noted, LR MC will not be more than SR MC
- Given the firm's extra flexibility in the long run, *long-run average cost* can be no greater than *short-run average cost*

## Long-run average cost



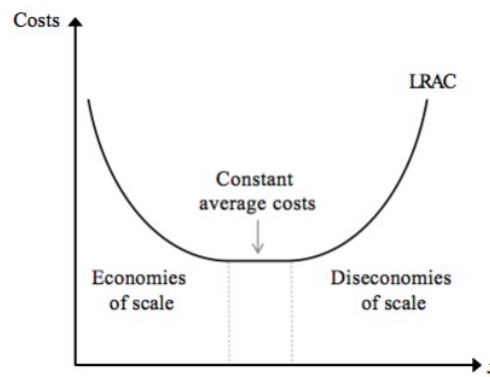
- As a result of this, the long-run average cost curve will be the lower envelope of all of the short run average cost curves

**Economies of scale** is when long-run average costs decrease with output

**Diseconomies of scale** is when long-run average costs increase with output

**Constant returns to scale** is when long-run average costs are constant as output expands

## Economies of scale

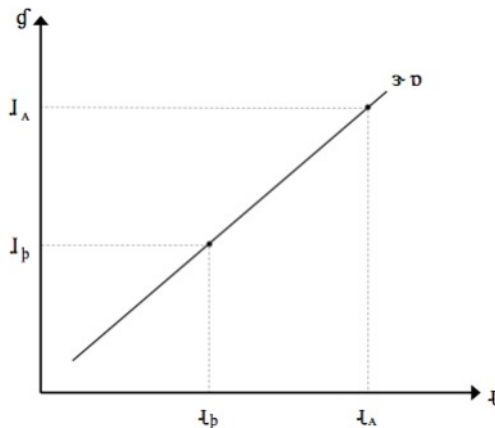


### Supply

- Now we use costs to derive an individual **firm's** supply function and the **market** supply function
- We focus on **competitive markets**, in which there are many buyers and sellers, such that no individual buyer or seller has the power to materially affect the price in the market
  - As a consequence, both sellers and buyers in the market are *price takers*
- **Firm supply** - the quantity of output a firm is willing and able to supply at a certain price
  - The supply curve traces out all combinations of 1. Market price and 2. Quantities that a firm is willing and able to sell at that price
- **A firm should sell up until  $P = MC = MR$**
- The marginal revenue for each unit that the firm sells is the price,  $P$ 
  - $MR = P$  (competitive market)
  - Remember, a competitive firm is a price taker - it cannot affect market price, This means price is unchanged, regardless as to how much an individual firm sells
- First, if a firm supplies a quantity where  $P > MC$  for the last unit sold, profits rise when increasing its output by one unit
  - It will increase its profit since the additional revenue from selling that extra unit ( $P$ ) outweighs the  $MC$

- Second, if a firm is producing where  $P < MC$  for the last unit made, the firm can increase profit by not making that last unit
  - The extra revenue ( $P = MR$ ) is less than the extra costs that are incurred
- Consequently, a firm should sell up until  $P = MC$

## Firm supply



- If price changes from  $P_1$  to  $P_2$ 
  - As price rises, so does the firm's MR
  - It now continues to produce until  $P = MC$  for the last unit produced
  - As MC is often increasing, the quantity supplied in the market is higher when price is higher
- A movement along the supply curve when output price changes is called a '*change in quantity supplied*'

### The law of supply

- Means that a firm's supply curve is given by its MC curve
- MC curve is upward sloping due to diminishing marginal product
  - This gives a positive relationship between the price of a good and the quantity of that good supplied
    - Ceteris paribus, the higher the price of a good, the greater is the quantity supplied
- The firm's supply curve is derived by assuming that only the price and quantity supplied of the product can change (ceteris paribus)
- If any other relevant factors change, the supply curve itself will shift
  - These factors include the cost of inputs, technology and expectations about the future
  - At any given output price, the quantity supplied changes
- If there is a change in one of these factors there will be a change in supply moving to the right or left

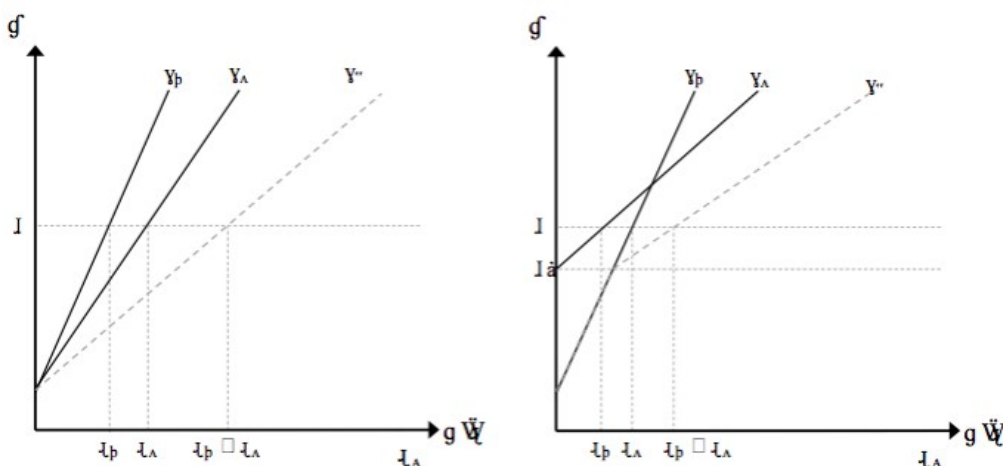
### Market supply

- Given that an individual firm's supply curve is given by its MC curve, we can use this to derive the market supply curve
  - Shows the quantity supplied in a market at different market prices, ceteris paribus



- Graphically, the market supply curve is the horizontal summation of the individual supply curves
  - The individual MC curves summed horizontally along the q-axis

## Market supply – two examples of horizontal summation of individual S curves



- The law of supply also holds for the market supply curve
  - We also use the term 'change in the quantity supplied' to refer to movements along the market supply curve
  - The term 'change in supply' again refers to a shift of the supply curve itself

### 3 - 03/12: DEMAND, MARKET EQUILIBRIUM AND WELFARE

- Consumer behavior - DEMAND
  - Consumers aim to maximize their well being
  - Relate marginal benefit of consuming a good to demand
- Function of MARKETS
  - Demand + supply = equilibrium
  - Market equilibrium: price, quantity traded
  - Welfare analysis: surplus for consumers and firms
- Consumer behavior → demand for goods and services
- In economics we examine consumer behavior assuming each consumer tries to maximize their well being, or the benefit he or she gets from consuming goods and services, subject to their budget constraint (trade-offs)
- First we consider competitive markets
  - That's where the choices of individual consumers do not affect the price in the market - consumers are price takers

Benefit and willingness to pay

- Consumer derives some benefit from consuming a particular good or service
- The benefit a consumer gets is also their willingness to pay
  - The maximum price a consumer will pay for a good is equal to the benefit they anticipate getting from the item (in money terms).

#### Total benefit and marginal benefit

- When a consumer buys multiple units of a good, important to distinguish between total and marginal benefit
  - E.g. Candice's willingness to pay for coffee is \$4 for the first cup, \$3 for the second and \$2 for the third
    - Total benefit for the three cups is \$9
    - Her marginal benefit measure how much extra benefit she derives from consuming an additional cup
- Generally, we expect marginal benefit to decline with each additional unit consumed (declining or *diminishing MB*)
  - The extra benefit a consumer gets from a good gets smaller the more of that good the consumer has already enjoyed
- When the consumer buys many units of a good, typical to have a continuous (smooth) MB curve

#### Individual demand

- We can use a consumer's marginal benefit curve to derive his individual demand curve
- An individual's demand is the quantity of a good or service that a consumer is willing and able to buy at a certain (market) price
  - Hence, the individual demand curve traces out all combinations of a) market price and b) individual demand at that price, *ceteris paribus*
- $MB = D$ 
  - Marginal benefit is effectively demand curve like marginal cost is equal to supply curve
- A consumer purchases units of a good up to  $P=MB$
- Consequently, a consumer's individual demand curve is the MB curve
  - Due to diminishing MB, individual demand is downward sloping
- A demand curve represents how much a consumer is *willing* and *able* to buy at different markets

#### Movement along a demand curve

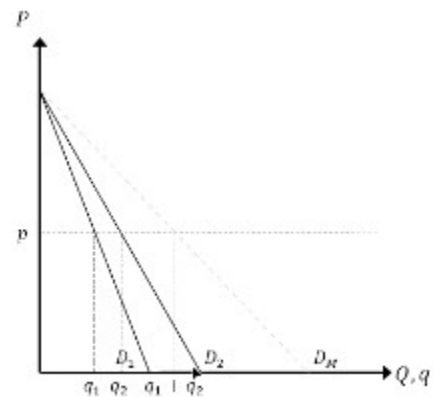
- The demand curve is derived by assuming that only price and quantity can change
- If there is a change in the price/quantity, there will be a movement along the demand curve
  - If there is a movement downwards along the demand curve, this is called an 'increase in the quantity demanded'
  - If there is a movement up along the demand curve, this is called a 'decrease in the quantity demanded'

## Changes in demand

- A demand curve is drawn assuming all other relevant factors (other than the price of the good itself and the resulting quantity demanded) are held constant (*ceteris paribus*)
  - These factors include the income, tastes, price expectations and the prices of other related goods
- If any of these factors change, the demand curve itself will shift in or out
- A shift of the demand curve is called a change in demand
  - If demand shifts right this is called an 'increase in demand'
  - A shift to the left, this is called a 'decrease in demand'

## Market demand

- An individual consumer's demand curve is given by his MB curve
  - We can use this to derive the market demand curve
- The market demand curve traces out combinations of a) market price and b) quantities that all consumers in a market are together willing and able to buy at that price
- We often are interested in demand at the market level (rather than for one individual)
  - The market demand curve can be derived by adding together the quantity demanded by each individual consumer at each price



## Market Equilibrium and Welfare Analysis

- A market is in equilibrium if, at the market price, the quantity demanded by consumers equals the quantity supplied by firms in the market
  - The price at which this occurs is called the market-clearing price (equilibrium price)
- If a market is not in equilibrium, there will be pressure on price and quantity to move towards the equilibrium price and quantity

## Comparative static analysis

- Markets are affected by a change or event beyond the direct control of buyers or sellers in that market
- IN such cases, we may want to analyse how that change or event affects the choices of firms and/or consumers in the market, and how those choices affect market outcomes

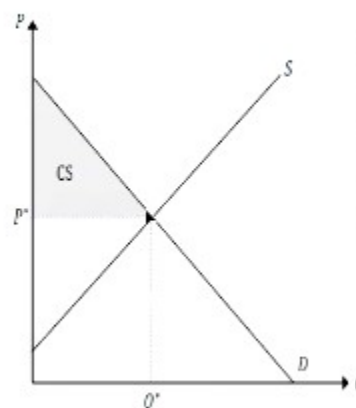
## Welfare - the benefit to market participants

- Markets are one of the main ways that goods and services are produced and distributed
- Consumers and firms will only participate in markets if it is beneficial to them
  - They are at least as well off from trading than if they do not

- We can measure and observe changes in the benefits to these participants using welfare analysis

### Consumer surplus

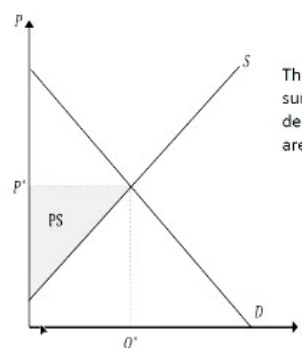
- CS is the welfare consumers receive from buying units of a good or service in the market
  - We can measure CS by evaluating the net value of a good or service to the consumer, as he or she perceives it
- That is, consumer surplus is given by the consumer's willingness to pay, minus the price actually paid, for each unit bought
- *An individual CS is by calculating the area between the individual demand curve and the price line*
  - Similarly, we can find the CS of all consumers in the market by calculating the area between the market demand curve and the price line



The area of consumer surplus in this market is denoted by the grey-shaded area – the area under the demand curve above the price line.

### Producer surplus

- **Producer surplus** is the welfare producers (firms) receive from selling units of a good or service in the market
- PS can be measured by considering the net benefit of selling a good or service
- That is, producer surplus is given by the price the producer receives, minus the cost of production, for each unit of the good or service bought



The area of producer surplus in this market is denoted by the grey-shaded area.

### Pareto efficiency

- Pareto efficient if it is not possible to make someone better off without making someone else worse off
  - Pareto efficient outcome maximizes total surplus
- In the competitive market equilibrium, all the potential gains from trade are exhausted
  - There are no consumers left in the market with a willingness to pay higher than any seller's MC to provide an additional unit
  - The price mechanism ensure that the people with the highest value for the product end up with the goods, and that those firms with the lowest costs are the ones who make the goods

- While these actions are *completely decentralized*, a competitive market manages to maximize total surplus
- An outcome that is pareto efficient is not automatically the most fair or equitable, or even the most desirable
  - More about efficiency in that you cannot improve without hurting someone else

#### 4 - 03/19: Elasticity, Perfect Competition

- *Elasticity*: Responsiveness of one variable to a change in another variable
- We are often interested in measuring how a change in one variable affects another
- Issue with measuring quantitative changes is that different markets use different units of measurement
  - each market has its own price level
- Elasticity is a way we can compare quantitative changes across different situations by looking at proportional changes
- Elasticity measure how responsive one variable (y) is to changes in another variable (x)
  - When x is changed, does y change by a small amount or by a large amount?

We can calculate elasticity ( $\epsilon$ ) by dividing the percentage change in y by the percentage change in x. Note:  $\Delta$  simply means 'change'.

$$\epsilon = \frac{\% \Delta y}{\% \Delta x}$$

This says for 1% change in x there will be an  $\epsilon\%$  change in y. Note the larger the absolute value of  $\epsilon$  the more responsive y is to changes in x, and vice versa.

- It is not always obvious how to determine the proportional change in a particular variable

Generally, we can calculate the proportional change in a variable by dividing the change in the variable by the variable itself:

$$\varepsilon = \frac{\Delta y / y}{\Delta x / x}$$

#### Point method (equation)

- At times we are interested in the elasticity around a particular outcome
  - In other words, how responsive is the quantity demanded to a change in the price at Q1, P1?

$$\varepsilon = \frac{\Delta y / y}{\Delta x / x} = \frac{\Delta y}{\Delta x} \cdot \frac{x}{y} = \frac{dy}{dx} \cdot \frac{x}{y}$$

#### Midpoint method

- Sometimes we are interested in elasticity when moving from one point to another
  - Midpoint will calculate the proportional changes by measuring the average (midpoint) of P and Q

$$\varepsilon = \frac{\Delta y / y^m}{\Delta x / x^m} = \frac{\Delta y}{\Delta x} \cdot \frac{x^m}{y^m}$$

where

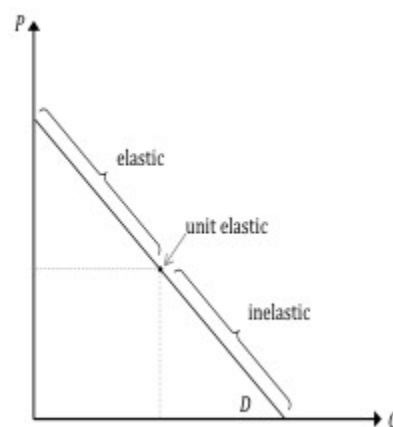
$$y^m = \frac{y_1 + y_2}{2} \text{ and } x^m = \frac{x_1 + x_2}{2}$$

- The price elasticity of demand measure how sensitive the quantity demanded of a good (Qd) is to changes in price (P)
  - It is the proportional change in quantity demanded of a good, given a 1% change in it's price
- Why is it useful to have an understanding of the responsiveness of QD to change in P?
  - Business might be interested in the effect of a price change on quantity sold, revenue and profits
  - Governments might want to know how (consumer or firm) behavior changes when a specific policy is put in place
- Given the law of demand, the elasticity of demand will normally be negative
  - Some authors will drop the minus sign when reporting the elasticity of demand, treating the negative sign as implicit

#### Interpretation of elasticity of demand

- If elasticity of demand = 0, demand is perfectly inelastic
- If EoD is between -1 and 0, demand is inelastic
- If EoD = -1 demand is unit elastic
- If EoD is less than -1, demand is elastic
- If EoD is less than infinity, demand is perfectly elastic

- The price elasticity of demand depends on the slope of the line, but also the reference point on the curve used to calculate elasticity
- Thus the price elasticity of demand changes along a linear (straight-line) demand curve
  - Because the slope of the demand curve is constant, the elasticity varies because the proportional change in quantity (and price) varies depending on the size of quantity (or price) at a particular point



#### Importance

- Using the price elasticity of demand we can evaluate the (expected) effect on price and quantity of a change in supply
- Not only the direction of the effects but also the amount and effect on revenue

#### Elasticity and revenue

- We can determine from the elasticity of demand how total revenue in the market will change as price changes
- Total revenue as a function of P is:  $TR(P) = P \cdot q(P)$ 
  - Calculated by multiplying price and quantity
- We can differentiate this equation with respect to P in order to determine how total revenue changes in response to a small increase in price

$$\frac{dTR}{dP} = q + P \cdot \frac{dq}{dP}$$

- Rearranging gives:

$$\frac{dTR}{dP} = q \left( 1 + \frac{P}{q} \cdot \frac{dq}{dP} \right) = q(1 + \epsilon_d)$$

- This equation provides a direct link between the price elasticity of demand and the change in total revenue
  - In order for TR to increase with a price increase, the right hand side of the equation must be positive
    - This will be true if and only if  $EoD > -1$  (inelastic)
    - On the other hand, if demand is elastic TR will fall when the market price rises
- On the elastic part of the demand curve the price needs to be lowered in order to increase TR
- On the inelastic part the price needs to be raised to increase revenue
- Thus, TR is maximized when demand is unit-elastic (middle of the demand curve)

### Changes in revenue and elasticity

- If demand is elastic, a 1% increase in price will cause a greater than 1% fall in quantity demanded
  - The increase in P is more than offset by the decrease in Qd, causing TR to fall overall
- If demand is inelastic, a 1% increase in price will cause Qd to fall but by less than 1%
  - The increase in P outweighs the decrease in Qd causing TR to increase overall

### Elasticity of supply

- Elasticity of supply measures how sensitive the quantity supplied of a good (Qs) is to changes in price (P)
  - Proportional change in quantity supplied of a good, given a 1% change in its price
- Midpoint and point method equation:

$$\epsilon_s = \frac{\Delta q / q_s^m}{\Delta P / P^m} = \frac{\Delta q}{\Delta P} \cdot \frac{P^m}{q_s^m} \qquad \epsilon_s = \frac{\Delta q_s / q_s}{\Delta P / p} = \frac{dq_s}{dP} \cdot \frac{P}{q_s}$$

- The elasticity of supply is typically positive due to law of supply
- If EoS = 0, it's perfectly inelastic
- If EoS is between 0 and 1, supply is inelastic
- If EoS = 1, supply is unit elastic
- If EoS > 1 supply is elastic
- If EoS = infinity, supply is perfectly elastic

### Cross price elasticity

- Measures how sensitive the quantity demanded of good A is to changes in price of good B

#### Point method:

$$\epsilon_{AB} = \frac{\Delta Q_A / Q_A}{\Delta P_B / P_B} = \frac{dQ_A}{dP_B} \cdot \frac{P_B}{Q_A}$$

#### Midpoint method:

$$\epsilon_{AB} = \frac{\Delta Q_A / Q_A^M}{\Delta P_B / P_B^M}$$

- If cross price < 0, an increase in the price of good B is associated with a fall in the QD of good A
  - MEANS THEY'RE COMPLEMENTS (likely to be consumed together)
- If cross price > 0, an increase in the price of Good B is associated with a rise in the QD of good A
  - MEANS THEY'RE SUBSTITUTES
- If cross price = 0, they're independent goods and unrelated



- Important to understand as businesses need it for multi-brand product management and government for taxes on consumer behavior

#### Income elasticity

- The demand for a good may also depend, in part, on a consumer's income
- Income elasticity measures how sensitive the QD of a good (Q) is to changes in income (Y)

The midpoint formula is, using the midpoints for quantity ( $Q^M$ ) and income ( $I^M$ ):

$$\eta = \frac{\Delta Q / Q^M}{\Delta Y / Y^M}$$

Using the point elasticity formula:

$$\eta = \frac{\Delta Q / Q}{\Delta Y / Y} = \frac{dQ}{dY} \cdot \frac{Y}{Q}$$

- If income elasticity  $< 0$ , demand decreases when income rises (inferior good)
- If income elasticity  $= 0$ , demand is invariant to changes (neutral good)
- If income elasticity is between 0 and less than 1, it is a normal good
- If income elasticity  $> 1$ , when income rises by 1% demand increase by more than 1% (luxury good)

## Market Structures

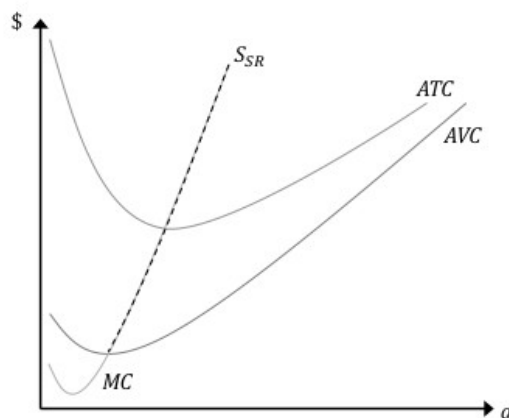
### Perfect competition

- Perfect competitive markets have the following characteristics:
  - Many buyers and sellers
  - Homogeneous products - consumers are indifferent as to who they purchase from
  - Price taker - no individual buyer or seller has sufficient market power
  - Free entry and exit - firms can freely enter and exit the market

### The supply curve in perfect competition

- Short run
  - Each firm's plant size is given
    - Some inputs cannot be altered (fixed inputs, e.g. capital goods)
    - This number of firms in the industry is fixed
- At least one of a firm's factors of production is fixed in the short run
  - Firm has a fixed cost of production that will be incurred regardless of its output
  - In deciding the level of output to produce in the short run, a firm will ignore its fixed costs

- If a firm produces output, its supply curve is given by its *marginal cost curve*
- However, if a firm choose not to produce output in the short run ( $Q=0$ ) the firm will shut down
- In the short run, the firm should only take into account its variable costs, as its fixed costs are sunk
  - We can derive the shutdown condition as  $TR < VR$
  - We can also divide shut down by the level of output  $q$  to yield  $TR/q < VC/q$  or  $p < AVC$
- If a firm does produce a positive output, it chooses the level of output in accordance with its supply curve - that is, its MC curve
  - Firms produce until  $P = MC$
- Shut down rule for competitive firm:  $P < AVC_{min}$

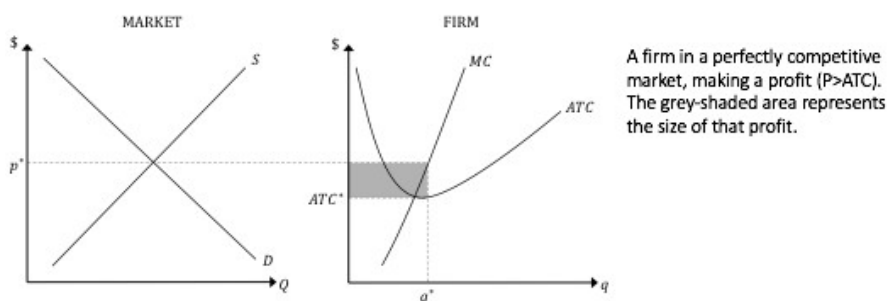


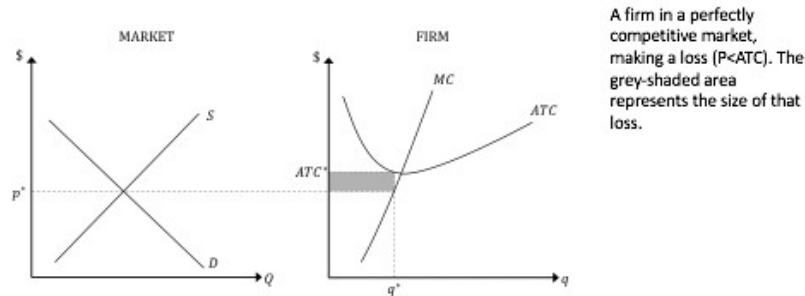
#### Market supply in the short run

- In the short run, there is no entry or exit of firms in the competitive market
  - A firm is prevented from exiting the market by its fixed costs
    - If a firm in the market wishes not to produce anything, it shuts down
    - No new firms can enter in the short run
- Hence, the number of firms in the market is fixed in the short run
- Thus the short run market supply results from horizontal summation of the individual firm's supply curves

#### Profit and losses in the short run

- In a competitive market, it is possible for firms to make profits, break even or incur losses in the short run
- If a firm is making a loss, total revenue must be less than total costs
  - $P < ATC$
- If a firm is making profits:  $TR > TC$ , or  $P > ATC$ 
  - Difference between price and ATC is the revenue
- A firm will be willing to continue to sell in the short run when making a loss provided  $P > AVC_{min}$ 
  - The firm is better off shutting down because the extra revenue (in excess of its variable costs) help it pay for some of its fixed costs



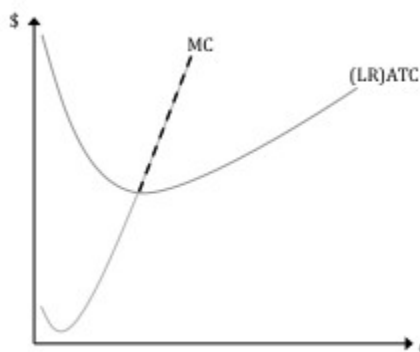


### Supply in the long run

- Each firm can change the size of its plant
- All inputs can be varied
- Firms can enter (and exit) the industry, thus number of firms is variable
- All production factors are variable
  - Firms can exit a market/industry, new firms can start operating in a market
- There is a free entry and exit of firms in the market
  - Means that all costs are opportunity costs (no sunk costs)
  - Hence, a firm deciding its level of output in the long run will take into account the costs of all inputs
- A firm will enter or exit the market depending on its (anticipated) level of profit or loss in the market
- The market will reach its long run equilibrium when there is no longer any entry into or exit from the market - this occurs when firms are making zero (economic) profits

### Firm supply: the exit/entry decision

- If a firm choose to exit in the long run, they will incur no costs
- Hence, a firm will choose to exit the market if its total revenue is less than its costs
  - Firm will exit if  $P < ATC_{min}$
- A firm's long run supply curve is the section of its (long run) MC that lies about (LR)  $ATC_{min}$

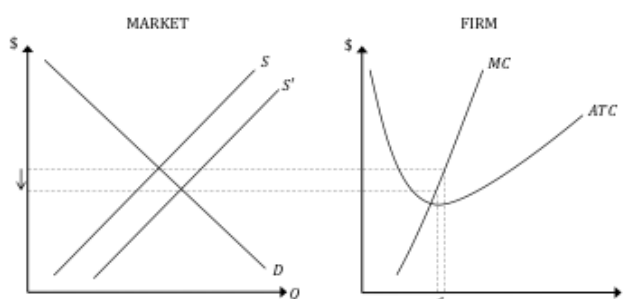


The long-run supply curve of a firm is traced out by the part of the (LR)MC curve that lies above (LR) $ATC_{min}$ .

### Elimination of profits and losses

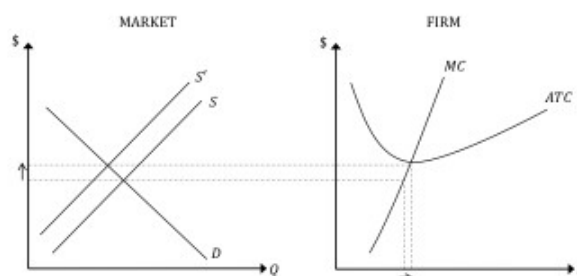
- In the long run, firms can enter or exit depending on whether they are going to make a profit or loss
- When firms in the market are profitable ( $P > ATC_{min}$ ) firms will want to enter the market

The entry of more firms in the market will progressively shift the short run market supply curve to the right, driving the equilibrium price downwards



When the market price is above average total cost, profits will encourage entry into the market, resulting in an increase in supply from  $S$  to  $S'$ . This will put downward pressure on market prices.

- When firms in the market are sustaining losses ( $P < ATC_{min}$ ), firms will tend to exit the market
- This shifts the short-run supply curve left, pushing the equilibrium price upwards as firms leave the industry



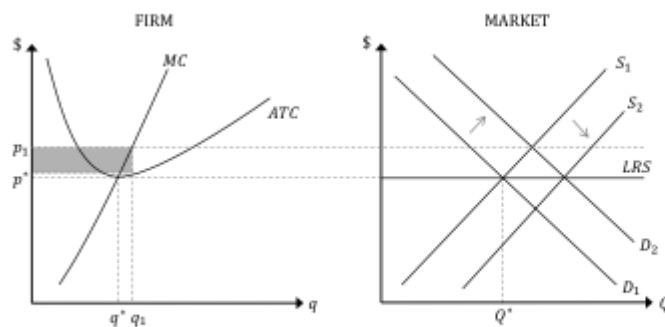
When the market price is below average total cost, firms in the market make a loss. This encourages exit, shifting the supply curve left from  $S$  to  $S'$  (decrease in supply), causing price to rise.

### In summary:

- Because of free exit and entry of firms
  - Price tends to decrease when its above ATC and increase when below ATC
- Thus price = ATC in the long run
  - Because supply curve cuts the ATC at its minimum, the long run market price will be  $p = ATC_{min}$
- As  $P = ATC$ , competitive firms will make zero profits in the long run

### Market supply curve in the long run

- For the long run market supply curve, we need to account for the fact that the market responds to demand via the entry and exit of firms
  - The long run price adjusts back to the minimum of ATC, no matter what the quantity traded in the market
- Taking account of exit/entry, the long-run industry supply curve is horizontal at  $ATC_{min}$
- Industry with a perfectly elastic long run industry (or market) supply curve is a *constant-cost industry*
  - A competitive industry is assumed to be a constant-cost industry

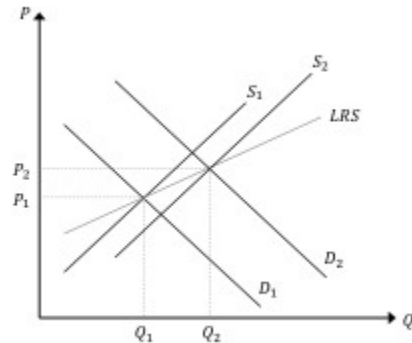


Following an unanticipated increase in demand, in the short run price rises and firms in the industry increase output ( $q_1$ ) and make positive economic profits. However, in the long run, entry forces prices back down to the  $p^* = ATC_{min}$ . Each firm again sells  $q^*$  units and economic profits are zero.

Note: ATC is LRATC, so firms operate at min LRATC, where they exhaust all economies of scale.

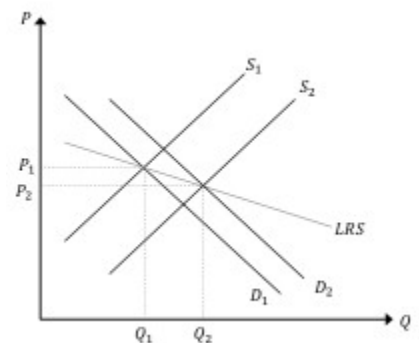
### Increasing-cost industry

- In a constant cost industry, entry/exit in the long run ensures that all firms earn zero profits and the price is  $P = ATC_{min}$ 
  - Assumes that all firms have access to the same technology and has the same cost structure, and this cost structure does not change as industry grows
- However, long run industry supply curve need not be perfectly elastic; can be upwards sloping
  - Known as increasing cost industry
    - If potential entrants have higher costs than incumbent firms (already in the market)
    - Some resources used in production may be limited in availability (input prices as industry expands), thus costs for all firms rise
    - Congestion may rise with industry output

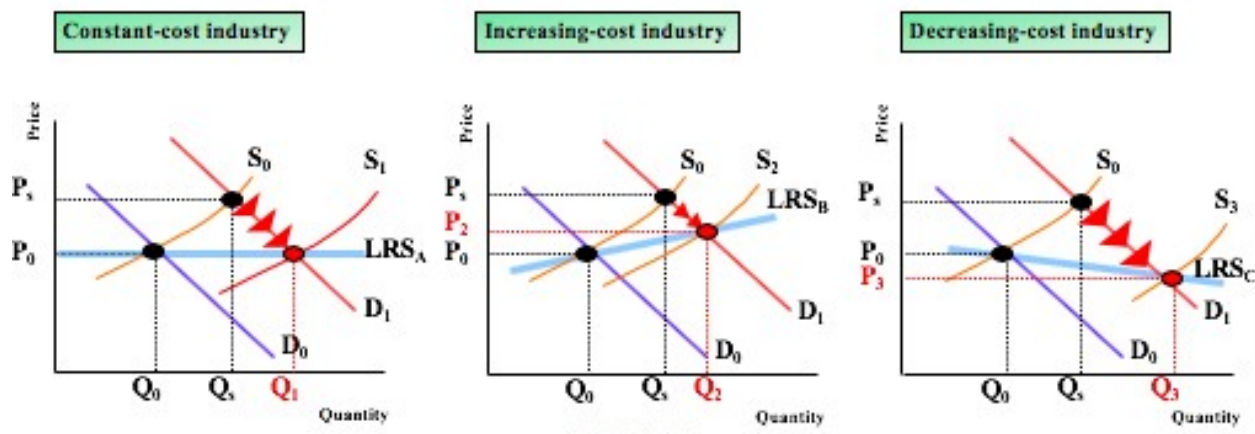


### Decreasing-cost industry

- Suppose that as output in an industry expands, costs for all firms fall
  - If there are economies of scale in input markets
  - E.g. computer software industry - as the market has expanded average costs for all firms could actually fall
- Following an increase in demand, as entry will continue until it is no longer profitable, the new long-run equilibrium price has to be lower than the initial equilibrium price
  - In this case, long-run industry supply curve is downwards sloping - decreasing cost industry

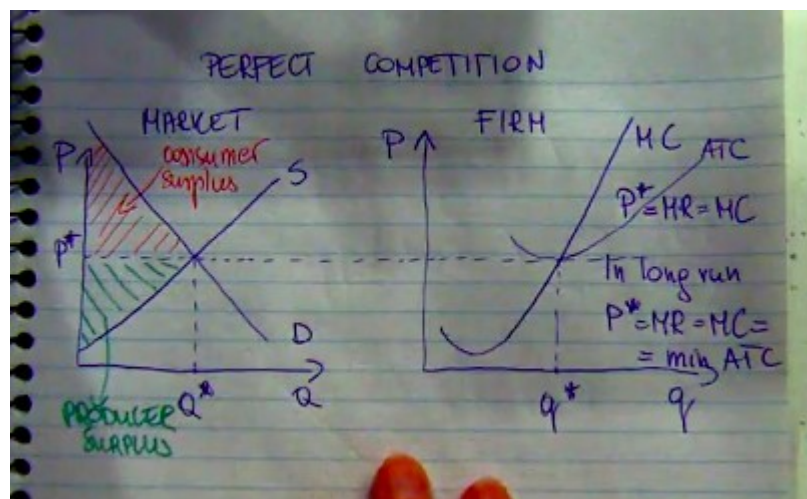


### SUMMARY OF PERFECT COMPETITION's COST INDUSTRY GRAPHS:



## 5 - 03/26: Monopoly and market power 1 (Reading: Chapter 13)

### Concept Review: Perfect Competition



### Characteristics of a monopoly

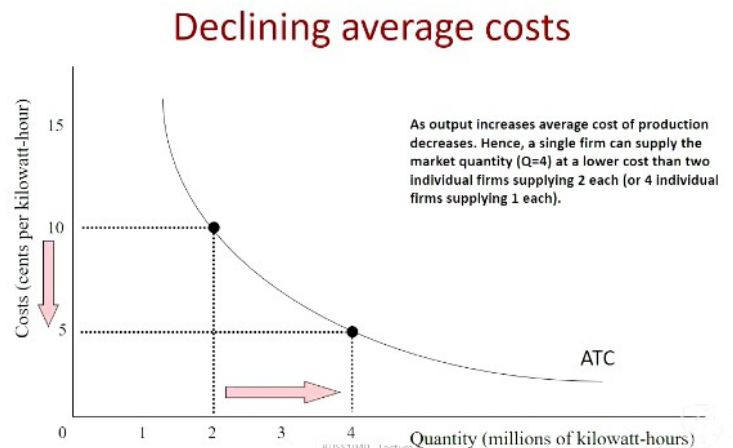
- A market with a single seller
  - Is a monopoly, and that seller is a monopolist
  - One seller and many buyers
  - Because the monopolist is the only firm in the market, it has market power to determine the price in the market - that is, it is a price maker
- Barrier to entry to potential entrants
  - Think of it as a cost that must be incurred by a new entrant in the market that incumbents do not bear
  - Barriers to entry are legal or 'natural constraints' that protect a firm from potential competitors

### Why are there monopolies?

- There must be some barriers to entry
- Competition and entry is restricted by various mechanisms including:
  - Legal barriers to entry
    - Exclusive right over a goods production (patent, copyright)
    - Public franchise (Australia Post); government licenses (taxis, practice of medicine)
  - Natural barriers to entry
    - Control over an essential input not available to other firms
      - Esso/BHP and natural gas fields in Victoria
    - The monopolist might simply have a lower cost of production that effectively allows them to prevent other firms from entering the market
      - E.g. favorable access to raw materials, favorable geographic location, learning curve advantages
    - Technology/level of demand make one producer more efficient than a number of producers

### Natural Monopoly

- A natural monopoly results from a situation where a single firm can supply an entire market at lower cost than two or more firms could supply that market
- Declining (long run) average total cost implies natural monopoly
  - I.e. substantial economies of scale (a 'natural' barrier to entry)
  - Often large capital costs (infrastructure), but low marginal cost of supply
- Large fixed costs, but low variable costs resulting in a declining ATC



### What is market power?

- A monopoly is an industry comprised of a single firm
  - No close substitutes for the firm's product
  - The firm is protected from competition by some barrier to entry which prevents and or inhibits entry of other firms
- In the absence of close competition....
  - A monopolist has market power - the ability to affect price
- A firm that has a LOW price elasticity of demand for its output can raise price and not lose all its customers

- *Market power captures the idea that a firm can raise its prices above the level that would exist in a perfectly competitive industry and not lose all its customers*
- A competitive firm has to take the price as determined in the market (price taker)
  - No market power
  - Faces a perfectly elastic demand curve for its good
- A monopolist instead is a price maker
  - Has market power
  - Faces a downward-sloping D-curve for its good
  - Not only a monopolist has market power, but whenever imperfect competition in market, e.g. a monopolist, firm in a monopolistically competitive market, oligopoly

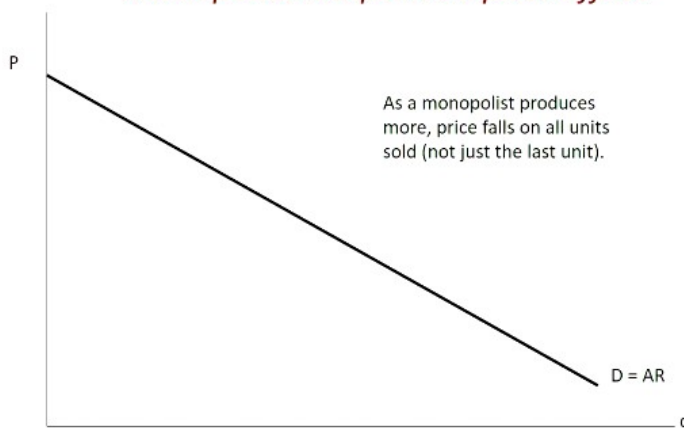
### Monopoly Pricing Strategies

- A single-price monopolist is a firm that must sell each unit of output for the same price
  - Monopolist chooses quantity (and thus price) to maximise profits
- Price discrimination is the practice of selling different units of a good or service for different prices
  - E.g. haircuts, movies, utility bills
  - Monopolist sets a variety of prices to maximise profits

### Single-price monopolist

- A monopolist who charges the same price to all of its consumers, also known as a single-price monopolist
- As the monopolist is the sole producer, it faces all the demand in the market
  - Faces the downward-sloping market demand curve
  - Firm has market power (pro monopoly power) - it can raise price and not have the quantity demanded drop to zero
  - Monopolist has choose the price (or the quantity it wants to sell)
- A monopolist can alter the price in the market by changing q
  - Faces a downward-sloping (market) demand curve
  - If it increases output by one unit the price will fall by some amount
    - If produces more, price falls
    - If produces less, price rises
  - This causes a trade off for the monopolist: sell less q for higher price or sell more q for lower price
- The Monopolist maximizes profit when  $MR = MC$ 
  - $dTR/dQ - dTC/dQ = 0$

### Monopolist: output and price effect





## Monopolist and Marginal revenue

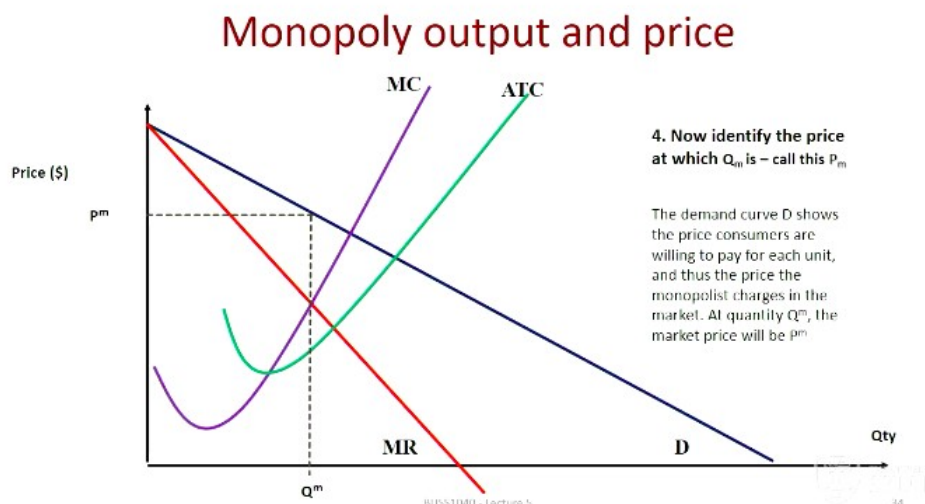
- **Marginal revenue (MR)** is the additional revenue that the firm received from selling one extra unit of a good.
- For a monopolist, the marginal revenue incorporates two effects:
  - Output effect: as you sell more units, you obtain extra revenue from the additional units sold; and
  - Price effect: as you sell more units, price falls and you lose revenue on the existing units sold
- Hence MR is not the same as the market price: **MR is always below P**
- Note, there is no price effect for a competitive firm, only an output effect
  - Price is invariant to the quantity it sells:  $MR=P=AR$  is constant for any  $q$  supplied
- MR is the change in total revenue when the firm sells one more unit
  - Can obtain the MR by differentiating TR with respect to  $q$ :

$$MR = dTR/dQ$$

- MR is also equal to half of P: if  $P = a - bq$  then  $MR = a - 2bq$

## Monopoly and profit maximization

- Profits will be maximized when a monopolist sets marginal revenue equal to marginal cost:  $MR = MC$ 
  - If  $MR > MC$ , the monopolist can increase its profit by selling one extra unit
  - If  $MR < MC$ , profit falls from selling the last unit, so it would be better off from not selling that unit
- For a competitive firm -  $P = MR = MC$
- For a monopolist -  $P > MR = MC$
- Note - this means that for a (single-price) monopoly  $P > MC$  at the optimal quantity supplied (while competitive firms produce until  $P = MC$ )



Monopolist profits:

$$\pi = TR - TC$$

$$\pi = (TR/q - TC/q) * q$$

As before  $TR/q = AR = P$ ;  $TC/q = ATC$ , so

$$\pi = (AR - ATC) * q$$

$$= (P - ATC) * q$$

- $P - ATC$  is the profit per unit sold,  $q$  is the quantity sold; profit is then the average profit per unit output times by the quantity sold

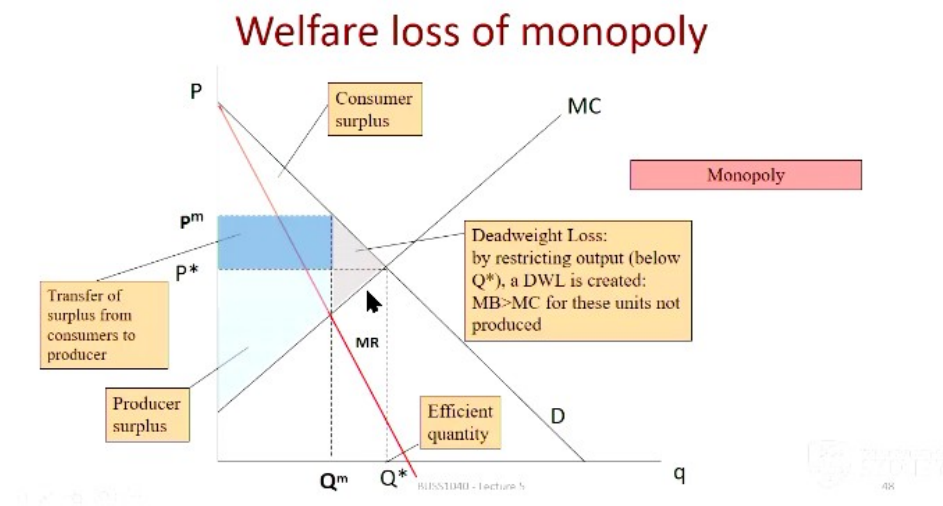
TOTAL PROFIT IS BETWEEN  $AR = P_m$  AND  $ATC_m$  (where  $m$  is maximizing point)

TOTAL REVENUE IS  $Q * P_m$  (where  $m$  is maximizing point)

- If  $ATC_m$  is above the demand and  $P_m$ , then a firm will be experiencing a loss

Welfare/efficiency with a monopoly

- Socially efficient level of output is where the marginal value to consumers (MB) equals the marginal cost of production (MC)
  - $MB = MC$ : all gains from trade are exhausted
  - Welfare (total surplus) maximum, competitive market output  $Q^*$
- Monopolist produces where  $MR = MC$ 
  - We know that for every level of output (except the every first unit sold):  $MR < MB = (P)$
  - Thus the monopolist restricts output to  $Q_m < Q^*$
  - As a result surplus is not maximized
  - Another way to think of it - a monopolist's price is too high, reducing quantity demanded
  - Using its market power, a monopolist can create a wedge (like a tax) between the consumers' WTP and the producer's costs
  - A deadweight loss (DWL) results



## Deadweight loss

- Monopoly causes a deadweight loss because it reduces output from socially efficient level (not because it earns profits perse)
  - Higher prices transfer surplus from consumers to producers
  - Higher prices reduce output: this causes DWL
- A possible additional loss of a monopoly is rent seeking behavior
  - E.g. bribing politicians to maintain government monopoly

## PERFECT COMPETITION VS. MONOPOLY

### Perfect Competition

- a price taker
- produce where  $P = MC$
- $P = MR = MC$
- no barriers to entry
- no economic profits (in LR)

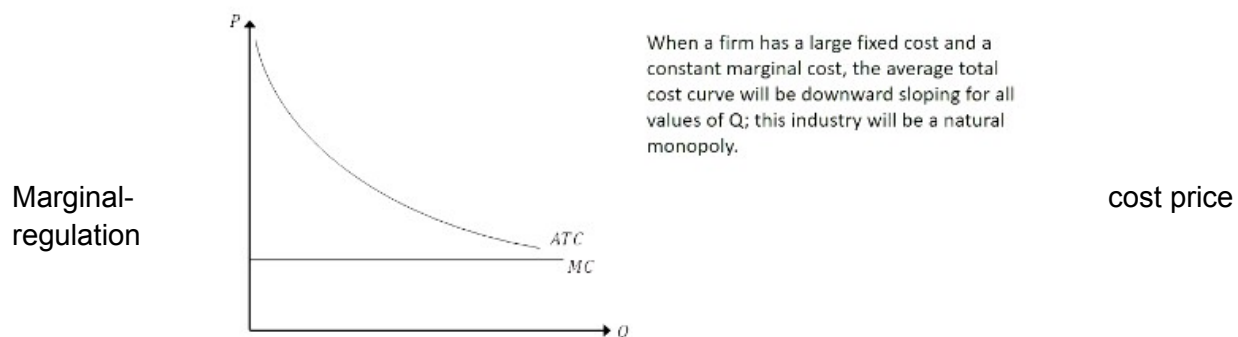
### Monopoly

- influences price (price maker)
- produces where  $MR = MC$
- $P > MC$ ;  $P > MR$
- barriers to entry
- restricts output, charges a higher price and can earn economic profits

## Public policies towards monopolies

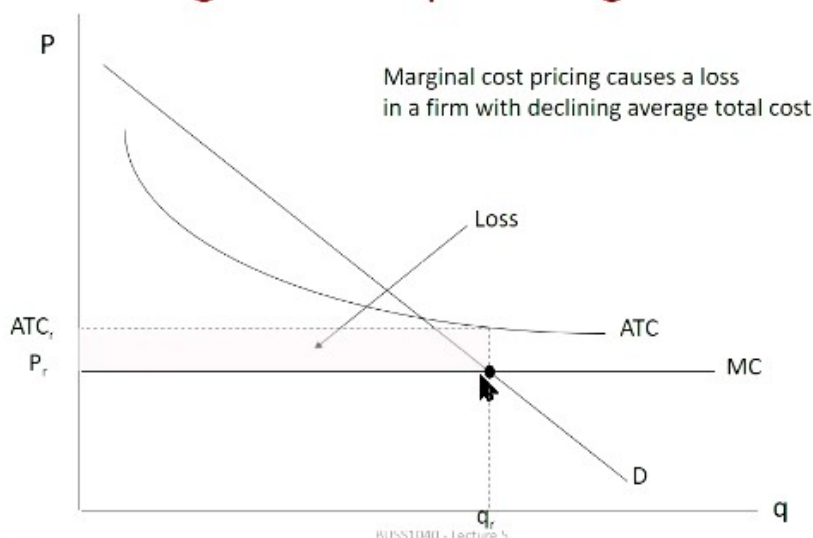
- Given it creates a DWL, governments might try to regulate a monopoly
- Goal: Increase competition in monopolised industries
- Australian Competition and Consumer Commission (ACCC)
  - Cartels (price-fixed agreements) illegal
  - Oppose mergers
  - Misuse of market power
- Price regulation
  - Regulate price of a monopolist (typically monopolist with declining ATC - a natural monopoly)
  - Two basic forms: MC-price regulation; ATC-price regulation

### *An example of a natural monopoly*



- Under marginal-cost price regulation, the government sets the monopoly price at  $P=MC$  (assuming constant MC for simplicity)
- This means that the  $DWL = 0$
- However, this means that the monopolist makes a loss equal to the grey-shaded area (that is, its fixed costs), and will exit the market when it can
- To prevent this, the government will need to subsidize the monopolist that amount to prevent them from leaving the market
  - These funds will typically have a DWL associated with them (from taxation)
  - Such a subsidy could also be politically unpopular

## Marginal-cost price regulation



### Average-cost price regulation

- Under average - cost price regulation, the government sets the monopoly price at  $P = ATC$
- However, the monopolist will produce less than the efficient quantity (the monopolist does not produce where  $MB = MC$ ), so there is still some DWL
- However, regulation typically decreases DWL relative to the situation with no regulation at all
  - Above graph if  $ATC - D$  intersection is operating costs, then there is no loss but there is deadweight loss

### Public policies

- Problems with price regulations
  - MC pricing: if enforce marginal cost pricing monopolist makes a loss, monopolist requires a subsidy (DWL of tax)
  - ATC pricing, monopolist earns zero profit but there is a DWL in the market
- Public ownership
  - Can be difficult to implement

- Public ownership alters incentives for managers
    - Motivation of private managers may differ from public managers (why?)
    - Assess relative success of regulation vs. ownership
- Do nothing

### MONOPOLY: KEY IDEAS

- A market with a single seller is a monopoly, and that seller is a monopolist
- A monopolist will use its market power to charge higher prices in order to increase its profits
  - Downward sloping D-curve, profit-max ( $MR = MC$ ) implies restricting the quantity traded below the efficient level:  $P > MC$
  - As well as increasing profits, this has implications of overall welfare; there is a potential for a market failure (a deadweight loss)
- Regulations are possible but are unlikely to eliminate any DWL and can raise their own problems
  - Preventative regulation - trying to limit scope of monopolies/banning cartels; or ex post regulation, such as price regulation
- A monopolist might be able to increase profits further by tailoring prices to specific consumers based on their valuations for the product; this is called *price discrimination*

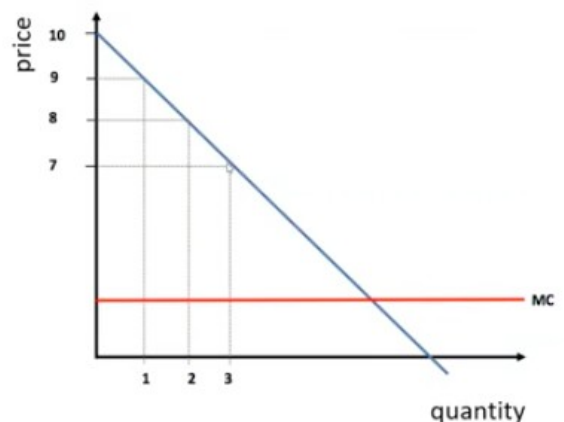
## 6 - 04/02: Price Discrimination and Monopolistic Competition

(reading: Chapter 13 & 14)

### Price discrimination

- Charging a different price for different units of output that are not related to the cost of production
- Why?
  - Profits are larger, extract consumer surplus
- How?
  - Requires some market power
- The intuition is straightforward - try and charge a higher price to those who have a higher willingness to pay
- First degree price discrimination
  - Monopolist charges different price for each unit sold
  - Monopolist charges maximum willingness to pay
  - Monopolist extracts all consumer surplus
  - Requires knowledge of willingness to pay for every unit consumed by every consumer

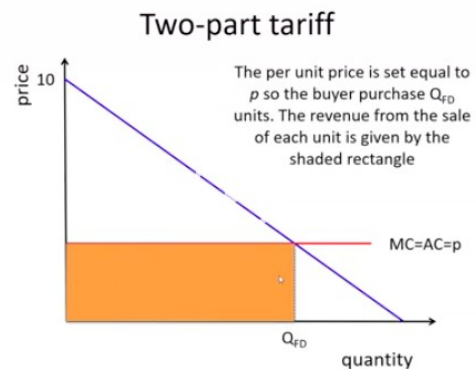
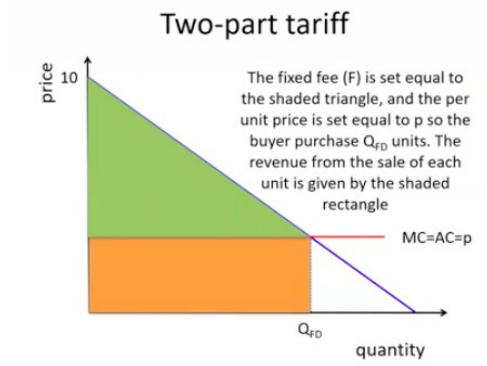
### First-degree price discrimination



- Alternatively, the monopolist can use a two part tariff
- There is not a single market price, different price for each additional unit sold
- The monopolist's MR curve in the first degree price discrimination is the same as D
  - Because the monopolist sells each unit exactly at the consumer's willingness to pay
- Under first price discrimination there is no deadweight loss
  - However, the consumer surplus that exists in a perfectly competitive market is captured by the monopolist
- Monopolist continues to sell units as long as  $P > MC$
- Called perfect price discrimination because monopolist extracts all consumer surplus
- It is critical that the monopolist be able to prevent arbitrage
  - Arbitrage - taking advantage of a price difference between two or more markets

### Two Part tariff

- First degree price discrimination can also be implemented using a two-part tariff



consisting of:

- A fixed fee,  $F$
  - A per unit fee,  $p$ 
    - E.g. inc. electricity, gyms, razors, printers...
- Consider following simple example
  - Demand curve is that for a single consumer and MC is (constant) marginal cost
  - Monopolist sets  $p=MC$  and uses  $F$  to extract consumer surplus
  - More difficult if consumers heterogeneous

### Second degree price discrimination

- Monopolist offers a menu of pricing options to consumers and allows consumers to choose which one they want
- Monopolist cannot distinguish between groups
- Monopolist knows demand curve or WTP of different groups
- Need to design prices to induce more inelastic groups to pay higher prices

#### Example:

- Assume that the cost of production is zero
- Buyers purchase only one unit of software (to do their taxes, for example)
- They (the customer) choose the version that gives them the highest consumer surplus
- Essentially consumers are self selecting

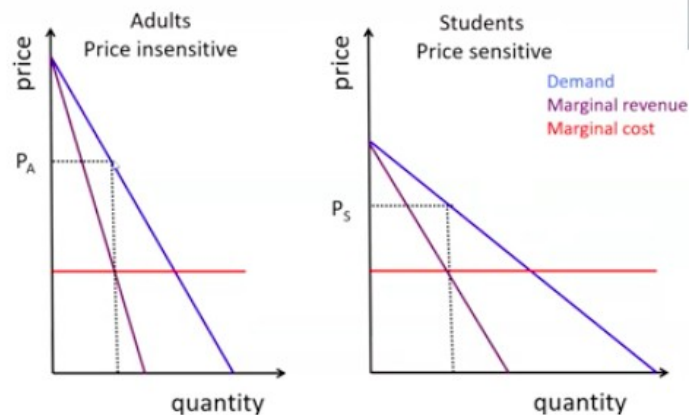
In the example, businesses and consumers will buy based on their consumer surplus

- Other examples: quantity discounts, hard cover & soft cover versions of books - in each case there is temporal price variation
- No need to worry about arbitrage

### Third degree price discrimination

- Monopolist charges different prices to different groups of consumers
- Monopolist must be able to distinguish between groups
- Monopolist knows demand curve of different groups
- Intuition is that you charge a higher price to the more inelastic segment of the market
- Examples - student or pensioner discounts for movies, haircuts
- Effectively what the monopolist wants to do is to maximize profits
- This requires that they 'act like a monopolist in each of the separate markets'
  - That is, the monopolist should equate marginal cost and marginal revenue in each of the markets in which they operate
- Classic examples include movies, public transport, haircuts and clothes
- Important to be able to identify different groups
- Preventing arbitrage is important
  - Example: people pose as students or other groups to get more advantageous prices

#### Third-degree price discrimination



### Monopolistic competition

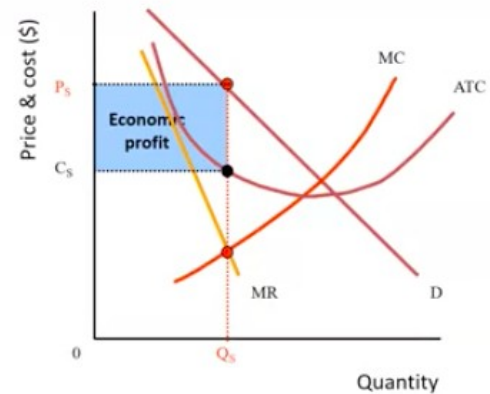


- In monopolistic competition
  - Many buyers and sellers
  - Firms produce similar but differentiated products
  - There is freedom of entry and exit
- As a result
  - No one firm can influence what other do
  - Firms face a downward sloping d curve
  - Firms earn zero economic profit in LR

Short run:

- Firms behave like monopolists
  - Produce where  $MR=MC$
  - Firm can earn short run economic profit
  - Produces less than capacity - that is less than the level of output that minimizes average total cost

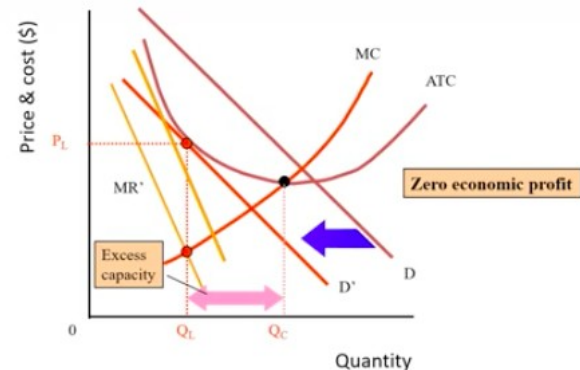
### Monopolistic competition: short run



Long run:

- In the LR, economic profit must equal zero
  - Economic profit attracts new entrants
  - When firms enter the industry, the firm's demand curve and marginal revenue curve start to shift leftward
    - That is, we expect a decrease in demand and for demand to become more elastic
    - The profit maximizing quantity and price fall

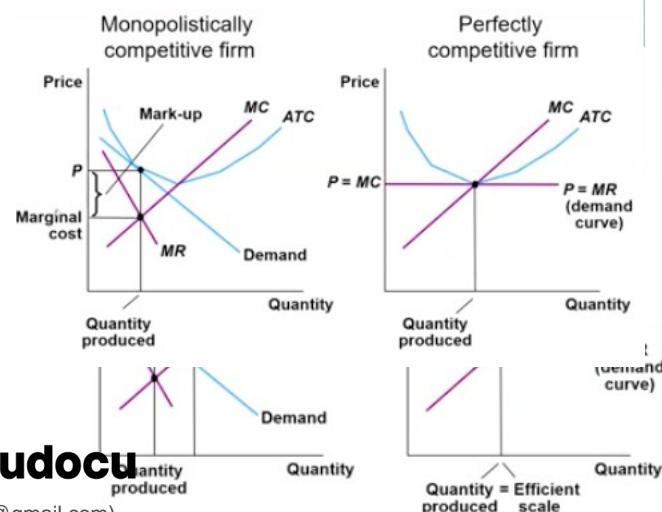
### Monopolistic competition: long run



### Monopolistic competition: mark up

- In a competitive market, firms charge price equal to marginal cost
- In a monopolistically competitive market, firms charge a mark-up over marginal costs

### Monopolistic competition: mark up



### Efficiency

- Firms charge a price that exceeds marginal cost



- Leads to deadweight loss
- But consumers do gain variety
- The loss in efficiency needs to be weighed up against the gain of greater product variety
- Does this mean that monopolistically competitive firms are inefficient?
  - Maybe, maybe not
    - Monopolistically competitive firms are likely to innovate to stay ahead of rivals
    - Also, monopolistically competitive markets offer a greater range of products to consumers
- Are zero economic profits in the LR inevitable?
  - You can stay one step ahead of your rivals
  - Example: innovate by offering new products

Model type	Price	Profit Max Prod.	Deadweight loss	ATC minimised?	LR profits?
Perfect Competition	$P=MC$	$P=MC$	no	yes	no
Monopolistic Competition	$P>MC$	$MC=MR$	yes	no	no
Monopoly	$P>MC$	$MC=MR$	yes	no	yes

b

## 7 - 04/09: Strategic Behavior

(reading: chapter 3 & chapter 15)

### Oligopoly

- A small number of firms compete
- Firms may produce identical or differentiated products
- Firms have some market power
- There are barriers to entry
  - Scale economies
  - Entry or exit costs
  - Patents
  - Strong brands
  - E.g. coke vs pepsi, apple vs dell, coles vs woolworths

### Strategic interaction

- Because there are only a small number of firms, firms recognize that:
  - Actions of rival firms can have large impact on profits
  - Firm's own actions can influence the profits and actions of rivals
  - Quantity sold by each firm depends on the prices and quantities chosen by rivals
  - Firms have an incentive to act strategically to influence the actions of competitors
- **Game theory** is a tool used to analyze the strategic interaction of agents (firms or people)
- Components of game:
  - Players: how many? Does nature/chance play a role?
  - Action: available choices/decisions
  - Strategies: a strategy is a contingent plan of action
    - E.g. if my competitor charges 100, I will charge 95
  - Rules: describe how the game works - e.g. sequential or simultaneous decisions, can players communicate or not, one-shot or repeated interaction?
  - Information: what do players know when making decisions
  - Payoffs: consequences to players for each possible outcome, e.g. profits

### Prisoner's dilemma

- Imagine that two suspects of anti-competitive behavior, alf and bob, have been captured by the police
- Without a confession, the police have insufficient evidence
- STRATEGY:
  - Suspects are put in separate rooms and cannot communicate with each other
  - Suspects are then questioned by the police
  - If only one of the suspects confesses, he can go free. The partner will then be convicted and face a heavy sentence for uncooperative behavior
  - If both prisoners confess, they will be convicted and face a moderate sentence
  - If neither confesses, they only face minor charges
- Each player can either confess or deny

- Happens simultaneously
- Possible outcomes
  - Both confess
  - Both deny
  - Alf confesses and bob denies
  - Bob confesses and alf denies
- Payoffs
  - If both confess, they will get 5 years
  - If one confesses, the other will get 10 years
  - If neither confess, they each get 1 year
- The payoff matrix describes the payoffs to both players for every possible outcome
  - Called a normal form representation

		<b>Alf</b>	
		Confess	Deny
<b>Bob</b>	Confess		
	Deny		

#### Definitions

- A *dominant strategy* is a strategy that is optimal for every possible strategy of your rival
- A *weakly dominant strategy* gives a payoff that is at least as good as (can be equal to) any other own strategy, for every possible strategy of the opponent
- A *strictly dominant strategy* gives a strictly larger payoff than any other own strategy for every possible strategy of the opponent
- In a *Nash equilibrium (NE)*, players choose the best possible strategy given the strategies of their opponents. No player can benefit from changing own strategy
  - Each player in “best-responding”

#### Assumptions underlying NE

- The payments in the payoff matrix need to represent “utility” (especially relevant for individuals)
- Perfect information: players need to know the structure of the game and the payoffs (profits of the other firm)
- *Common knowledge of rationality*: each player needs to know the other player is rational, and that the other player knows he is rational, and that the other player knows he knows the other player is rational...
  - Is a strong assumption and hard to hold true

#### Nash equilibrium and optimality

- It may happen that nash equilibrium is not Pareto optimal
- The prisoner's dilemma illustrates why it is difficult to cooperate even when it is in the best interest of both parties
- Games like the prisoner's dilemma can be used to study strategic interaction in oligopolies
  - Can firms avoid a prisoner's dilemma
    - Pre game communication, but there may be cheap talk
    - Commitment is possible such as a future punishment or law

## Repeated prisoner's dilemma

- If a game is repeated one firm has the opportunity to punish the other
- Hence a cooperative outcome might be sustainable
- That is, an outcome in which both duopolists split the monopoly profits. But, there must be a penalty for cheating (ASSUMPTION IS THAT TRIALS ARE DONE FOR AN INFINITE AMOUNT OF TIME)
  - Tit for tat punishment strategy
    - Cooperate as long as your rival cooperated yesterday
    - If your rival cheated yesterday you 'punish' them by cheating today
    - Punishment is temporary - one period only
    - Possible we may never see punishment occurring because parties always cooperated
    - Threat of punishment dissuades cheating
  - Trigger strategy
    - Cooperate as long as your rival has cooperated
    - If your rival cheats you punish them forever
    - More extreme than 'tit-for-tat'
    - May never actually observe punishment

## Oligopoly and game theory

- Cartel: a group of firms that enters into a collusive agreement
- Collusion: any agreement between firms to divide up the market, set a market price, or set market output
- Price-fixing game (prisoner's dilemma)
  - To maximize profits, A and B would like to collude and charge the same price that a monopolist would choose
  - However, if A charges the monopoly price, B could charge a lower price and capture a large market share
- Rules:
  - Each firm chooses what price to set
  - Firms cannot observe the choice of their rival
- Strategies:
  - Cooperate and charge the monopoly price, or
  - Cheat i.e. undercut their rival's price and steal all demand
- The profit when both charge the monopoly price is 50
- By undercutting, the cheater can make a profit of 100
- A firm that charges a monopoly price when the other firm cheats makes a loss of -50
- *Dominant strategy*: Cheating is a best response to whatever action your rival chooses
- Nash equilibrium: A(ABC) and B(doug) cheat
  - If A cheats, B's best response is to cheat
  - IF B cheats, A's best response is to cheat

		Doug	
		Cheat	Cooperate
ABC	Cheat	10,10	100,-50
	Cooperate	-50,100	50,50

## Public policy toward oligopolies

- A and B failed to coordinate on the higher price
- In general price coordination among firms is undesirable
  - Leads to production that is too low
  - Leads to prices that are too high
- Trade law prohibits firms to:
  - Sign contracts that substantially lessens competition;
  - Agree to fix, control or maintain prices
- Explicit collusion is illegal

### Coordination game (matching pennies game)

- If E and J go to the same place, they get a payoff of 50
  - If different, no payoff
- There are 2 pure Nash equilibriums (B,B) and (N,N)
- Analogies in business:
  - Technology choices
  - Positive locational externalities
  - Product differentiation
- How can they get around this challenge?
  - Ritual, routine or custom assuming game is played many times
  - Standard setting by government or industry association
  - Communication - but is it credible?
- We can use game theory to study other business problems
  - Example: how much to spend on product differentiation?
    - Innovation and new product launches
    - Research and development
    - Marketing (e.g. advertising)
  - Product differentiation can increase profits because:
    - It makes products less substitutable,
    - It reduces the demand elasticity for the firm's product
    - It allows the firm to raise price

### Coordination Game

		Julia	
		Newtown	Bondi
Emma	Newtown	50,50	0,0
	Bondi	0,0	50,50

### Research and development game

- Two Nash equilibria:
- ABC invests, Doug invests – payoff dominant equilibrium
- ABC does not invest, Doug does not invest – risk dominant equilibrium (no matter what the opponent does, I always get 10)

		Doug	
		Invest	Not invest
ABC	Invest	20,20	0, 10
	Not invest	10,0	10,10

### Advertising game

- Suppose both ABC and Doug wanted to increase consumers' awareness of their product and simultaneously decide whether to advertise or not.

		Doug	
		Advertise	No advertising
ABC	Advertise	10,30	40,-15
	No advertising	-10,70	25,45

### Location game:

- Is there a dominant strategy? No!
- Two Nash equilibria:
  - Both locate in the City
  - Both locate near the beach
- Notice that these equilibria are not fair. One player consistently does better than the other

		Kebab	
		City	Beach
Pub	City	30,20	10,10
	Beach	10,10	20,30

### Oligopoly

- We have studied a duopoly – 2 firms
- We can use the same methods to think about several firms

### Remember:

- In Nash equilibrium everyone chooses the best possible strategy, given the choices of all other players.
- Dominant strategy is the best possible plan of action for any possible strategy of all other players

### Assumptions underlying NE

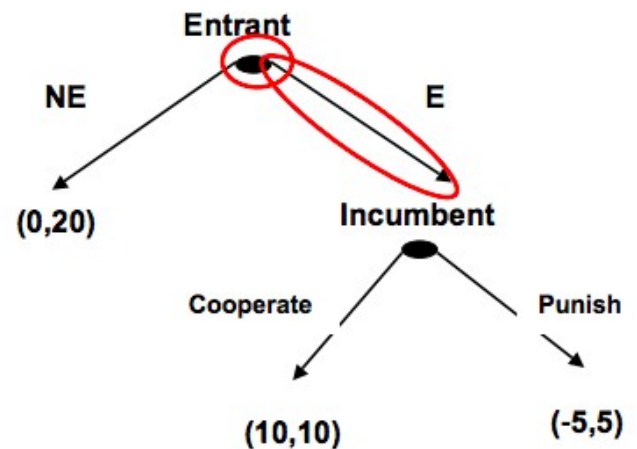
#### Rationality

- Common knowledge: each player needs to know the other player is rational, and that the other player knows he is rational, and that the other player knows he knows the other player is rational...
- The payments in the payoff matrix need to represent “utility” (specially relevant for individuals).
- Perfect information: players need to know the structure of the game and the payoffs (profits of the other firm).

## 8 - Strategic Behavior II (chapter 3, 5, & 15)

### Sequential games

- Last week we considered simultaneous move games - that is when players made their choices simultaneously
  - Might have simply meant that neither player knew what the other had chosen when they made their choice
  - In many economic and business decision settings, players or economic agents make their choices after observing the choice of other players
    - Players make their choice sequentially
  - In some games players move sequentially
    - E.g. one firm (Honda) chooses to build a small or large factory *after* observing the choice of a rival (Toyota)
    - Woolworths makes a choice about the price of milk after observing the choice of Coles
  - Alternatively, think about bargaining settings
    - E.g. one party makes an offer; the other party accepts, or not, and makes a counter offer...
- In the game here, we think about two firms, an incumbent and a potential entrant
  - The potential entrant makes a choice to enter or not
  - The incumbent then makes a choice about how to react



Normal form representation of this game:

		Incumbent	
		Cooperate	Punish
Entrant	Enter	$(10, 10)$	$(-5, 5)$
	Not Enter	$(0, 20)$	$(0, 20)$

- Nash equilibrium in the (normal form) game

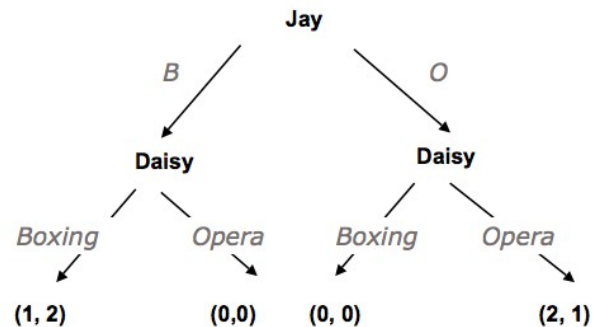
above

- $(NE, P)$  &  $(E, Cooperate)$
- Ask yourself, do these seem sensible?
- Examine the subgames - each subgame consists of one choice by one player
- Hence, E's choice to enter or not is a sub-game. Also, I's choice to punish or not is a subgame
- Subgame perfect equilibrium - each players strategy must be a NE in every subgame
  - Threats credible - strategy would be adopted if needed
  - To solve this game, we need to work backwards - use backward induction
- To solve such games we use backward induction

- This identifies the subgame perfect equilibrium so that every player's actions are a Nash equilibrium
- Solving the game in this way identifies credible equilibria
- The key point is that to get rid of or eliminate non-credible outcomes, we need to solve backwards
- This effectively tests if the threats of one of the players would ever actually be implemented
- If not, then such a strategy could never be part of a credible equilibrium
  - That is, it could not be part of a subgame perfect equilibrium
- WE ASSUME that players are rational and forward looking
  - Moreover, just as they did last week each player looks after themselves - they are self-interested
- Note that the SPE is a Nash Equilibrium, but, not all NE are SPE

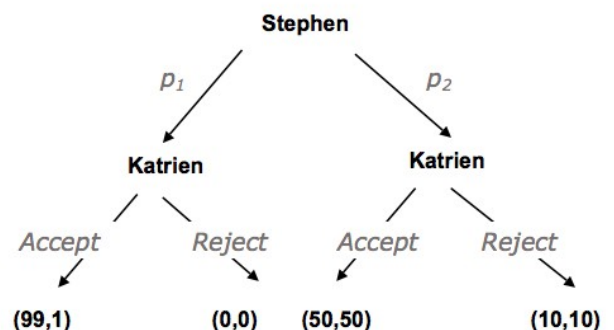
### Sequential games (continued)

- 'dating' game
  - Jay and Daisy are trying to organize a date
  - Jay prefers the opera while Daisy is a UFC (boxing) fan
  - This is really a coordination problem with payoffs below
  - In this game we assume Jay makes a choice and then informs Daisy of his choice - at that point, Daisy makes her decision



- Solution:
  - Use backward induction
  - The SPE is (Opera; Opera(if Opera), Boxing (if Boxing))
  - Captures what is chosen at each of the nodes in the extensive form of the game

- 'Bargaining' game
  - Stephen can make an offer of  $p_1$  or  $p_2$
  - Following the offer, Katrien can either accept or reject the offer
  - Payoffs are as follows: if S offers  $p_1$ , and K accepts, then 99 goes to S and 1 goes to K. If K rejects S's offer, then both get zero.
  - Conversely: if S offers  $p_2$  and K accepts, then 50 goes to S and 50 to K. If K rejects S's offer they both get 10



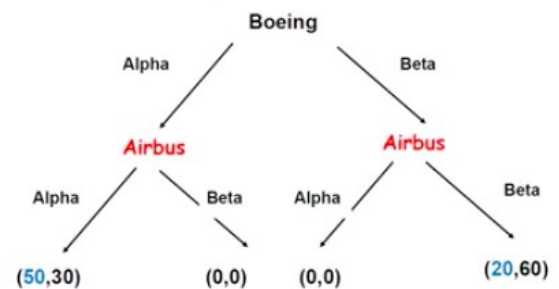


- In the case of the take it or leave it offer between Stephen and Katrien, Stephen received almost all of the surplus
  - This occurred because Stephen credibly made the last offer
  - The outcome would be different when counter-offers are possible
- Solve backwards - with the offer being made being dependent on the anticipated response (how might this influence offer?)
  - Making the last offer gives a party bargaining power, but power might come from other sources such as:
    - Relatively low value of trade
    - Low cost of delays in bargaining/patience
    - Credible outside options, uncertainty can cause bargaining to be costly
    - Asymmetric info & negotiation breakdown

#### First mover advantage

- Sometimes it is better to go first, other times it is better to learn from the mistakes of others
- Consider when there is an advantage from being the first mover & a firm can commit to an action. Then, the follower must adapt to the strategy of the leader:
  - A firm builds a hotel first
  - A firm choose how much output to produce and a rival responds
  - Leader makes a choice over technology

		Boeing	
		Alpha	Beta
Airbus	Alpha	(50, 30)	(0, 0)
	Beta	(0, 0)	(20, 60)



#### Second-Mover Advantage

- Sometimes, it is not the first mover who wins
  - For example, Apple, Microsoft or the iPhone were not the first movers
  - A firm may wish to avoid moving first
  - Why? It may be the case that the first mover makes large investments on infrastructure that new entrants can free ride off
- Business Applications
  - Investment free riding
  - Group assignments
  - Advertising new products

#### Zero Sum War games

- One player's gain is another one's loss

## 9. Market Interventions: Price Regulation, Taxes & Subsidies (Ch. 16)

### Sources of inefficiency

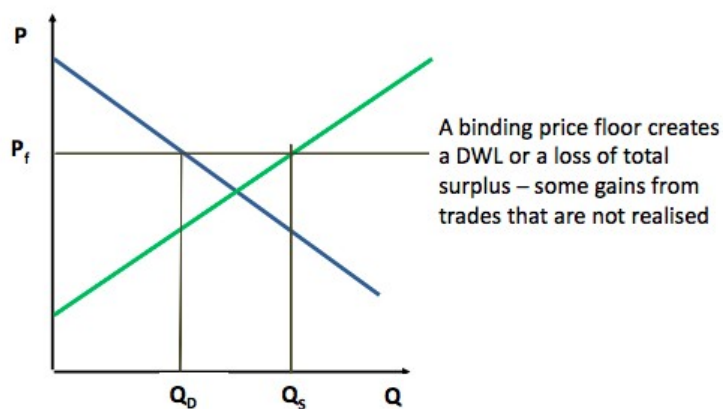
- Monopoly
  - Raises price and restricts output relative to a competitive market
- Price ceilings and floors
- Taxes and subsidies
  - With a tax or a subsidy, the amount paid by the consumer  $\neq$  amount received by producers/ firms
  - *Price signals no longer consistent*
- Public goods
  - Goods for which one person's consumption does not detract from another's consumption or enjoyment of the good
    - Defence, police, roads ( up to a point)
    - Generate a free rider problem
- External costs and benefits
  - Costs imposed on agents other than the consumers or producer of the good
    - Pollution from a factory
    - Listening to music loudly
    - Public education
    - Talking in lectures :(
  - Marginal benefit (demand) and marginal cost (supply) curves do not reflect total or society's benefits/ costs

### Price controls or regulation

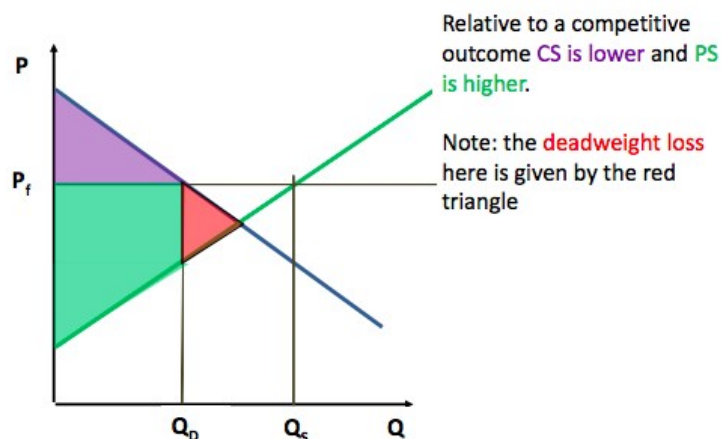
- Usually enacted when the market price is deemed socially unacceptable. Examples include:
  - Minimum wages
  - Public housing
  - Agricultural price support schemes

### Price floors

- A price floor (Pf) establishes a minimum price at which a good can be sold
  - Not binding if set below the equilibrium or market clearing price
- A binding price floor causes a surplus (excess supply)
- Non price rationing means determine who gets to *sell* the good or service
- Examples:
  - Agricultural price supports - wool
  - Minimum wages - under perfect competition...leads to a number of outcomes
    - Unemployment
    - Time spent searching for scarce jobs
    - Black markets in jobs
    - Switching occupations

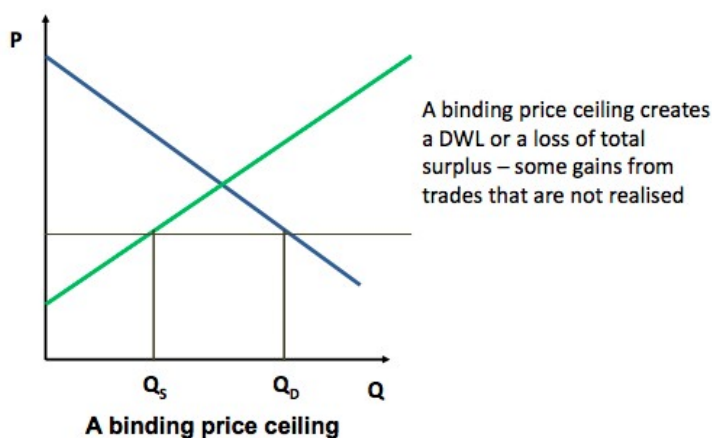
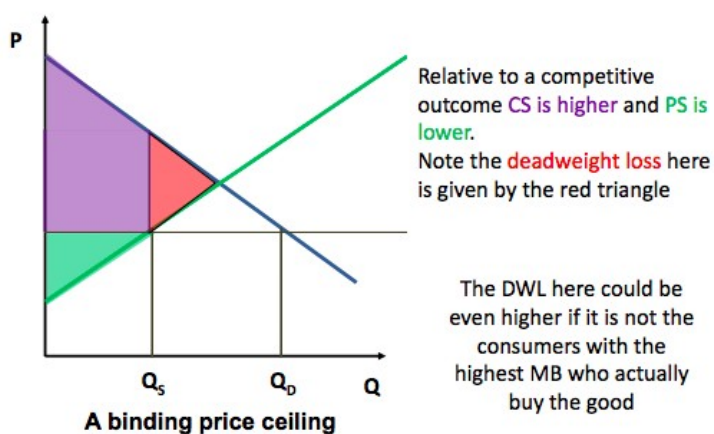


**A binding price floor**



### Price ceilings

- A price ceiling ( $P_c$ ) is a legally established maximum price at which a good can be sold
- Price ceiling is not binding if set above the equilibrium or market-clearing price
- A binding price ceiling causes a shortage or excess demand
- Non-price rationing means determine who gets to buy the good or service
- Examples:
  - Rent and housing price controls in the US
  - Leads to:
    - Queues
    - Discrimination by sellers or government
    - Black markets (side payments)



### Taxes and subsidies

- Drives a wedge between the price paid by buyers and the price received by sellers
- If a tax is imposed, buyers pay more than sellers receive (and keep)

- If a subsidy is imposed, buyers pay less than sellers receive (and keep)
- Effectively have two prices (signals) when there are taxes

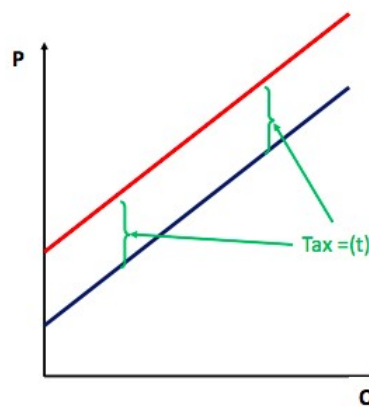
- Buyers respond to post-tax prices
- Sellers respond to pre-tax prices

- Why have taxes and subsidies?

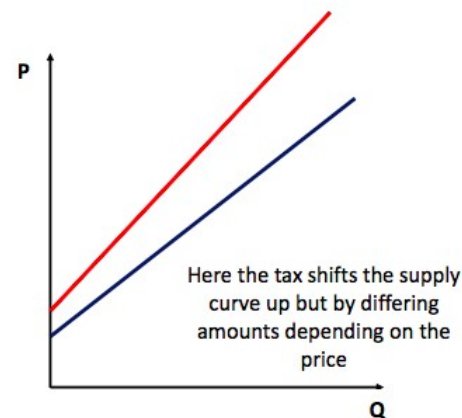
- Correct market failures, i.e. externalities. For example a carbon tax
- To raise revenue

- Types of taxes

- Excise taxes or specific
- Ad valorem or proportional taxes
- Taxes on buyers
- Taxes on sellers



An excise tax

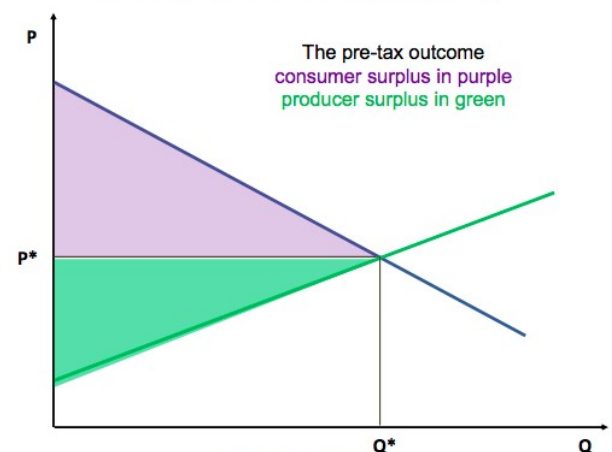


An ad valorem tax

### Incidence of taxation

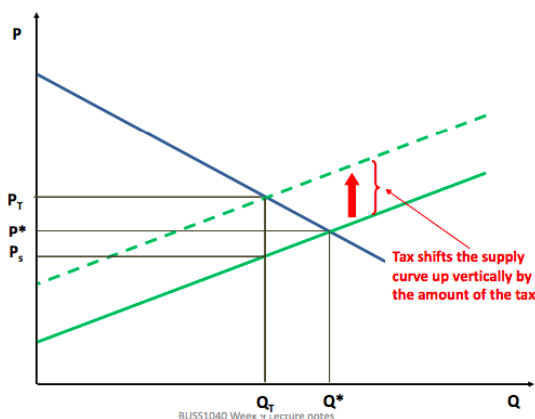
- Describes who bears the economic burden of taxation
  - In general, the economic burden falls partly on the buyer and partly on the seller
- The economic burden of taxation is distinct from the legal requirement to pay the tax. This requirement (the legal requirement) may rest with:
  - The seller
  - The buyer
- Consider each in turn

### Incidence of taxation



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### Incidence of taxation (tax on sellers)

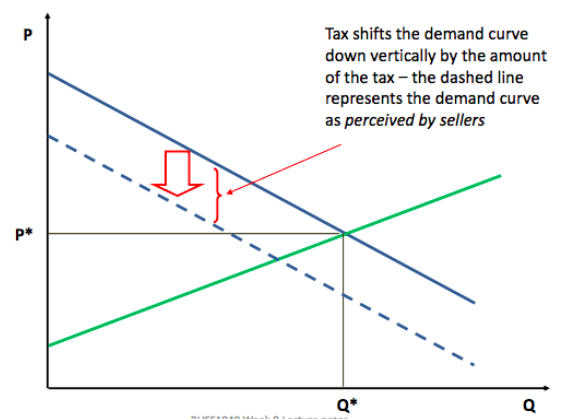


BUSS1040 Week 9 Lecture notes

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### Incidence of taxation (tax on buyers)

### Incidence of taxation (tax on buyers)



BUSS1040 Week 9 Lecture notes

24

- Initially the equilibrium price was  $P^*$
- Imposition of the tax shifts the supply curve up vertically by the amount of the tax
- The new post tax supply curve is dashed
- The new equilibrium price at which exchange occurs is  $P_t$
- But the seller only gets to keep  $P_s$  ( $P_t - P_s$  of each unit sold is remitted to the government)
- Recall that tax generates a DWL or a loss in total surplus
- You can think about this as the lost net surplus or benefit from engaging in trade
- Occurs because the quantity traded moves away from what we get in a competitive equilibrium

#### Incidence of taxation (tax on buyers)

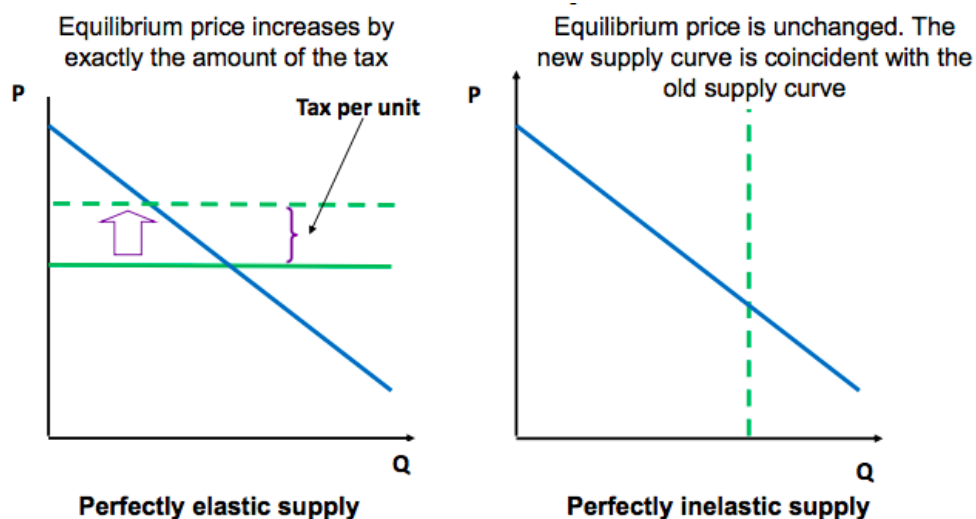
- Initially the equilibrium price was  $P^*$
- Imposition of the tax shifts the demand curve down vertically by the amount of the tax
- The new post-tax demand curve is dashed. This is now the demand curve perceived by the sellers
- The new equilibrium price at which exchange occurs is  $P_t$
- BUT, the total paid by the seller for each unit is  $P_b = P_t + \text{tax}$

\*The incidence of the tax is unaffected by who must legally pay the tax\*

- The incidence of a tax depends on elasticity
  - The more inelastic the supply, the more the seller pays
  - The more elastic the supply, the more the buyer pays
  - The more inelastic the demand, the more the buyer pays
  - The more elastic the demand, the more the seller pays
- In general, the burden of the tax falls on the more inelastic side of the market

#### Incidence of taxation and supply elasticity

- Consider perfectly elastic supply
  - The buyer pays all the tax or bears the full economic burden
- Consider perfectly inelastic supply
  - The seller pays all the tax or bears the full economic burden



### Incidence of taxation and demand elasticity

- Consider perfectly elastic demand
  - The seller pays all the tax or bears the full economic burden
- Consider perfectly inelastic demand
  - The buyer pays all the tax or bears the full economic burden

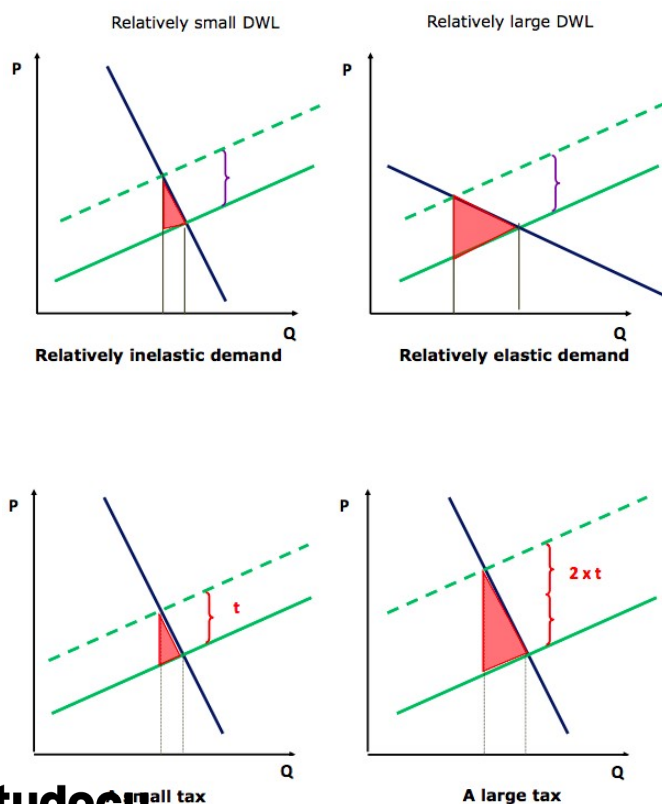
Draw diagrams:

### Incidence of taxation and elasticity

- Consider a relatively inelastic demand and relatively elastic supply
  - Here price rises by a large amount when the tax is imposed on sellers. That is, the economic burden of the tax is largely borne by buyers
- Consider a relatively elastic demand and relatively inelastic supply
  - Here price rises by a small amount when the tax is imposed on sellers. That is, the economic burden of the tax is largely borne by sellers

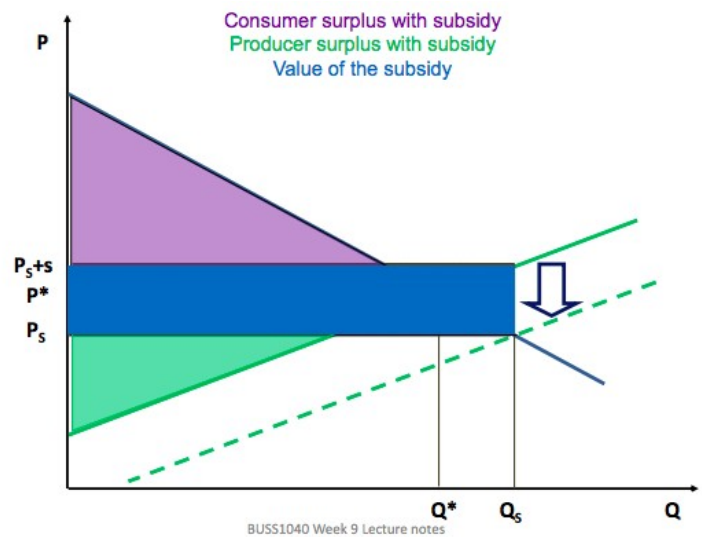
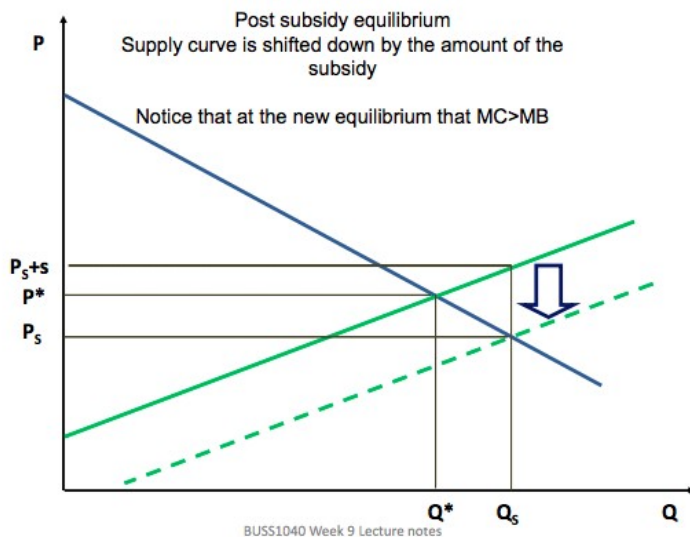
### Determinants of deadweight loss

- Size of the deadweight loss will depend on change (decline) in market/equilibrium output that comes about as a result of the tax
- This depends on elasticities of supply and demand
- In general, the more elastic are supply and demand the larger the DWL
- A tax creates a DWL because it induces buyers and sellers to change their behavior compared to the market outcome with no tax
- The market 'shrinks'
- In general, the DWL increases more rapidly than the tax
  - Doubling the size of the tax leads to a quadrupling of the DWL



## Subsidies

- Subsidies are really just negative taxes, hence the analysis of them is similar to that of taxes
  - Drive a wedge between price paid by buyers and price received by sellers
  - Move the market outcome away from the competitive equilibrium
  - Create a deadweight loss
- Consider a subsidy on production (or a subsidy paid to producers)
- Subsidies also create DWL



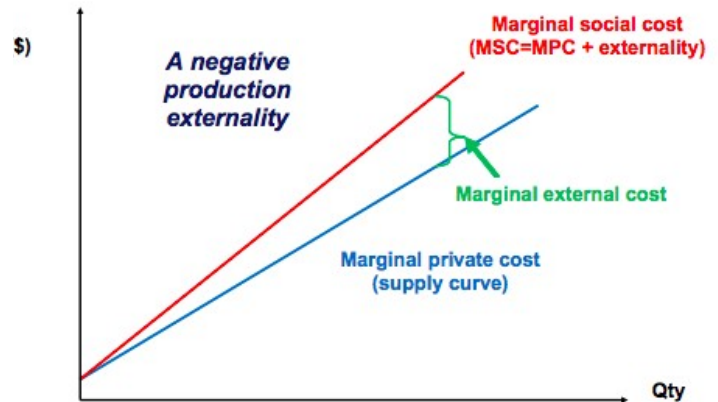
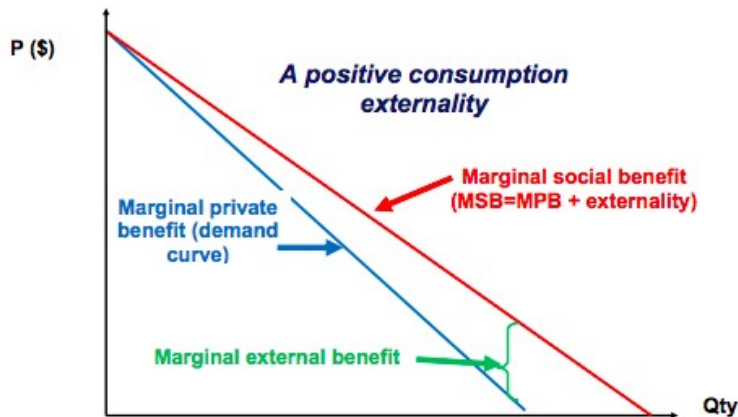
## 10. Externalities and Public Goods (Ch. 17,18,19)

### Externalities

- Externalities are costs or benefits to parties other than those in a transaction:
  - Pollution from a factory
  - Greenhouse gases
  - Education - (a positive externality)
  - Immunisation - (a positive externality)
- The optimal level of externalities (or production) depends on the marginal social costs and benefits
- In the absence of an externality (what has been dealt with throughout the semester), efficiency requires  $p = MC$
- In the presence of the externality the price in a competitive market reflects only private cost, not the cost to others
- Externalities represent a market failure



- Consumers or producers don't take into account costs/benefits to others so inefficiency (i.e. a deadweight loss) results:
  - Negative externalities such as pollution generally result in over production
  - Positive externalities such as immunization or education are generally under consumed/ produced



- The problem with externalities is that economic agents ignore them when they make decisions
  - Hence, relative to the efficient level where  $SMB = SMC$ , we have too much or too little consumed or produced
    - Negative externalities generally result in too much being produced/consumed
    - Positive externalities generally result in too little being produced/consumed

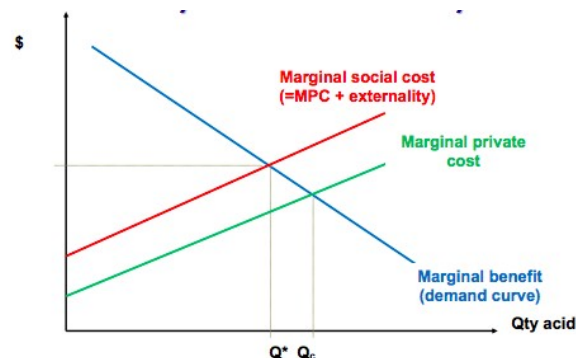
### Property rights

- Why do externalities arise?
  - One explanation is a lack of ownership or well-defined property rights
- We define property rights as 'the rights individuals or firms have to the exclusive use of their property, including the right to buy or sell it'
- In the absence of property rights, e.g. ownership of a river, polluters will not care how much pollution is dumped into it
- This suggests that we can 'resolve' externalities (or more to the point the inefficiency resulting from an externality) by defining property rights



### The inefficiency from externality

- A firm owns a sulphuric acid factory that discharges waste into the Cooks River
  - The waste is dumped into the river and is hazardous to fish
  - We can think about the firms' MB curve
  - We can think of the firm's MC curve
- For a fishing club that uses the river, the quality and quantity of fish decline with more waste
- The efficient outcome is where MB equals MSC,  $Q^*$
- The outcome we expect in a perfectly competitive market is where marginal private cost and MB are equated, i.e.  $Q_c$ 
  - DWL is between MSC and MPC (units over which  $(S)MC > MB$ )



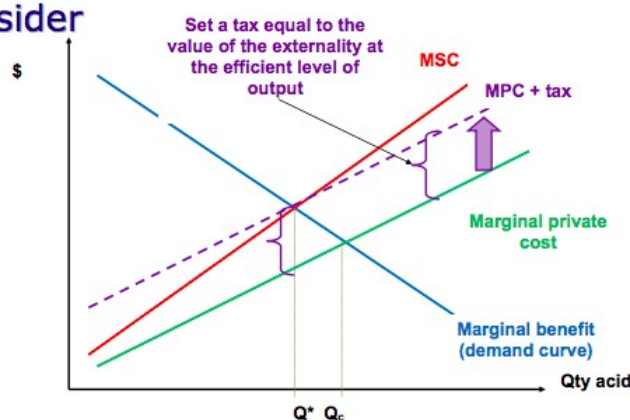
### Solving externalities - the Coase Theorem

- The Coase Theorem states:
  - With low transaction costs & complete property rights the efficient outcome will be achieved
  - The owner ensures that the 'polluter' compensates him/her for his actions, i.e. pollution
- There are two ways we could define property rights:
  - If the factory 'owns' the river; the fishing club pays the factory to reduce their pollution
  - If the clubs 'owns' the river; the factory pays the club to pollute
- The key point about the Coase theorem is that it does not matter who the PRs are vested in - we still get the efficient outcome!
- Limitations
  - Transaction costs
  - Distributional concerns

### Other ways of addressing externalities

- Control and command
  - Regulate pollution for each firm
- Emission charges
  - Charge firm for each unit of pollution
- Taxes
  - Impose charge on each unit of output
- Marketable permits, i.e. a PR solution
  - Impose a limit on total pollution (really just another form of PRs)

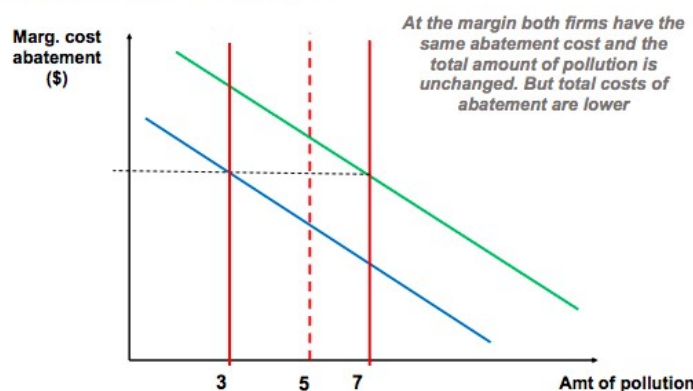
### Consider



- Consider a Pigouvian tax:

- Impose a tax on the activity (production) that generates the externality
- Impose a tax on the activity equal to the level of the externality at the efficient level of output
- Consider a Pigouvian subsidy
  - In the case of a positive externality, rather than using a tax we could simply use a subsidy - this would shift the perceived MPC down
- An alternative to a Pigouvian tax might be a tax on the pollution itself:
  - What might be the benefit of this (to the firm)?
  - What might be a problem with this?
- We might also consider a marketable permit scheme - that is directly regulate the total quantity of pollution
  - An issue with such a scheme is that the regulator still needs to know the optimal level of overall pollution
  - *Having established the total level of pollution, the firms can then buy and sell the 'right to pollute'.*

### Marketable Permits



### Private goods and public goods

- Private goods have two characteristics:
  - Rivalry in consumption - 'if I eat donut, you don't eat it'
  - Excludability - you can be excluded from eating the donut unless you pay for it
- Public goods are:
  - Non rivalrous - my consumption of the good doesn't detract from yours
  - Non-excludable - individuals cannot be excluded from consuming it (air)

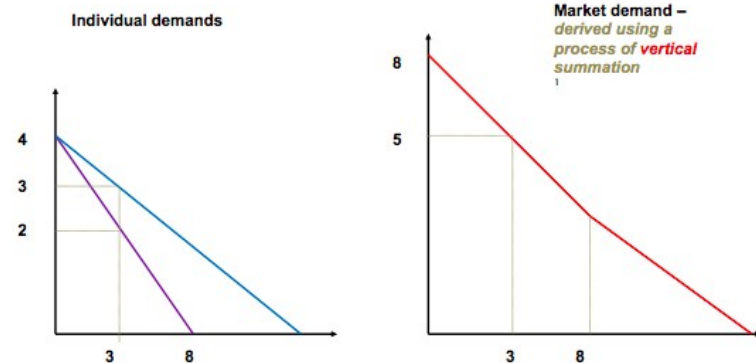
### The free rider problem

- Public goods benefit many people because they are non-rivalrous - we can all consume the public good that is provided
- Public goods are non-excludable so we cannot force people to pay for them
- This leads to a free-rider problem
  - Those who don't pay for them (in general) cannot be excluded from consuming them

### Provision of public goods

- What is the problem with private provision of the goods in the presence of the free-rider problem => there is little or no incentive to provide them
- An alternative?
  - Public provision financed by taxes

- Amount that government should provide depends on the comparison of marginal social benefits and marginal social costs
- The first question we might ask is how we define MSC and MSB of a public good
  - Costs: we might use economic analysis to identify the total (& marginal) opportunity cost of providing the good
  - Benefits: ask individuals about their willingness to pay and use this to identify the MB or WTP for society



### Public goods

- In deriving the demand curve for a public good we want to *vertically* summate the demand curves:
  - Reflects the fact that the public good is non-rivalrous
  - For any amount of the public good, we want to identify the total willingness to pay of all consumers, keeping in mind that they can all consume the same units

### Common Resources

- Common resources are:
  - Rivalrous in consumption - one persons' consumption detracts from another's
  - Non-excludable - people cannot be prevented from consuming the good
- Because of non-excludability individuals will tend to consume too much of the good
  - Individuals consume as long as the private MB exceeds the private MC

### SUMMARY OF PRODUCT TYPES

	Excludable	Non-excludable
Rivalrous	<i>Private goods</i>	<i>Common resources</i>
Non-rivalrous	<i>Quasi public goods</i>	<i>Public goods</i>

### Theory of

### Second Best

- If there is a market failure that cannot be corrected, actions to correct other market failures may have the effect of decreasing total surplus overall
- Examples:
  - If a firm produces a negative externality, if it is a monopolist then it may be detrimental to tax that monopolist

- Marginal cost pricing of public transport may be inefficient if car users generate negative externalities

## 11. Macroeconomics: GDP and Business Cycles (eReserve)

*Macroeconomics studies the behavior of the entire economy*

*Microeconomics provides a foundation for macroeconomics*

- *Macroeconomics aggregates the impacts of individual decisions (of private agents and the government)*

Goals of macroeconomic policy

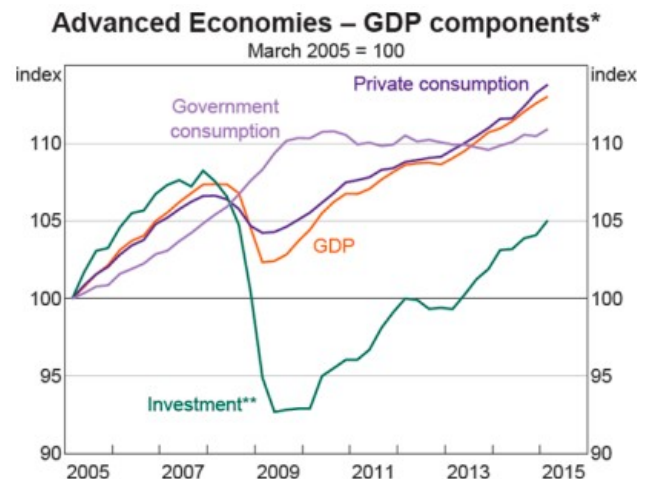
- Full employment
- Economic growth (in the short run and the long run)
- Price stability (low inflation)

Gross Domestic Product (GDP)

- **GDP (or nominal GDP) is the money value of all final goods and services produced in a country in a given time period**
- Money value (or “market value”)
- Final goods and services
- Produced within a country
- In a given time period

Three approaches to measuring GDP

1. Final goods or expenditure approach
  - Think of GDP in terms of who buys the goods and services
  - $GDP = C + I + G + X - M$  where C = consumption goods; I = Investment goods and inventory investment; G = government; X = Exports to foreigners; M = imports
  - Expenditure side is extremely useful for thinking about economic fluctuations
2. Production or value-added approach
  - Value added = firms' revenue - cost of intermediate inputs
  - GDP = sum of value added of all firms in an economy
  - Example for an economy that produces \$6 of bread:
    - Wheat farmers' value-added = \$2 (wheat) - \$0 (no intermediate input costs) = \$2
    - Flour making factory value added = \$3.5 (flour) - \$2 (wheat) = \$1.5
    - Bakery shop value added = \$6(bread) - \$3.5 (flour) = \$2.5
  - Production accounts show how each industry is performing



### 3. Income approach

- Think of GDP in terms of where payments for goods and services go
- Firms' revenue = compensation of employees (wages) + gross operating surplus (profits + depreciation + interest) + indirect taxes (taxes on production less subsidies) + cost of intermediate inputs
- Recall from value added approach (#2):
  - $GDP = \text{value added} = \text{firm's revenue} - \text{cost of intermediate inputs}$
- Using the expression above, GDP under the income approach is:
  - $GDP = \text{compensation of employees} + \text{gross operating surplus} + \text{indirect taxes}$
- Rising profit share an indicator of rising inequality
- All 3 approaches to measuring GDP in principle give the same answer

### Nominal GDP and Real GDP

- Nominal GDP is the *money value of final goods and services* produced during a given year valued at the prices that prevailed in that same year
  - Nominal GDP is just a more precise name for GDP
- Real GDP is the value of final goods and services produced in a given year when valued at the prices of a reference base year
  - $\text{Real GDP} = \text{nominal GDP divided ('deflated')} \text{ by a measure of average prices called a Price index}$
  - Real GDP moves with changes in the quantity of goods and services produced, not with changes in prices
    - Measure of economic growth

### Real GDP growth

- Often we focus on growth (not level) of real GDP
  - % change in real GDP over the last year
- $\text{GDP growth} = (\text{GDP in year } t / \text{GDP in year } t - 1) - 1$

### - Example: GDP growth in Australia:

	December 2018	December 2019
Quarterly Real GDP	\$470,071m	\$480,379m

- $\text{GDP growth} = (480,379 / 470,071) - 1 = 0.022$
- 2.2% growth in GDP

### Short term vs Long term

- In the short term, GDP can grow more or less than the trend growth rate
- Recession often defined as two consecutive quarters of negative growth
- Growth is subject to a lot of variation, booms and recessions, that form the business cycle
- Federal government and reserve bank of Australia (RBA) intervene to "smooth" the cycle, avoid recessions (and some aspects of booms)

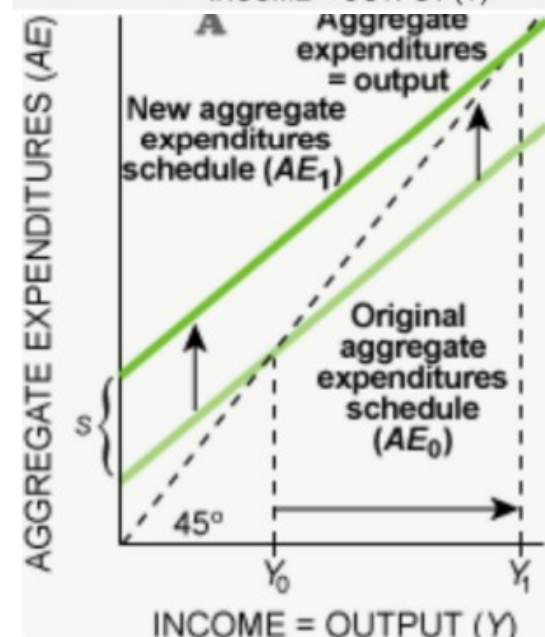
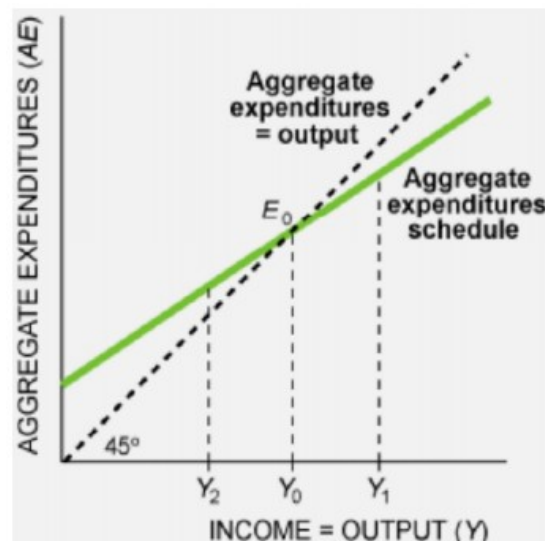
### Aggregate Expenditures

- What determines output in the short-run?
- Keynesian cross model:

- Prices are fixed in the short-run. Firms meet demand for their products at a fixed price
- GDP is determined by people's desired spending. This is known as Planned Aggregate Expenditures (PAE)
  - But people's desired spending in turn depends on GDP
- PAE can differ from actual Aggregate Expenditures if firms sell more or less of their output than they expected
- We want to find equilibrium GDP where  $PAE = AE$

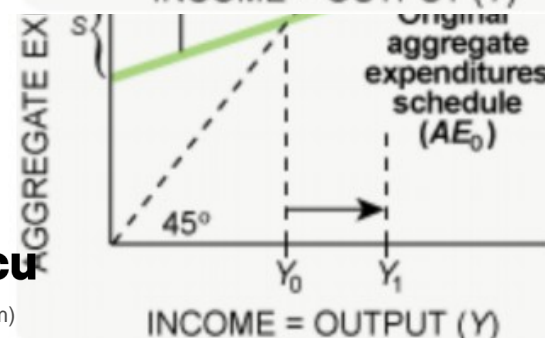
### Planned Aggregate Expenditures (PAE) curve

- The PAE curve is upwards sloping
  - Desired spending increases with incomes
- Recall from GDP identity that  $AE = Y$ 
  - Economy is always on a point along the curve  $AE = Y$
- In equilibrium  $PAE = Y$ 
  - Unplanned inventory investment is equal to zero
- Equilibrium is where PAE intersects the 45-degree line (i.e. where  $PAE = Y$ )
  - At  $Y_1$ , output exceeds PAE. some goods produced go unsold: unplanned inventory accumulation occurs. Firms reduce output.
  - At  $Y_2$ , PAE exceeds output, firms' inventories get depleted. Firms raise output.
  - Equilibrium is at  $Y_0$ , where  $PAE = Y$
- PAE curve can shift due to many factors that can lead households, firms, government or the foreign sector to change spending
  - An upwards shift "s" in the PAE curve (example: increased G)
  - The change in equilibrium income ( $Y_1 - Y_0$ ) divided by the size of the upwards shift "s" in PAE is called the multiplier



### Shift in the PAE curve

- Note that if the PAE curve is flatter the multiplier and hence the equilibrium change in income is smaller
- What would make the PAE schedule flatter?
  - Consumers might not change consumption plans much in the face of short-term income fluctuations (b is smaller)





- A lot of increased spending may be on imports (b<sup>M</sup> is larger)

Mathematical formulation of equilibrium output

- Assume for simplicity that there are no taxes

$$\begin{aligned}
 - \text{PAE} &= C + I^P + G + X - M \\
 &= \underbrace{A + bY}_{C} + I^P + G + X - \underbrace{b^M Y}_{M}
 \end{aligned}$$

- **b** is the marginal propensity to consume
  - The fraction of each dollar of income that is spent on consumption goods and services
- **b<sup>M</sup>** is the marginal propensity to spend on imports
  - The fraction of each dollar of income spent on imports
- Group terms into those that depend on Y and those which are exogenous (do not depend on Y)
- **PAE = (A + I<sup>P</sup> + G + X) + (b - b<sup>M</sup>)Y**
  - Equilibrium is where PAE = Y
- We have 2 equations and 2 unknowns: PAE and Y
  - Solve for Y in equilibrium

$$\begin{aligned}
 - Y &= (A + I^P + G + X) + (b - b^M)Y \\
 - Y &= \frac{(A + I^P + G + X)}{(1 - (b - b^M))}
 \end{aligned}$$

The Multiplier

- Multiplier = the effect of a \$1 increase in exogenous expenditures on equilibrium output
- Our algebraic expression for equilibrium output:

$$Y = \frac{(A + I^P + G + X)}{(1 - (b - b^M))}$$

- If any of the exogenous expenditures (the terms on the numerator) increase by \$1 then output rises by:

$$\frac{1}{(1 - (b - b^M))}$$

GDP per capita

- $\text{GDP per capita} = \text{GDP} / \text{population}$

Real GDP per capita & wellbeing

- These are not the same thing
- Real GDP per capita highly correlated with:
  - Life expectancy
  - Health
  - Literacy rate
  - Education levels
  - Other "human development" indicators
- Happiness generally has a positive correlation with GDP

## **12. Unemployment and Inflation (diff textbook; principles of economics 1st and 2nd (ch 8 and 16))**

Labor Market Statistics

- The population is divided into two groups:
  - The working-age population - the number of people aged 15 years and older
  - People too young to work (under 15 years of age)
- The working age population is divided into:
  - People in the labor force (working or seeking work)
  - People not in the labor force
- The labor force is the sum of employed and unemployed workers

Labor market measurement

- To be counted as employed, a person must have during the reference week:
  - Worked for more than 1 hour as a paid employee or in a family business or farm; or
  - Had a job or business from which they were temporarily absent
  - Note: People working 0 hours and on JobKeeper are classified as employed
- There is also a concept of underemployment - the underemployment rate is the proportion of the labor force that has a job but would like to work more hours
- To be counted as unemployed, a person must be:
  - Actively looked for full time or part time work and been available for work in the reference week; or



- Waiting to start a new job and could have started if the job was available
- Labor market measurement in Australia (additional information):

-Australian labour force categories in Apr 2020:

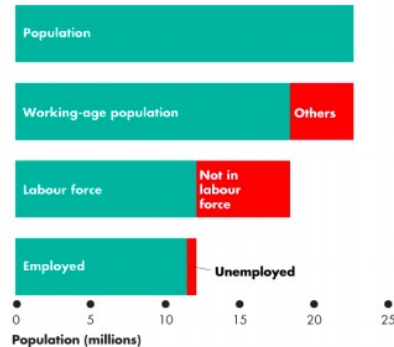
-Population: 25.7 million

-Working-age population: 20.8 million

-Labour force: 13.2 million

-Employment: 12.4 million

-Unemployment: 0.8 million



Labor market measurement - unemployment rate

- The unemployment rate is the percentage of the labor force that is unemployed
- The unemployment rate is:

$$\frac{\text{Number of people unemployed}}{\text{Labour force}} \times 100$$

- The labor force is currently 13,242,000 persons and 823,000 people are unemployed, so the unemployment rate is 6.2 percent

*The unemployment rate increases in a recession and tends to reach its peak value after the recession ends*

Employment and Unemployment

- The labor force participation rate: the percentage of the working-age population who are members of the labor force

$$\frac{\text{Labour force}}{\text{Working – age population}} \times 100$$

- The labor force is currently 13,242,000 and the working-age population is 20,840,000
- The labor force participation rate is 63.5 percent

*Female labor-force participation has trended higher over time while participation has declined for males, particular unskilled males*

Types of unemployment (Frictional and structural are natural rates of unemployment)

- Frictional
  - Short-term unemployment from job search
  - From new entrants, layoffs, and quits
- Structural
  - Mismatch between worker skills and job vacancies
  - E.g. due to technological change; globalization
- Cyclical
  - Unemployment resulting from the business cycle
  - Falls during economic expansion; rises during recessions

Full employment

- “Full employment” means that there is no cyclical unemployment
  - Not the same as zero unemployment
  - Unemployment still includes frictional and structural unemployment - termed the “natural rate of unemployment”
- Determinants of the natural rate of unemployment
  - Job-search frictions
  - Structural change
  - Unemployment benefits
  - Labor market regulation: minimum wages and conditions

Unemployment and potential GDP

- Potential GDP ( $Y_f$ ) is the quantity of real GDP produced at full employment
- Potential GDP corresponds to the capacity of the economy to produce output on a sustained basis
- Real GDP minus potential GDP is the output gap
- Over the business cycle, the output gap is closely related to fluctuations of the unemployment rate around the natural unemployment rate
- Potential GDP generally changes slowly over time so changes in the output gap closely correspond to changes in GDP growth at an annual or quarterly frequency

Okun's Law: Unemployment and Growth

- A 2 percentage point increase in real GDP growth reduces the unemployment rate by about 1 percentage point

The price level, inflation and deflation

- The price level is the average level of prices - it determines the value of money
  - A persistently rising price level is called inflation
  - A persistently falling price level is called deflation
- We are interested in the price level because we want to

- Measure the inflation rate
- Distinguish between money values and real values of economic variables
- Better understand monetary policy (interest rates)
- Consumer price index (CPI) is the most commonly reported measure of prices
- Define a base year: CPI = 100 in the base year
- Determine the basket of goods and services consumed from the Household Expenditure Survey

$$CPI = \frac{\text{Cost of basket in current year}}{\text{Cost of basket in base year}} \times 100$$

#### Step 1: Constructing the CPI basket

- The figure illustrates the CPI basket
- Housing is the largest component
- Food, recreation and transportation are the next largest components
- The remaining components account for 36.7 percent of the basket

#### Step 2: Conduct a price survey

- The quarterly price survey
  - Every three months, Australian Bureau of Statistics (ABS) employees check the prices of goods and services in the CPI basket in all major cities
- Monthly surveys performed in many country

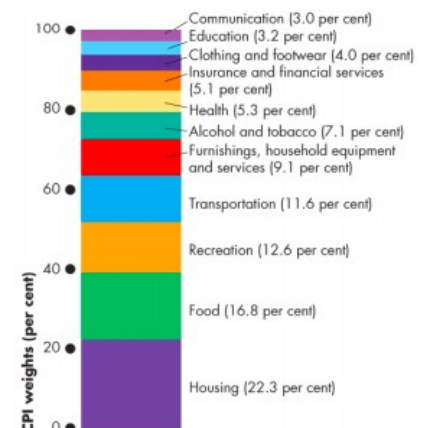
#### Step 3: Calculate the CPI

1. Find the cost of the CPI basket at base-period prices
2. Find the cost of the CPI basket at current-period prices
3. Calculate the CPI for the current period

#### Inflation is costly

- Price movements are never perfectly coordinated
  - Higher inflation means more variability in relative prices
- Search costs: people spend more time searching for better deals
- Cost of changing price ("Menu costs")
- Tax system distortions
  - "Tax bracket creep"; mismeasurement of income and expenses
- Unexpected redistribution of wealth
  - Reduces real value of debts and real value of cash
  - Though this is sometimes useful - 'reboot' the economy after a debt binge

#### Deflation is costly

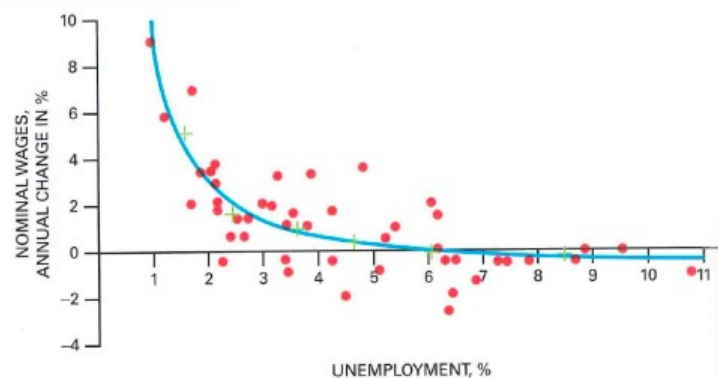


- Real value of debt rises
  - Debt burden increases
  - Bankruptcy & unemployment
- Consumers put off purchases
  - Firms' profit margins decline
- A little inflation like the "oil" that greases the "economic wheel" when some prices are rigid
  - For example, makes it easier to reduce "real" wages when nominal wages are hard to reduce
- Some inflation useful, but not too much

Unemployment and wage growth: Phillips Curve

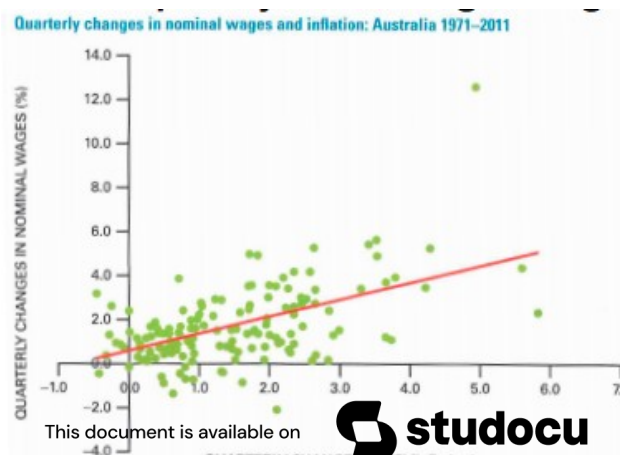
**Short-run negative relationship between unemployment rate and wage growth known as the "Phillips curve"**

The original Phillips curve



- Simple logic behind Phillips curve
  - If unemployment is low, firms have more difficulty hiring workers
  - Workers find it easier to look for other jobs
  - Bargaining position of workers improves
- All these factors point to firms having to increase wages when unemployment is low

*Faster wage growth causes business costs to increase more quickly - leads to higher inflation*



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#### Inflation expectations and the Phillips curve

- The short-run tradeoff between wage growth and unemployment can shift over time
- The unemployment rate is not the only factor affecting wage growth. Expectations of inflation also matter
  - Think of wage negotiations where workers and firms expect that inflation will be 3% per annum
  - Now think of wage negotiations where workers and firms expect that inflation will be 6% per annum - it is likely that larger wage rises will be negotiated
  - If inflation increases this year, workers may expect higher inflation next year, and so negotiate larger wage rises. This can lead to a “wage-price spiral”.

#### Inflation shocks

- Inflation shocks: events that produce temporary sudden changes in the inflation rate.  
Examples:
  - Oil price increases of the 1970
    - OPEC cartel exploited market power in supply of oil
  - China's growth in the 2000's
    - Increased demand for commodities
    - Increase supply of manufactured goods
- Inflation shocks affect the inflation rate and inflation expectations
- Can lead to shifts in the Phillips curve

### 13. Fiscal and Monetary Policy (Principles of economics Ch. 15)

#### Fiscal policy

- Insufficient aggregate demand widely viewed to be a cause of typical recessions
- Fiscal policy can stimulate aggregate demand in recessions and reduce variability of GDP
- Two types of fiscal stabilization policy:
  - **Automatic stabilizers:** Changes in government payments or taxes that automatically increase when economic conditions worsen (existing legislation)
  - **Discretionary fiscal stimulus:** deliberate changes in government policy.  
Generally requires new legislation to pass parliament

#### Automatic stabilizers

- Two components of the government budget change automatically in response to the state of the economy

- **Tax revenues (T,t):** Government sets tax rates, but the tax base those rates apply to (income, consumption) expands when the economy is doing well and contracts when the economy is doing poorly
- **Transfer payments (-T):** Welfare payments, especially the number of unemployment benefit payments, increase when an economy is doing poorly and decrease when the economy is doing well.

#### Discretionary fiscal stimulus

- Government can make discretionary changes to spending or taxes to moderate the business cycle
  - Spending and transfers (G,T), where:
    - Government spending on goods and services (G)
    - Transfer payments such as welfare benefits (negative T)
  - Tax rates (t)
    - Government may pass new legislation to lower tax rates

#### Australia's fiscal stimulus

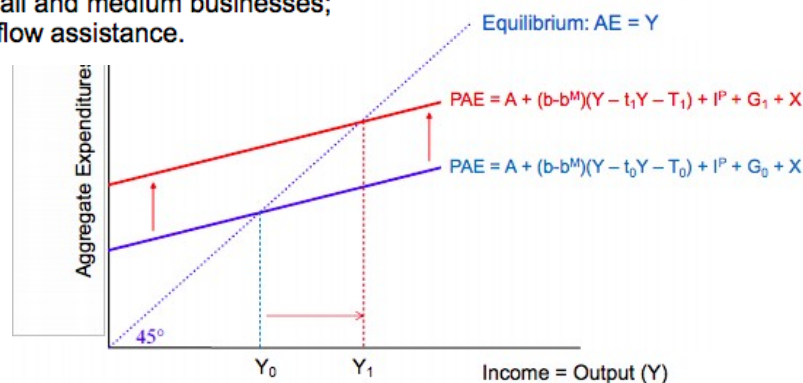
- One-off \$750 payment to persons receiving social assistance (Announced 12 March; paid in two rounds in early April and late July.)
- \$550 fortnightly payments to recipients of income support (Announced 22 March; payments beginning in late April and lasting for 6 months.)
- Early access to superannuation, up to \$20k for people experiencing financial hardship (FY2020 and FY2021)
- JobKeeper wage subsidy of \$1,500 per fortnight per eligible employee for up to six months (Announced 30 March)
- Plus: loan guarantees for small and medium businesses; investment incentives; cash-flow assistance.

#### How does fiscal stimulus work?

- Government spending is a component of planned aggregate expenditures:

$$PAE = C + I^P + G + (X - M)$$

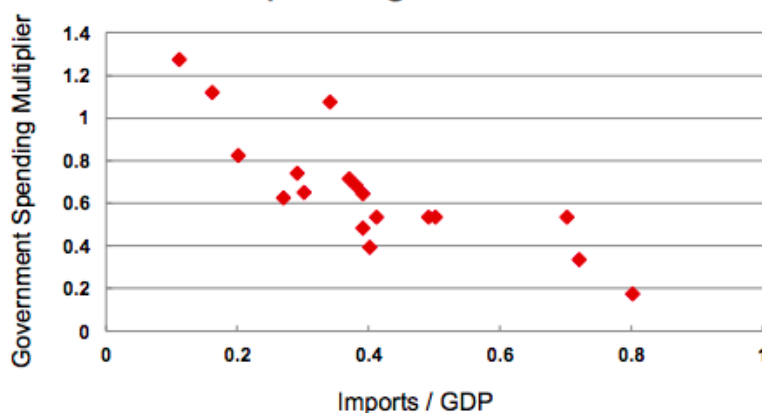
- Fiscal policy also affects other components of PAE:
  - Consumption spending © depends on income net of taxes and transfers:  $C = A + bY^d = A + b(Y - tY - T)$ . Reducing  $t$  or  $T$  increases consumption spending
  - Imports (M) depend on disposable income:  $M = b^M Y^d$
  - Treating government spending (G) and exports (X) as exogenous
- Economy is in equilibrium when  $PAE = Y$



- The expansion in equilibrium output exceeds the shift up in the PAE curve:
  - Multiplier effect, because expansion of income Y leads to an increase in PAE, further increasing Y, and so on
  - Change in output is larger for an increase in G than for the same sized decrease in T because some of the reduction in taxes is saved rather than spent
  - The PAE curve is flatter the larger is the share of income spent on imports. The multiplier is smaller when the AE curve is flatter. This makes fiscal stimulus less effective.

Estimated multipliers

- The government spending multiplier tends to be larger in countries that spend a smaller fraction of their income on imported goods and services.



Budget

balance

- Budget balance = tax revenues - expenditures
  - Surplus: revenue > expenditures
  - Deficit: expenditures > revenues
- *Structural budget balance* is what the budget balance would be if the economy were at full-employment
  - In a recession structural budget balance is greater than actual budget balance
  - In boom times structural budget balance is less than actual budget balance

Fiscal policy summary

- Fiscal policy likely most useful just as an economy is about to enter a recession
  - Use resources about to be idle from fall in private demand
  - Avoid consumer panic from spiraling unemployment
- Two components of fiscal stimulus:
  - Automatic stabilizers
  - Discretionary policy
- Larger multipliers for government investment spending and benefits or tax cuts to households with large marginal propensity to consume

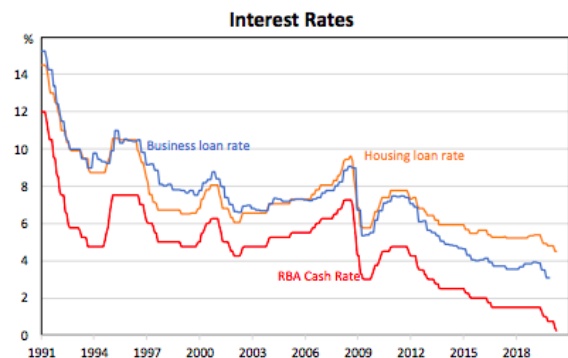
- Fiscal policy can have adverse effects
  - Some public spending appears wasteful
  - Accumulating debts now means higher taxes later
  - Stabilizing the business cycle should not be used as an excuse for running endless large deficits
- More valuable if government has low level of debt
  - Important for governments to save in good times

### Monetary policy

- The Reserve Bank of Australia (RBA) is responsible for monetary policy
  - Conventional monetary policy involves setting interest rates on overnight loans between major banks
  - The cash rate influences other interest rates in the economy, affecting the behavior of borrowers and lenders, economic activity and ultimately the rate of inflation
- RBA is independent from day-to-day politics
  - Prevents manipulation of monetary policy for political ends, and keeps monetary policy focused on its long-term goals

### Inflation targeting framework

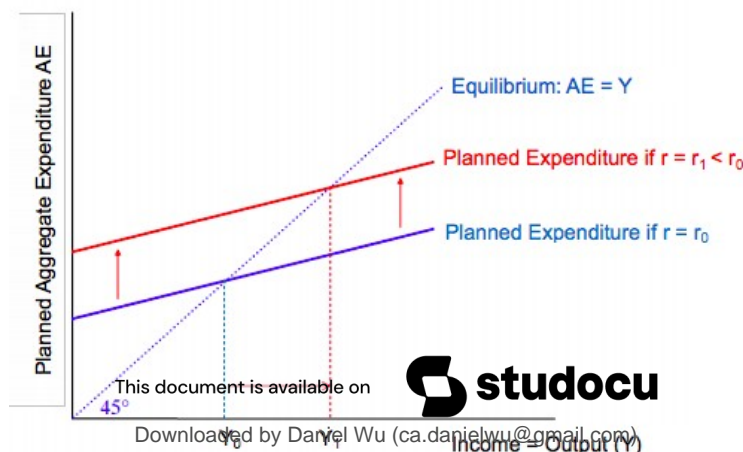
- Inflation target of 2-3% over the medium-term
  - Low target level of inflation reduces economic distortions
  - Target provides an anchor for inflation expectations
  - Flexible target: difficult/costly to fine-tune inflation
- RBA makes changes in interest rates to keep economy close to full employment
  - This stabilizes inflation at target



### Implementation of monetary policy

- RBA operates in the overnight money market to keep the cash rate close to its target level
- RBA's cash rate target influences interest rates faced by households and firms

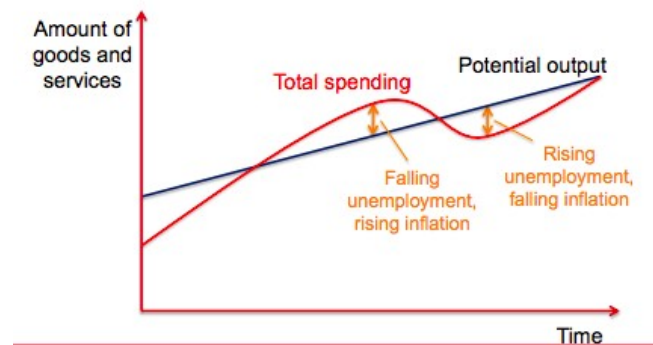
### How does monetary stimulus work?





### Output and inflation stabilization

- Stabilization of output close to potential keeps inflation stable and maintains full employment
  - Known as the “divine coincidence”



### Real vs. nominal interest rates

- Real values matter for aggregate expenditures
- Nominal interest rate = real interest rate + inflation
- Nominal interest rate must rise (fall) by more than increase (decrease) in inflation to stabilize inflation and output

### The zero lower bound

- Holding cash provides a nominal return of zero percent, so people would not be willing to lend at nominal interest rates more than a little below zero percent
- This places an effective lower bound on the nominal cash rate, limiting the scope of conventional monetary policy to provide economic stimulus
  - The RBA has recently begun buying government debt in the secondary market to lower medium and longer-term interest rates, which are above zero percent
  - In March the RBA announced a target for the yield on 3 year Australian Government bonds of around 0.25 percent, to help lower funding costs across the economy

### Monetary policy transmission

#### 1. Intertemporal substitution

- A reduction in interest rates reduces the return on saving, encouraging households to decrease saving and increase current consumption

#### 2. Investment

- When interest rates are reduced the return on investment spending (e.g. equipment or buildings) is more likely to be greater than the cost of borrowing, leading to an increase in investment spending
- Dwelling investment is one of the most interest sensitive components of investment

### **3. Cash flow channel**

- A reduction in interest rates lowers repayment amounts for households with variable rate mortgages
- Borrowing constrained households may increase spending when interest payment decline
- Interest earnings decrease for savers. But Australia is a net borrower and savers typically have a lower marginal propensity to consume than borrowers

### **4. Asset price and wealth channel**

- A decrease in interest rates boosts the price of assets (e.g. house prices and share prices)
- Assets are more valuable when interest rates are low because the present discounted value of future cash flows (e.g. rents or dividends) is higher
- An increase in asset prices increases people's wealth. This leads to higher consumption as households generally spend some share of any increase in their wealth
- Higher asset prices increase the value of an asset that can be borrowed against. This makes it easier for firms to borrow.

### **5. Exchange rate channel**

- A reduction in interest rates reduces the return on Australian financial assets relative to foreign-currency assets. This causes a depreciation of the AUD
- An exchange rate depreciation:
  - Makes Australian goods and services cheaper in foreign currency terms, increasing export demand
  - Raises the price of imports, encouraging Australians to substitute domestic goods and services for imports
- Everything works the same way in reverse for an interest rate increase

What does the RBA look at?

- RBA and other central banks try to take a forward-looking view of monetary policy
  - While the latest economic data gives you an imprecise picture of what has happened in the recent past, data + economic models give insights about future inflation and growth
- International indicators
  - International economic growth: especially China
  - Commodity prices ("terms of trade")
  - International financial markets: especially US and Europe

- Exchange rates
- Domestic indicators
  - Where is domestic economic growth coming from?
    - Consumption (C)
    - Housing investment (I)
    - Mining investment (I)
    - Other business investment (I)
    - Government demand (G)
    - Net exports (X-M)
  - Inflation pressures
    - Current inflation rate
    - Labor markets and wage growth
    - Import prices and the exchange rate
    - Inflation expectations
  - Domestic financial markets

Making the cash rate decision

- Reserve Bank Board meets on the first Tuesday of every month, except January
  - Nine members: Governor, Deputy Governor, Secretary to the Treasury, and six external members
- Cash rate decision announced at 2:30pm on the day of the board meeting

*Monetary policy critical to maintaining stable prices; Role in moderating the business cycle*

*The break-even/CVP analysis is based on multiple assumptions. For example, the model assumes that relationships between costs and revenues are strictly linear, when in reality it may differ. Additionally, fixed costs can be stepped fixed costs and not continuously the same value*