

# **BUSS1040 NOTES**

## **Lecture 1 – Key Concepts and Comparative Advantage**

### **Economics Basics**

- Economics is the study of choice under scarcity → scarcity is faced by consumers, businesses, government, countries, and so on – choices need to be made.
- Key issues that need to be addressed in an economy are:
  - what to produce
  - how to produce it
  - who should get what is made?
- In a modern economy, these questions are typically resolved in the 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 e.g. imposing regulations and taxes.
- Our focus is on the behaviour of individuals (consumers, firms, government) in markets.

### **Scarcity and Opportunity Cost**

- Resources are limited, so that not all wants can be met – this is scarcity. Any choice involves a trade off or opportunity cost → what we give up when we make a choice, or “the value of the next best forgone alternative”.
- This concept 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 (or, in other words, would be considered as costs by an accountant).
  - Implicit costs are opportunities that are forgone that do not involve an explicit cost.
- Opportunity cost does not include unrecoverable or sunk costs: only costs that could change if a different decision were made counts.
  - If a business spent \$100 million on an advertising campaign, the opportunity cost of continuing the campaign does not include this money, which cannot be recouped by stopping the campaign now.

### **Other Economics Terms**

#### **Marginal Analysis**

- Marginal means additional or extra → marginal benefit is the benefit of an extra unit consumed for an individual; marginal cost is the additional cost of buying one more unit.
- Marginal analysis is useful as it allows us to examine the behaviour of individuals in market.
  - Compare MB with MC of an activity. If  $MB > MC$ , the agent is better off doing the activity. If  $MB < MC$ , they are worse off doing it.

- Decision-making = thinking at the margin.

## Correlation and Causation

- Correlation: when two or more factors are observed to be moving in opposite directions, or together.
- Causation: a change in one variable brings about, or causes, a change in the other variable.
- Economic theory, providing a framework for how the world works, allows us to distinguish between the two.

## Ceteris Paribus

- To isolate the impact of one factor, economists examine the impact of one change at a time, holding everything else constant – this is called ceteris paribus (or ‘other thing equal’).
- If we are interested in the impact of the change in the price of a good on the quantity demand, we analyse this, holding income and any other relevant variables constant.

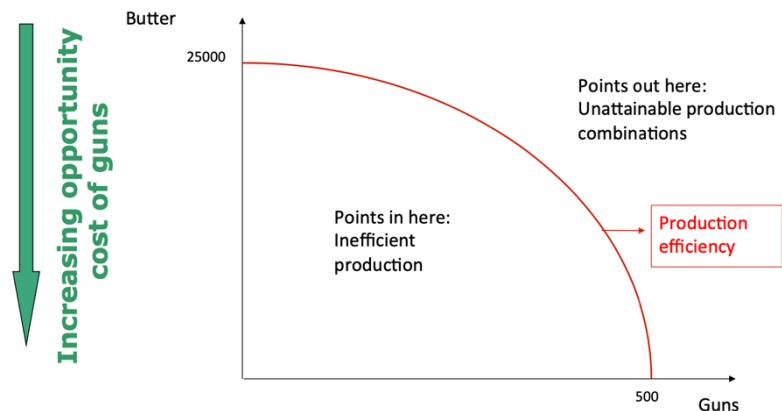
## **Production Possibility Frontier (PPF)**

- A PPF graphs the output that an individual (or a country) can produce with a particular set of resources.
- A country’s PPF shows the combination of goods and services that a country can produce given its resources and its current state of technology → if the country does not trade with others, the PPF also describes the country’s consumption choices.

## An Example

- Suppose a country can only produce guns and butter.

	Guns	Butter
A	0	25000
B	100	24000
C	200	22000
D	300	18000
E	400	13000
F	500	0



## The Shape of the PPF

- The slope of the PPF is concave → the opportunity cost of each good is decreasing the level of output of the other good – it depends on the country’s productive resources (labour, capital, land, etc.) and the current state of technology.
- If either the amount of resources available or the state of technology changes, the shape of the PPF can also change.
  - An improvement of technology could shift the curve out (if it improves productivity for both goods), or rotate the PPF out and up (if the new technology only improves production for one of the goods).

## Gains from Trade (or Exchange)

- A crucial idea in economics is that trade can make everyone better off. Trade is economic interactions that helps allocate goods to those who value them most → gains from exchange: improvements in income, production or satisfaction owing to the exchange of goods or services.
- I own a bike that I value at \$10. My friend wants a bike and is willing to pay \$100. If we exchange for \$40, both of us are better off → this trade is Pareto improving since both agents are better off.
- It is key that exchange is voluntary.
  - It 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: a higher price suits the seller, lower price the buyer.
- Trade also allows people to take advantage of gains from specialisation, reducing overall costs of producing and increasing output – related to comparative advantage in production.

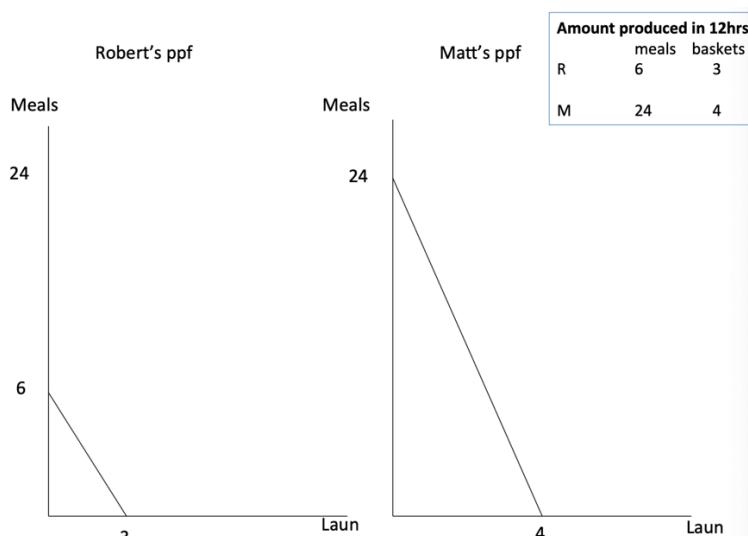
### An Example

- Robert only washes clothes. Matt only cooks → gains from trade are that they allow each other to consume a new good.
- When each can perform both tasks, but they do opposing tasks at great cost/effort, specialising can make both better off. What if one party is better at producing both services?

	Hours needed for => Amount produced in 12hrs			
	1 meal	1 basket	meals	baskets
R	2	4	6	3
M	1/2	3	24	4

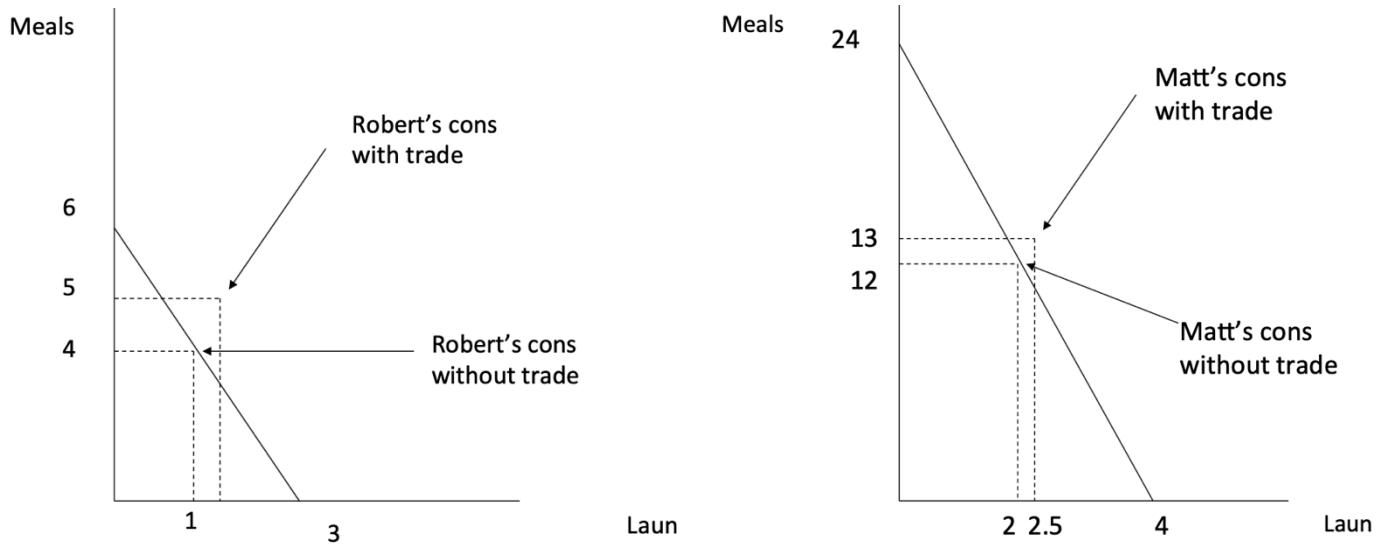
If both do not trade they consume on their PPF

Proposed trade:      Robert does 1.5 baskets of laundry  
for Matt. Matt cooks 5 meals for Robert.



	Without trade	With trade			
	Prod. and cons	Prod	Trade	Cons	Gains from trade
R	<b>4 meals 1 basket</b>	0 meals 3 bask	gets 5 meals for 1.5 bask	<b>5 meals 1.5 bask</b>	<b>1 meal 0.5 bask</b>
M	<b>12 meals 2 baskets</b>	18 meals 1 basket	gives 5 meals for 1.5 bask	<b>13 meals 2.5 bask</b>	<b>1 meal 0.5 bask</b>

End results: Both parties can consume outside of their ppf



	Meals (in terms of baskets forgone)	Baskets (in terms of meals forgone)
R	1/2	2
M	1/6	6

### Absolute and Comparative Advantage

- Party A has an absolute advantage over Party B in the production of a good if, for a given amount of resources, A can produce a greater number of that good than B.
- Party A has a comparative advantage over Party B in the production of a good if A's opportunity cost of producing that good is lower than B's opportunity cost.
- Robert has a comparative advantage in laundry; Matt in cooking. As opportunity cost is the inverse for the other good, it is impossible for a person to have a comparative advantage in both goods.
- Differences in opportunity costs of production create gains from specialisation and trade → each person specialised in the good in which they have a comparative advantage.

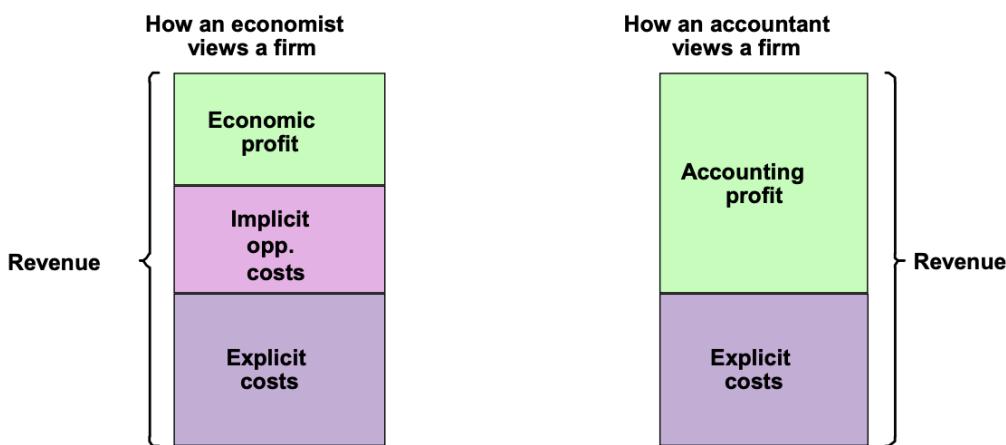
### Intuition Underlying Gains from Trade

- Trade is beneficial to individuals (and indeed countries) because it allows them to specialise in industries where they have the comparative advantage, and trade with others for things that would cost them more to produce personally. This principle holds even if one party has absolute advantage in both.

## Lecture 2 – Firm Behaviour; Production, Costs and Supply

### Economic Profit

- Economic profits are revenues minus total opportunity cost. Accounting profits are revenues minus all explicit costs.
- 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 + forgone opportunities = total opportunity costs of producing goods and services.
- Zero economic profit: revenues are just enough to cover opportunity costs.

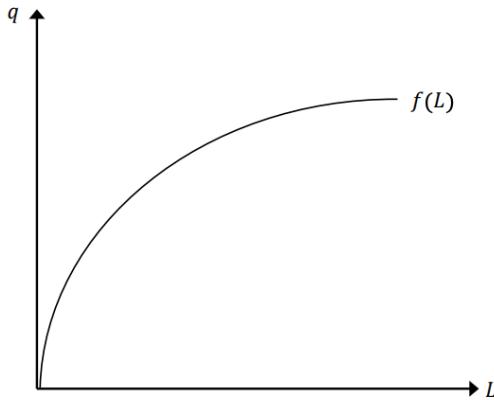


### Short and Long Run

- A firm, using the available technology, converts inputs – labour, machinery (often called capital), natural resources (typically called land) – into output that is sold in the 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 (inputs) are fixed – an input is fixed if it cannot be changed regardless of the output produced.
- The short run is the period of time during which at least one of the factors of production is fixed e.g. size of a factory might not be able to be changed.
- In the long run, all factors of production are variable (that is, not fixed) → in when the firm's lease of the factory ends, the firm is free to decide whether or not to renew the lease for that factory.
- The short run and the long run are 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 – this will differ between industries.

### Production

- A firm requires inputs or factors of production (labour, capital, land, etc.) in order to produce its final output (i.e. goods or services).
- A production functions shows the relationships between quantity of inputs used and the maximum quantity of output produced, given the state of technology.
- Where  $q$  is the level of output, and  $L$  is amount of labour, the production function for a hypothetical factory could be as follows:



## Marginal Product

- The marginal product (MP) is the change in output when one or more input is used. It is the slope of the production function. For example:

Number of Workers	Number of Umbrellas Made	Marginal Product
0	0	N/A
1	60	60
2	110	50
3	180	70

## Diminishing MP

- 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. It is very common (can be seen in the diagram above):
  - In the short run, there is fixed input of some kind which creates a capacity constraint. This means that each additional worker will contribute to the output less and less than those hired before.
- Crucially, diminishing MP is a short-run concept, relying on the idea that at least one output is fixed.

## Production in the Long Run

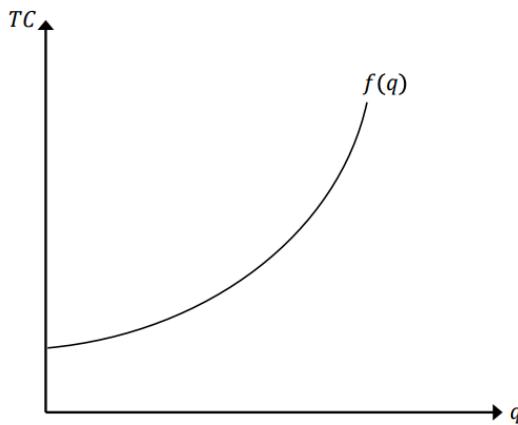
- Allow all inputs into the production process to be variable.
- We are interested in how the quantity of output changes when we change the quantity of all of the factors of production.
- production function in the LR:  $f(L, K) = q$

## Returns to Scale

- 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/more/less than the proportional increase in all inputs, there are constant/increase/decreasing returns to scale i.e.  $f(2L, 2K) = 2q/ > 2q/ < 2q$ .
- Note, it is possible that a firm has diminishing MP in the short run, and still has increasing returns to scale in the long run.

## Short-Run Costs

- A cost function is an equation that links the quantity of output with its associated production cost:  $TC = f(q)$ , where  $TC$  represents total cost and  $q$  represents the quantity of output. Typically:



- When output is zero, total cost is positive because, in the short term, some factors of production are fixed and must be paid for.
- The total cost curve rises as the output increases as the costs increase when more inputs are required.
- The total cost curve rises at an increasing rate, capturing diminishing MP.

## Fixed and Variable Costs

- 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 (FC) are costs that do not vary with output. When output is zero, all costs are fixed costs.
- By contrast, variable costs (VC) are costs that vary with output. All costs that are not fixed costs will be variable costs.
- Total costs (TC) consist of fixed and variable costs:  $TC = VC + FC$

## Average Costs

- Average fixed costs (AFC) is fixed cost per unit of output:  $AFC = FC/q$ , noting that the AFC curve is always downward sloping because fixed costs do not change.
- Average variable costs (AVC) is variable cost per unit of output: that is,  $AVC = VC/q \rightarrow$  because of diminishing MP, the AVC curve will eventually be upward sloping.
- Average total costs (ATC) is total cost per unit of output:  $ATC = TC/q$ . Since  $ATC = AFC + AVC$ , its shape is affected by both. At very low levels of output, ATC is usually in decline as 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

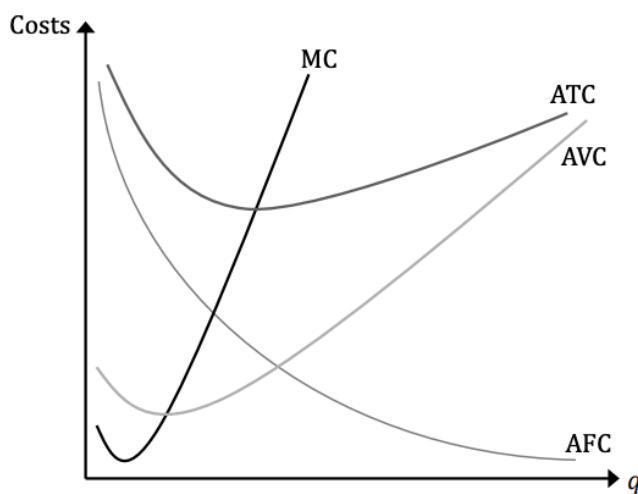
- Marginal cost (MC) is the increase in total cost from an extra unit of output. Due to diminishing MP, a typical MC curve will eventually be increasing in output - positive slope.
- In the short run, diminishing MP implies increasing MC.

Q of output	TC	FC	VC	AFC	AVC	ATC	MC
0	3.00	3.00	0.00	-	-	-	
1	3.30	3.00	0.30	3.00	0.30	3.30	0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90

### Relationship between ATC, AVC, and MC

- As a rule, MC passes through the minimum of ATC and AVC.
- 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.
- The same applies to MC and AVC; MC intersects the minimum of AVC.

Q	AVC	ATC	MC
1	0.30	3.30	0.30
2	0.40	1.90	0.50
3	0.50	1.50	0.70
4	0.60	1.35	0.90
5	0.70	1.30	1.10
6	0.80	1.30	1.30
7	0.90	1.33	1.50
8	1.00	1.38	1.70
9	1.10	1.43	1.90
10	1.20	1.50	2.10



### **Long Run Costs**

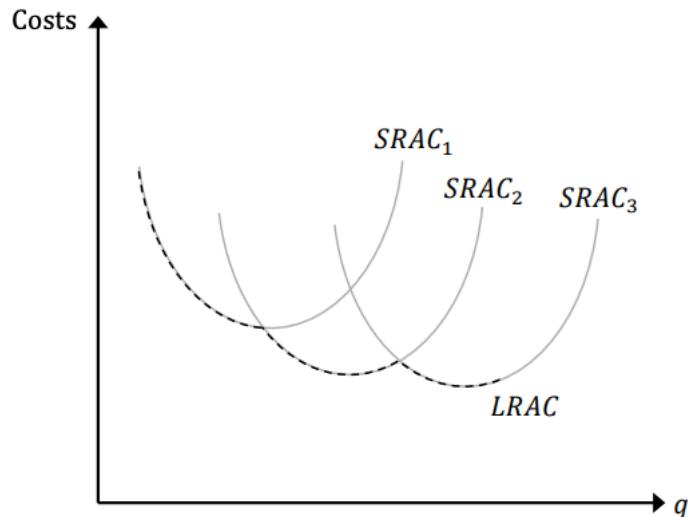
- In the long run, all inputs are variable. If a firm does not want to produce anything, its costs are zero.
- A firm producing a positive output has more flexibility to adjust all of its inputs so long run costs should not be higher than short run costs for a given level of output.

## Long Run Marginal Cost

- Long run marginal cost (LR MC) 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.

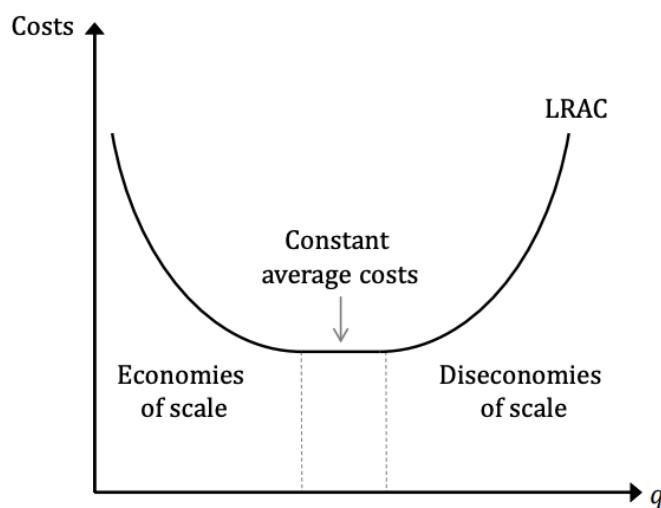
## Long Run Average Cost

- Given the firm's extra flexibility in the long run, long run average cost can be no greater than the short-term 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**

- Economies of scale is when the long run average costs decrease with output.
- Diseconomies of scale is when long run average costs increase with output.
- Constant returns to scale are when long run average costs are constant as output expands.

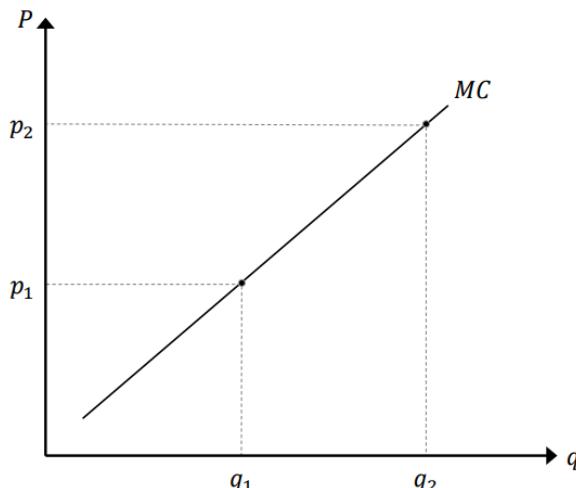


## **Supply**

- We can now 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

- Firm supply is the quantity of output a firm is willing and able to supply at a certain price. The supply curve traces out all combinations of market price and quantities that a firm is willing and able to sell at that price.
- Firm supply curve is drawn by changing the price of output, ceteris paribus.
- A firm should sell up until  $P = MC$ .
- The marginal revenue (MR) for each unit that the firm sells = the price,  $P$  i.e.  $MR = P$  (competitive market).
  - 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 (and this is true for at least one additional unit), 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.
- If a price  $P$  changes from  $P_1$  to  $P_2$ , as the 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 the price is higher.



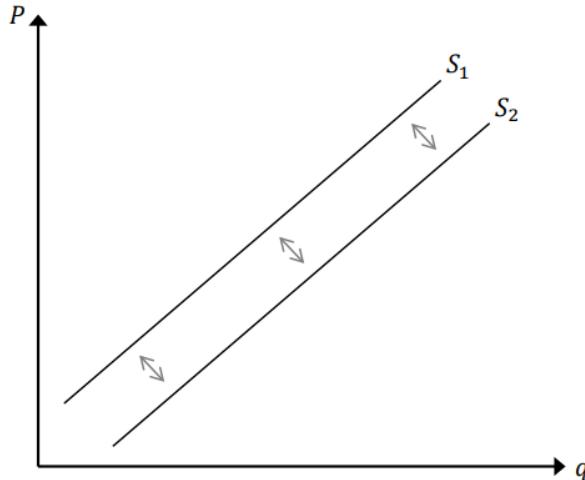
## **The Law of Supply**

- This means that a firm's supply curve is given by its  $MC$  curve, which 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.
- This positive relationship is known as the law of supply.

## Shifts in Supply

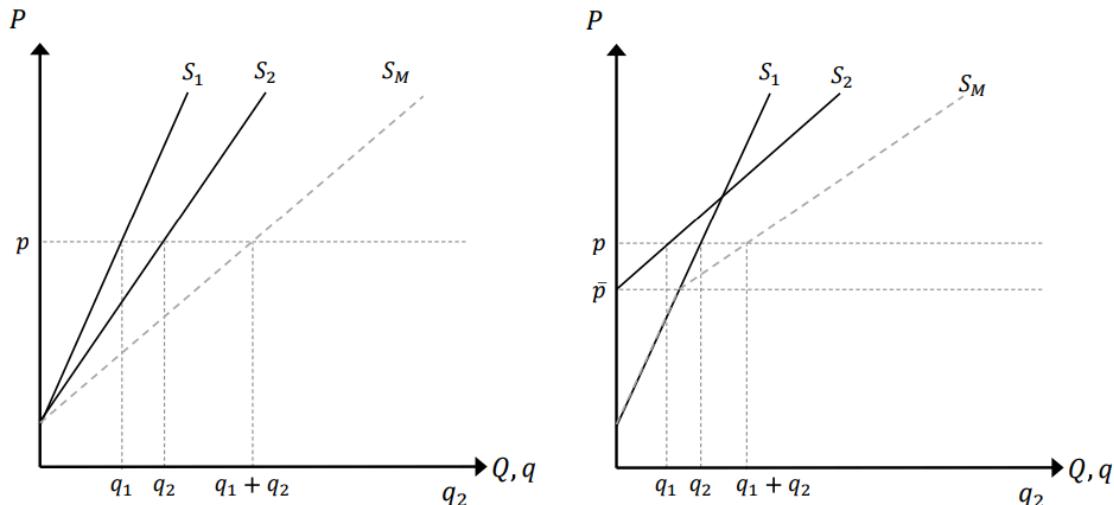
- The firm's supply curve is derived by assuming that only the price and quantity supplied of the product can change.

- If any other relevant factors change, the supply curve itself will shift e.g. cost of inputs, technology, expectations of 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, either:
  - “an increase in supply” for shifts of the supply curve to the right ( $S_1$  to  $S_2$ ); or
  - “a decrease in supply” for shifts of supply to the left ( $S_2$  to  $S_1$ )



## 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.
- 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.



- The law of supply 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.

## Lecture 3 – Demand, Market Equilibrium and Welfare

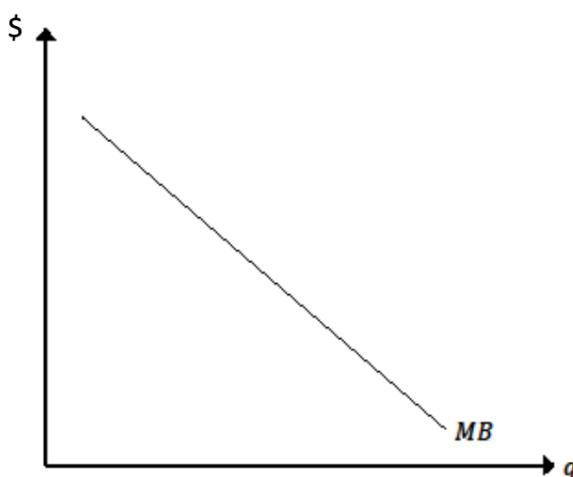
- Consumer behaviour → demand for goods and services.
- In economics, we examine consumer behaviour assuming each consumer tries to maximise their well-being, or the benefit he or she gets from consuming goods and services, subject to their budget constraint (trade-offs).
- In competitive markets, the choices of individual consumers do not affect the price in the market i.e. consumers are price takers.

### **Benefit and Willingness to Pay**

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

### Total Benefit and Marginal Benefit

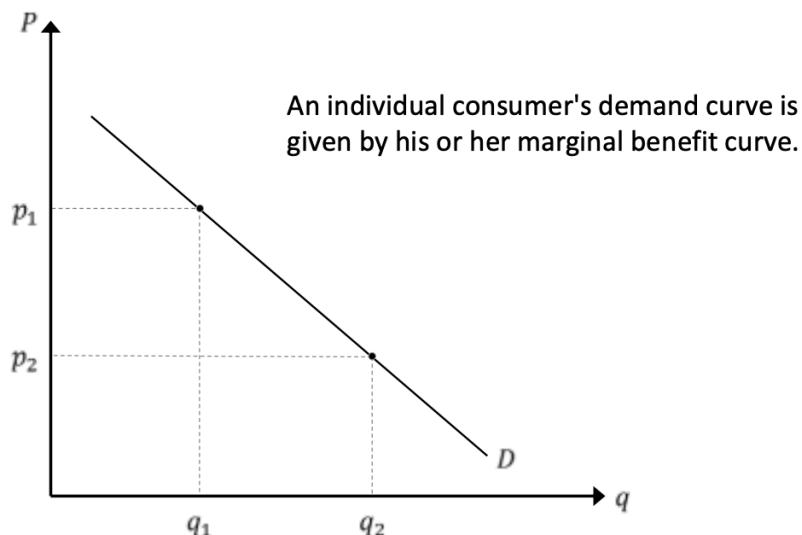
- When a consumer buys multiple units of a good, important to distinguish between total and marginal benefit. E.g. willingness to pay is \$4 for first, \$3 for second, \$2 for third → marginal benefit is prices for each cup, total benefit for three cups is \$9.
- Generally, we expect marginal benefit to decline with each additional unit consumed (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 MB curve.



### **Individual Demand**

- An individual's demand is the quantity of a good or service that a consumer is willing and able to pay at a certain market price → The individual demand curve traces out all combinations of a) market price and b) individual demand at that price ceteris paribus.
- A consumer will purchase units of good up until the point where  $P = MB$ .
  - If  $P < MB$  for a unit of a good, the consumer should buy that unit because their willingness to pay for that unit exceeds the price.
  - If  $P > MB$  for a unit of the good, the consumer should not buy that unit.

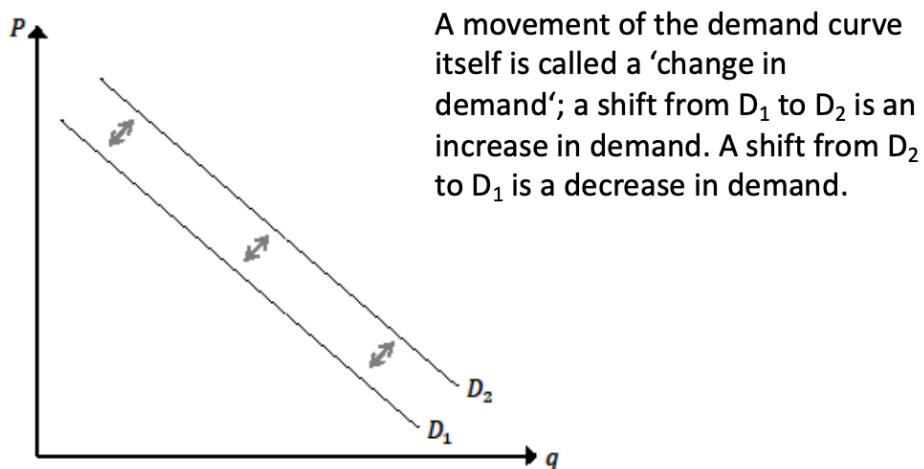
- Consequently, a consumer's individual demand curve is their Mb curve → it is downward sloping.



- The negative relationship between price and quantity demanded is known as the law of demand.

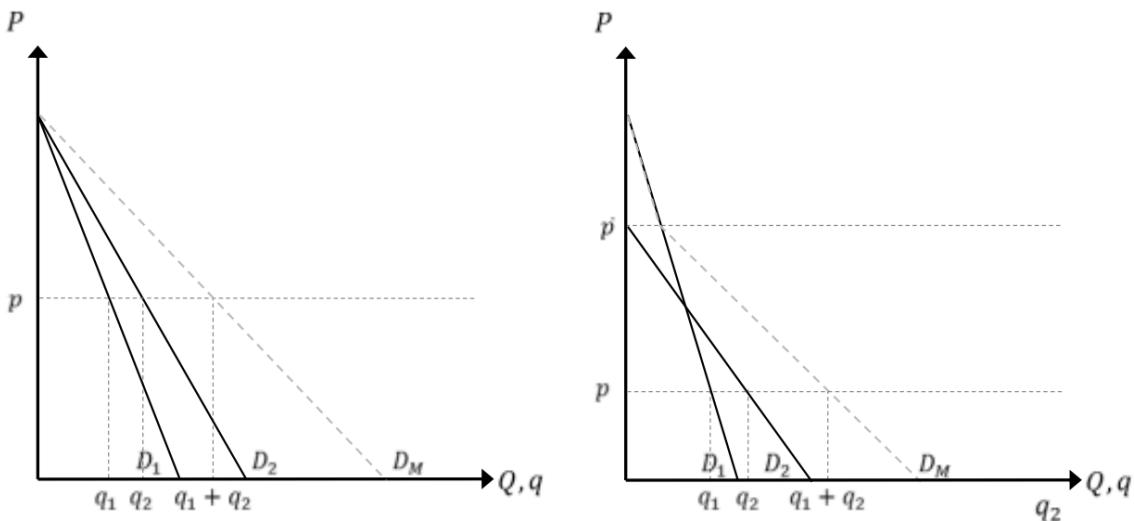
### Movement Along a Demand Curve/Changes in Demand

- 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/up along the demand curve, this is called an 'increase/decrease in the quantity demanded'.
- A demand curve is drawn assuming all other relevant factors are held constant, including 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 in the demand curve is called a change in demand. If demand shifts right/left, this is called an 'increase/decrease in demand'.



### **Market Demand**

- 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.
- It can be derived by adding together the quantity demanded by each individual consumer at that price (horizontal summation).

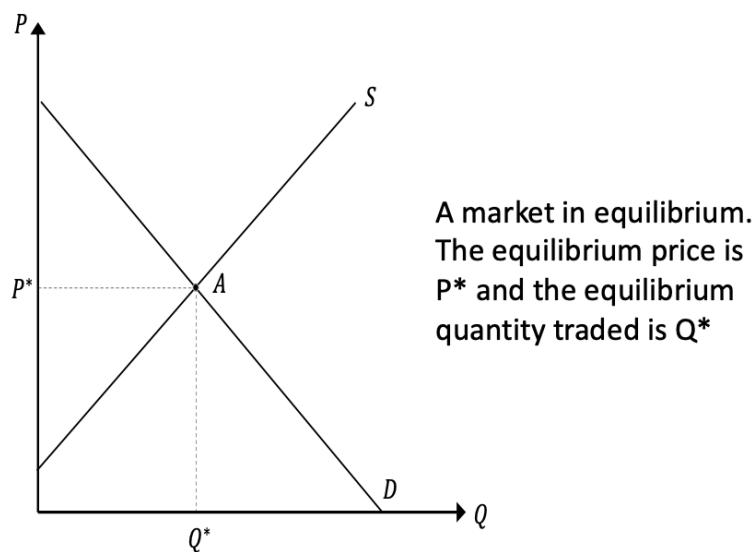


- The law of demand also holds for the market demand curve. We can also use the term change in the quantity demanded to refer to movements along the market demand curve, and the term change in demand to refer to a shift of the demand curve itself.

## Market Equilibrium

- Together, demand and supply determine the trade and quantity of a good or service in a market.
- 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 (or 'equilibrium price').



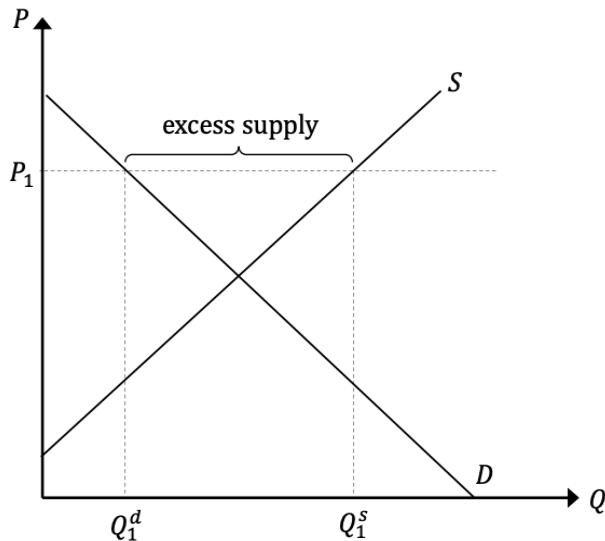
## Market Disequilibrium

- If a market is not in equilibrium, there will be pressure on price and quantity to move towards the equilibrium price and quantity.

### Excess Supply

- The market price is above the equilibrium price, the quantity supplied exceeds the quantity demanded → excess supply.

- Sellers cannot find buyers for all units supplied to the market, causing downward pressure on prices as sellers bring more consumers into the market → quantity supplied will fall and quantity demanded will rise in response to a decrease in prices.
- This downward pressure on prices will continue until the excess of supply is eliminated, moving the market towards equilibrium.

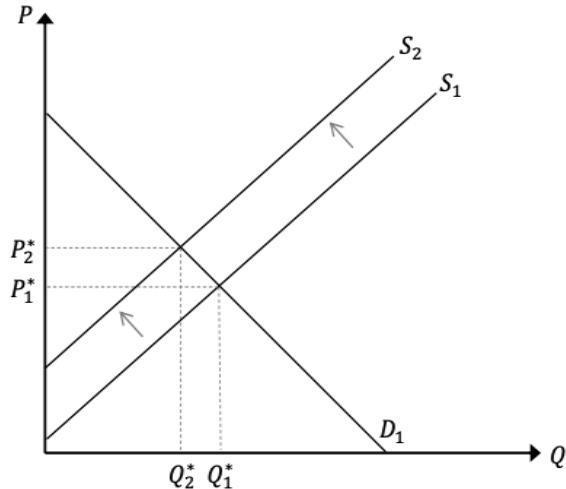


### Excess Demand

- If the market price is below the equilibrium price, there is excess demand: the quantity demanded exceeds the quantity supplied.
- Sellers do not supply enough units to meet consumer demand.
- There will be upward pressure on prices as buyers compete for limited units in the market – this increase in prices will increase the quantity supplied and also decrease quantity demanded.
- This upward pressure on prices will continue until the excess of demand is eliminated, moving the market towards equilibrium.

### 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.
- To deal with it:
  - Assume that the market in question is initially in equilibrium.
  - Ascertain whether the change or event will affect the demand curve or the supply curve of the market (or both) i.e. which curve will shift and which way.
  - Use the demand and supply diagram to compare prices and quantities traded in the market before and after the change.
- Considering the market for cars when the price of steel increases:

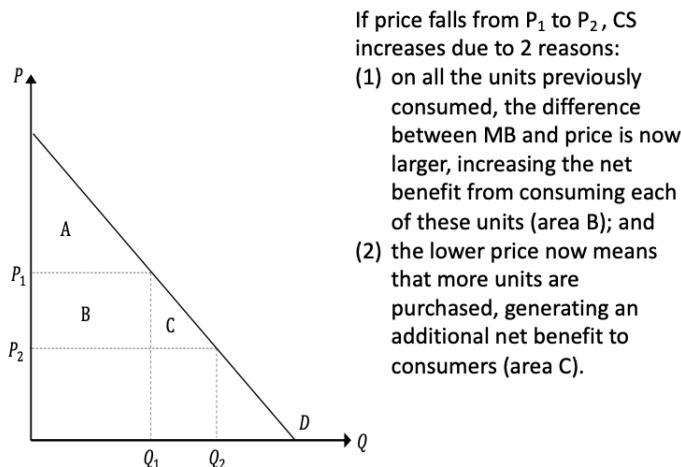
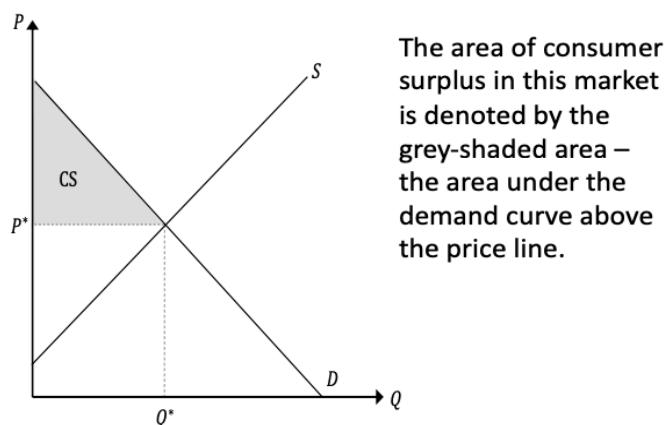


## Welfare – The Benefit to Market Participants

- 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

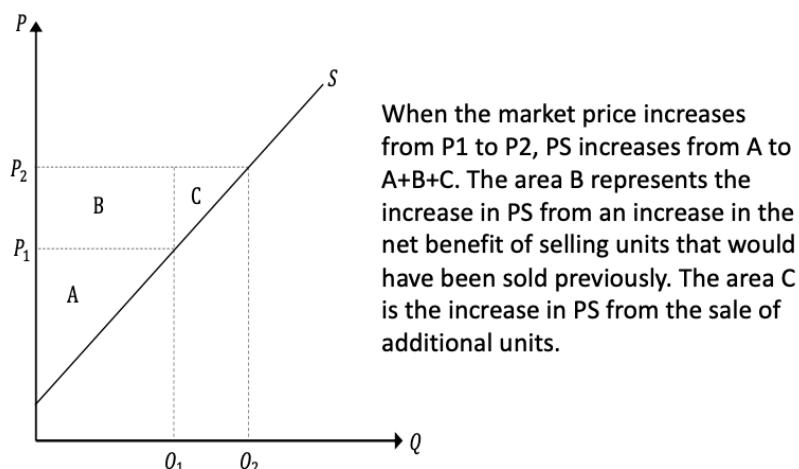
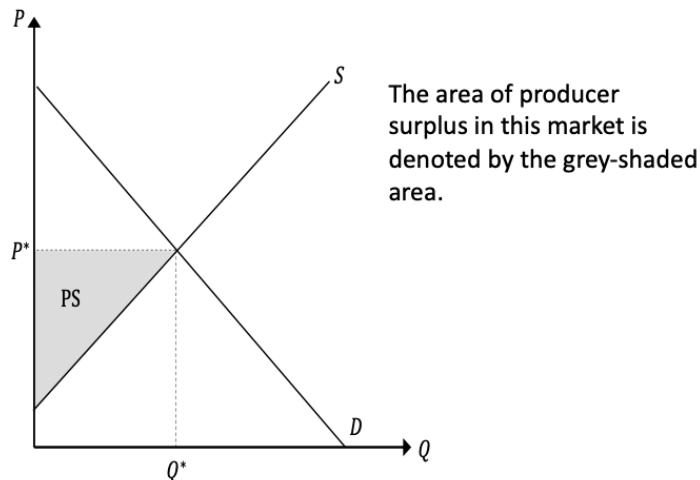
- Consumer surplus (CS) is the welfare consumers receive from buying units of a good or service in the market.
- We can measure consumer surplus by evaluating the net value (net benefit) of a good or service to the consumer, as he or she perceives it → consumer surplus is given by the consumer's willingness to pay, minus the price actually paid for each unit bought.



## Producer Surplus

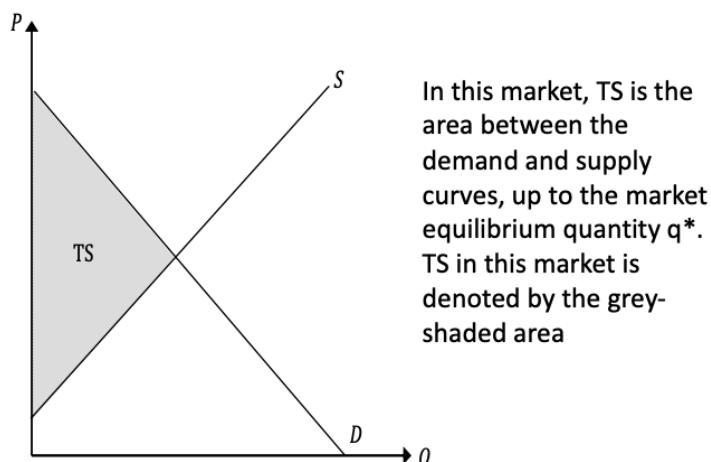
- Producer surplus (PS) is the welfare producers receive from selling units of a good or service in the market, by considering the net benefit of selling a good or service.
 

→ Given by the price the producer receives, minus the cost of production, for each unit of good or service bought.



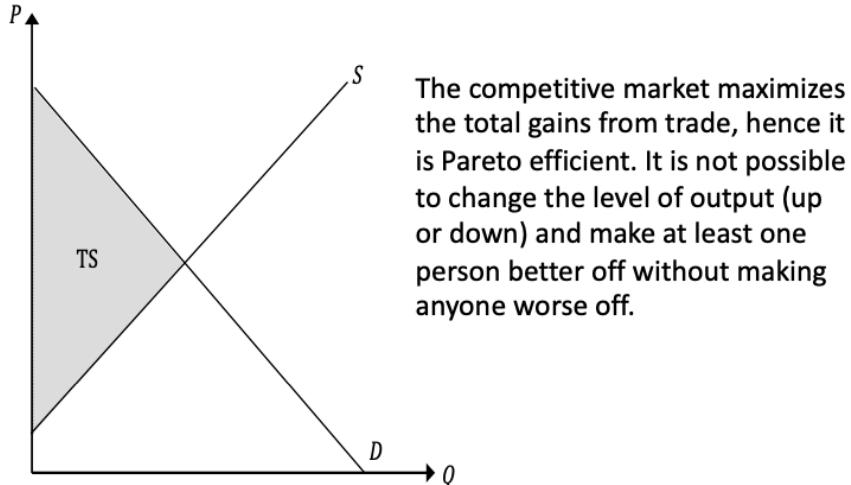
## Total Surplus

- The total welfare of all participants in the market is the sum of CS and PS:  $TS = CS + PS$ .
- This assume there are only two types of participants (consumers and producers) → governments factor in later.



## Pareto Efficiency

- Pareto efficient if it is not possible to make someone better off without making someone else worse off.
  - Conversely, an outcome is not Pareto efficient if it is possible to reallocate resources (or do things differently in the market) and make someone better off without making someone else worse off.
- It maximises total surplus.



- The outcome in a competitive market is Pareto efficient:
  - For all trades up to the competitive market equilibrium,  $MB \geq MC$ .
  - The consumer is willing to pay more than the extra cost required to make the item.
  - Trading all units up until  $Q^*$  increases total surplus as it increases CS, PS or both.
- If fewer than  $Q^*$  units are traded, this is not Pareto efficient because it is possible to increase the number of units traded in order to make the consumer and/or the producer better off, without making anyone worse off.
- If more than  $Q^*$  units are traded, we know that  $MC > MB$ . All units traded beyond  $Q^*$  make someone worse off: either the buyer paid more than his MB, the seller received a price less than their MC, or both → total surplus would rise if output were reduced back to  $Q^*$ .

## Competitive Market Outcome and Efficiency

- 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.
  - Importantly, the price mechanism ensures that the people with the highest value for the product end up with the goods, and those firms with the lowest cost are the ones who make the goods.
  - While these actions are completely decentralised, in the sense that no one person coordinates the actions of the many parties in the market, a competitive market manages to maximise total surplus/reach a Pareto efficient outcome.

## Caveat Regarding Pareto Efficiency

- Pareto efficiency has a very strict and specialised definition. It does not imply either uniqueness or fairness/equity.

- It is possible that there is more than one market outcome in an economy that is Pareto efficient (unclear which one is best).
- A Pareto efficient outcome is not automatically the most fair or equitable, or desirable.

## Concluding Comments

- A competitive market has the following characteristics:
  - via the price mechanism, it allocates goods to consumers who value them most highly; and
  - via the price mechanism, it allocates demand for goods to sellers who can produce at the least cost.
  - a competitive market maximises total surplus and, hence, is Pareto efficient. It follows that a person who can dictate the price and quantity of a good traded in the market (a 'social planner') cannot achieve an outcome that is more efficient than the free (competitive) market.

## Lecture 4 – Elasticity, Perfect Competition

### Elasticity

- Elasticity is the responsiveness of one variable to a change in another variable.
  - Elasticity is a way we can compare quantitative changes across different situations by looking at proportional (or percentage) changes.
  - Useful for business interested in the effect of a price change, or for governments and changes as a result of specific policy changes.
- We can calculate elasticity with the following equation, where  $y$  is the quantity and  $x$  is the price.

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

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

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

- It is not always obvious how to determine the proportional change in a particular variable. Two classic methods are the point method, using initial values, and the midpoint (arc) method, that uses the averages of the initial and final points.

### Point Method

- We are often interested in the elasticity around a particular outcome e.g. elasticity around the point  $(Q_1, P_1)$ . We are often given the slope of the line at this point – if not, it can be simply calculated.

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

### Midpoint (or Arc) Method

- Sometimes, we are interested in elasticity when moving from one point to another. It is unclear in this situation whether we should measure the change in price as a percentage of  $P_1$  or  $P_2$ .
- To resolve this ambiguity, we adopt the midpoint or arc method: to calculate the proportional changes, use the average of  $P$  and  $Q$ .

$$\epsilon = \frac{\Delta y / y^m}{\Delta x / x^m} = \frac{\Delta y}{\Delta x} \cdot \frac{x^m}{y^m} \quad y^m = \frac{y_1 + y_2}{2} \text{ and } x^m = \frac{x_1 + x_2}{2}$$

where

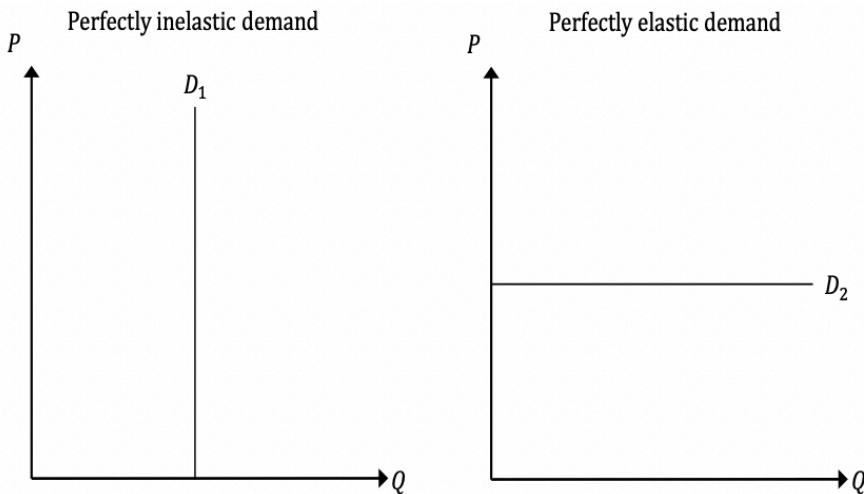
### Interpretation of the Price Elasticity of Demand

- The price elasticity of demand measures how sensitive the quantity demanded of a good ( $Q_d$ ) is to changes in price ( $P$ ), where price is  $x$ , and quantity is  $y$ .
- It is proportional change in quantity demanded of a good, given a 1% change in its price.

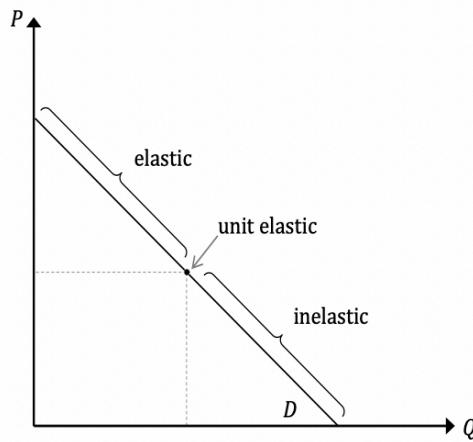
- Given the law of demand, the elasticity of demand will normally be negative – some authors find it convenient to drop the minus sign when reporting the elasticity of demand, treating it as implicit.

- If  $\epsilon_d = 0$ , demand is *perfectly inelastic*.
  - For a 1% change in price, there is no change in the quantity demanded.
  - Quantity demanded is not at all responsive to changes in price. The demand curve is vertical. Example?
- If  $-1 < \epsilon_d < 0$ , demand is *inelastic*.
  - For a 1% change in price, the resulting change in quantity demanded is less than 1%.
  - Quantity demanded is not very responsive to changes in price.
- If  $\epsilon_d = -1$ , demand is *unit elastic*.
  - For a 1% change in price, there is a 1% change in quantity demanded (a proportional change).
- $\epsilon_d < -1$ , demand is *elastic*.
  - A 1% change in price results in a change in quantity demanded larger than 1%; quantity demanded is very responsive to price.
- If  $\epsilon_d = -\infty$ , demand is *perfectly elastic*.
  - For a small increase in price, quantity demanded will drop to zero.
  - If a firm raises its price at all, its customers will go elsewhere to buy the product.

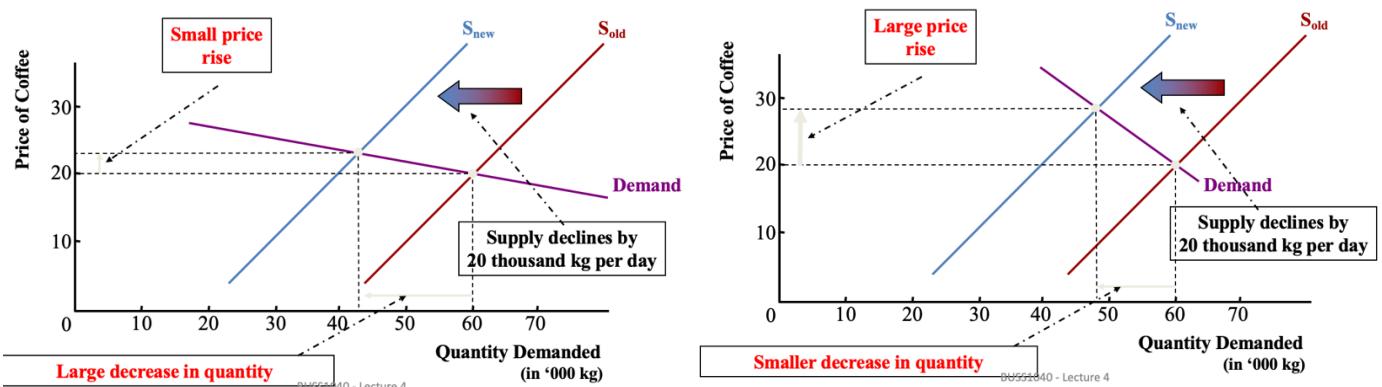
Demand is horizontal. Example?



- The price elasticity of demand depends on the slope of the line, but also the reference point on the curve used to calculate elasticity. The price elasticity of demand changes along a linear (straight-line) demand curve.
  - 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 at a particular point.
  - For every linear demand curve, there is an inelastic section (when quantity is high, and price is low); a point that is unit elastic (in the middle of the demand curve); an elastic section (when quantity is relatively low, and the price is relatively high).



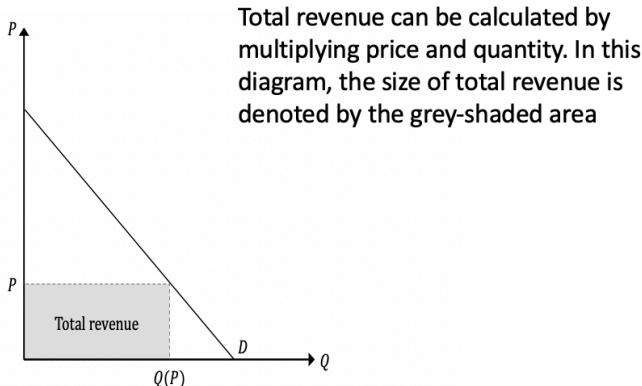
- Using the price elasticity of demand, we can evaluate the expected effect on price and quantity of a change in supply, including its direction, amount and effect on revenue.



## Elasticity and Revenue

- We can determine from the elasticity of demand how total revenue in the market will change as price changes.
  - As we know from the demand curve, the quantity demanded in the market ( $q$ ) depends upon the market price ( $P$ ). This means that we can write the quantity demanded as a function of price  $q(P)$ .

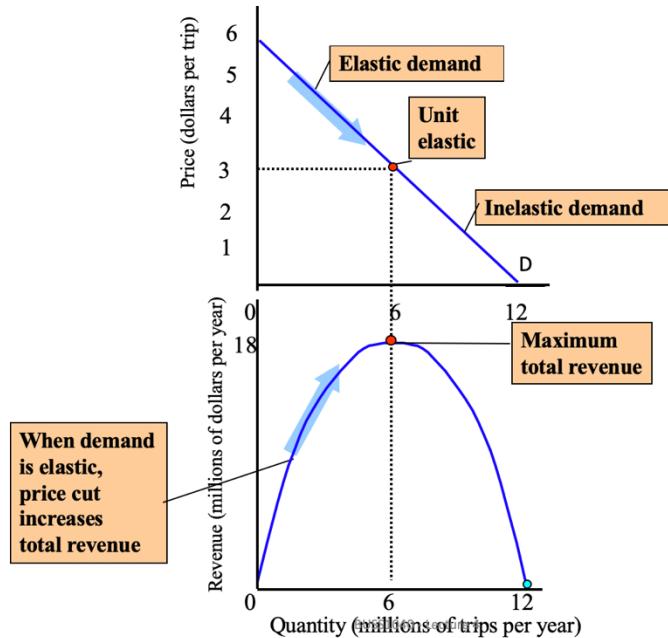
Total revenue is thus:  $TR(P) = P \cdot q(P)$



- We can differentiate the equation with respect to  $P$  in order to determine how total revenue changes in response to a small increase in price:

$$\frac{dTR}{dP} = q + P \cdot \frac{dq}{dP} \quad \text{i.e. } \frac{dTR}{dP} = q \left( 1 + \frac{P}{q} \cdot \frac{dq}{dP} \right) = q \left( 1 + \varepsilon_d \right)$$

- This equation provides a direct link between the price elasticity of demand and the change in total revenue.
- In order for total revenue to increase with a price increase, the right-hand side of the equation must be positive.
  - True if and only if  $\epsilon_d > -1$  – the demand is inelastic.
  - If demand is elastic ( $\epsilon_d < -1$ ), TR will fall when the market price rises.
- On the elastic part of the demand curve (the upper part), the price needs to be lowered in order to increase total revenue. On the inelastic part of the demand curve (the lower part), the price needs to be raised in order to increase revenue.
- Total revenue is maximised when demand is unit-elastic, in the middle of the demand curve.



- The intuition of the result is:
  - if the demand is elastic, a 1% increase in price will cause a greater than 1% fall in the quantity demanded. This means that the increase in P is more than offset by the decrease in  $Q_d$ , causing TR to fall overall.
  - if the demand is inelastic, a 1% increase in price will cause a less than 1% fall in the quantity demanded. This means that the increase in P is outweighs the decrease in  $Q_d$ , causing TR to increase overall.

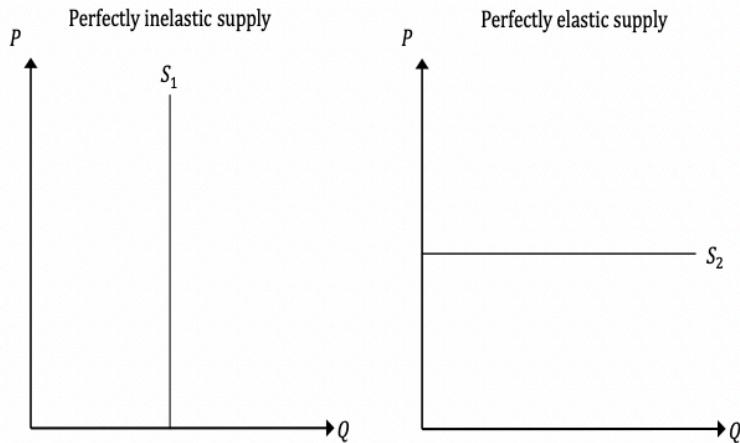
## Elasticity of Supply

- Elasticity of supply  $\epsilon_s$  measures how sensitive the quantity supplied of a good ( $q_s$ ) is to changes in the price (P) → what is the proportional change in quantity supplied of a good, given a 1% change in its price.
- The midpoint and point method for elasticity of supply are as follows:

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

- The elasticity of supply is typically positive, due to the law of supply.
  - If  $\epsilon_s = 0$ , supply is perfectly inelastic - for a 1% change in price, there is no change in the quantity supplied; the supply curve is vertical.

- If  $0 < \epsilon_s < 1$ , supply is inelastic - for a 1% change in price, the change in quantity supplied is less than 1%. The quantity supplied is not very responsive to changes in price.
  - If  $\epsilon_s = 1$ , supply is unit elastic - for a 1% change in price, there is a 1% change in the quantity supplied – the quantity supplied changes by the same proportion as the price.
  - If  $\epsilon_s > 1$ , supply is elastic - for a 1% change in price, the change in quantity supplied is more than 1% - the quantity supplied is relatively responsive to changes in price.
  - If  $\epsilon_s = \infty$ , supply is perfectly elastic – for a small decrease in price, quantity supplied will drop to zero – if the price of a good falls at all below a certain price, firms will stop supplying the product.
- The supply curve is horizontal.



## Cross-Price Elasticity

- Sometimes we are interested in the relationship between the demand for one good and the price of another related good.
  - Multi-brand product management for business: how easily do consumers switch between different brands when the price of 1 brand of product changes?
  - Impact of taxes on consumer behaviour: how do consumers substitute towards other alcoholic drinks after imposition of alco-pop tax.
- This relationship can be examined using the cross-price elasticity. This measures how sensitive the demand for Good A is to changes in the price of Good B.

$$\epsilon_{AB} = \frac{\Delta Q_A / Q_A}{\Delta P_B / P_B} = \frac{dQ_A}{dP_B} \cdot \frac{P_B}{Q_A} \quad \text{for point method}$$

$$\epsilon_{AB} = \frac{\Delta Q_A / Q_A^M}{\Delta P_B / P_B^M} \quad \text{for midpoint method}$$

- If  $\epsilon_{AB} < 0$ , an increase in the price of Good B is associated with a fall in the demand for Good A (at any given price of Good A). This means that the goods are complements i.e. goods that are likely to be consumed together.

- If  $\epsilon_{AB} > 0$ , an increase in the price of Good B is associated with a rise in the demand for Good A (at any given price of Good A). Goods A and B are substitutes.
- If  $\epsilon_{AB} = 0$ , an increase in the price of Good B is not associated with any change in the demand for Good A (at any given price of Good A) – they are independent goods.

## Income Elasticity

- The demand for a good may also depend on a consumer's income.
- **Income elasticity ( $\eta$ )** measures how sensitive the demand for a good ( $Q$ ) is to changes in income ( $Y$ ).

$$\eta = \frac{\Delta Q / Q}{\Delta Y / Y} = \frac{dQ}{dY} \cdot \frac{Y}{Q} \quad \text{for point elasticity formula}$$

$$\eta = \frac{\Delta Q / Q^M}{\Delta Y / Y^M} \quad \text{for midpoint formula}$$

- We characterise the good depending on its income elasticity.
  - If  $\eta < 0$ , demand decreases when income rises. This is called an inferior good e.g. consumers may substitute away from inferior cuts of meat as income rises.
  - If  $\eta = 0$ , demand is invariant to changes in income; this is a neutral good.
  - When  $0 < \eta \leq 1$ , if income rises by 1%, demand for the good increases by not more than 1%; this is a normal good.
  - If  $\eta > 1$ , when income rises by 1%, demand for the good increases by more than 1%; this is a luxury good.

## Perfect Competition

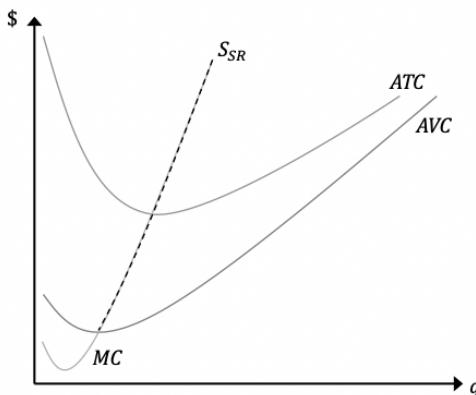
- Perfectly competitive markets have the following characteristics:
  - Many buyers and sellers. All buyers and sellers are a very small part of the total market.
  - Homogeneous products. Consumers are indifferent as to who they purchase from. All firms have access to the same technology.
  - Price taker. No individual buyer or seller has sufficient market power to influence market prices.
  - Free entry and exit. Firms can freely enter and exit the market in the long run – no barriers to entry.

## The Supply Curve in Perfect Competition

### Supply in the Short Run

- 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 chooses not to produce output in the short run ( $q=0$ ), we say that the firm shuts down.

- In the short run, the firm should only take into account its variable costs, as its fixed costs are sunk. Hence, we can derive the shut-down condition that a firm will shut down in the short run if total revenue is less than variable cost:  $TR < VC$ .
- We can also divide shutdown by the level of output  $q$  to yield  $TR/q < VC/q$ , or that  $P < AVC$ .
- If a firm does produce a positive output, it chooses the level of output in accordance with its supply curve – its MC curve.
- Remember that the MC curve intersects the AVC curve at its minimum. The shut-down rule for a competitive firm:  $P < AVC_{MIN}$ . Anything greater or equal to  $AVC_{MIN}$  will supply a positive quantity → a firm's short-run supply curve is the MC curve that lies above  $AVC_{MIN}$ .

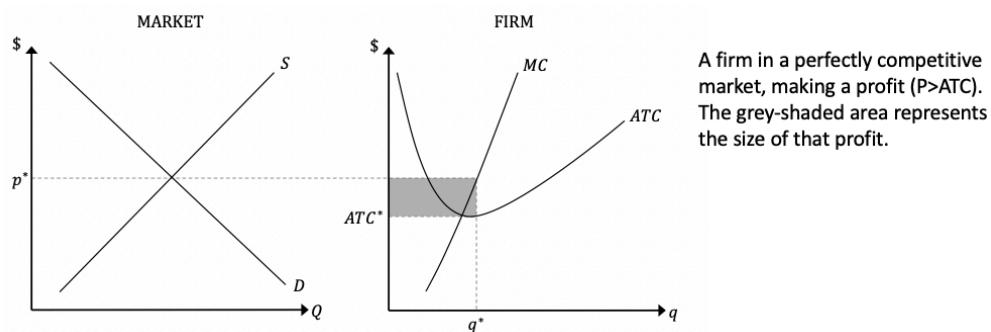


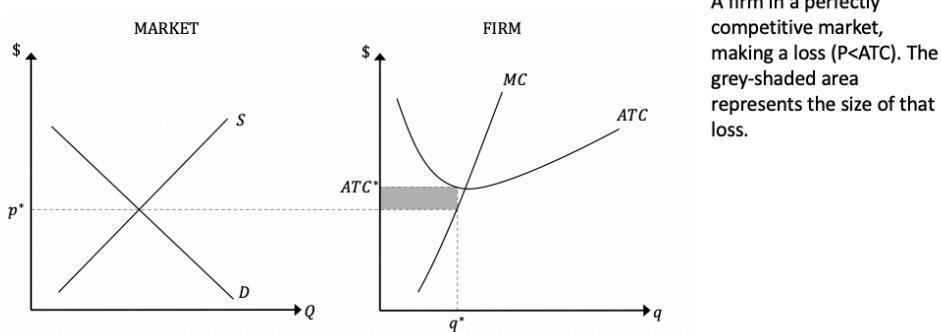
### Market Supply in the Short Run

- 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 it wishes to produce nothing, it shuts down). No new firms can enter in the short run.
- The number of firms in the market is fixed in the short run. The short-run market supply results from the horizontal summation of the individual firms' supply curves.

### Profits 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,  $TR < TC$  i.e.  $P < ATC$ .
  - If a firm is making profits,  $TR > TC$  i.e.  $P > ATC$ . The difference between  $P$  and  $ATC$  at the quantity supplied is the average profit or loss a firm is making.
- A firm is willing to continue to sell in the short run when making a loss provided  $P > AVC_{MIN}$ .
  - The firm is better off than shutting down because the extra revenue in excess of variable costs helps pay for some of the fixed costs.





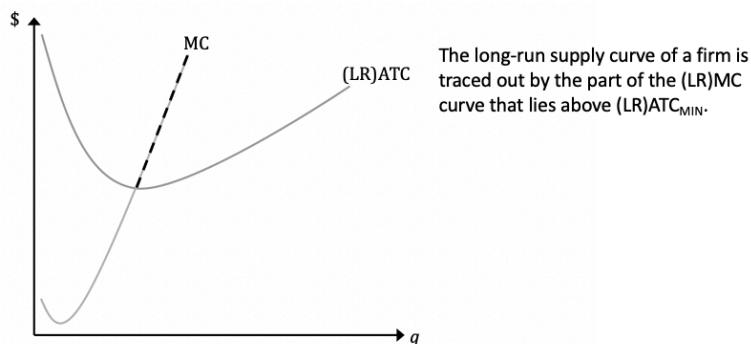
A firm in a perfectly competitive market, making a loss ( $P < ATC$ ). The grey-shaded area represents the size of that loss.

## Supply in the Long Run

- In the long run, all production factors are variable → firms can exit a market/industry, new firms can start operating in a market.
- There is free entry and exit of firms in the market – all costs are opportunity costs (no sunk costs); 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. This market will reach its long run equilibrium when there is no longer any entry into or exit from the market – occurs when firms are making zero profits.

### Firm Supply: The Entry/Exit Decision

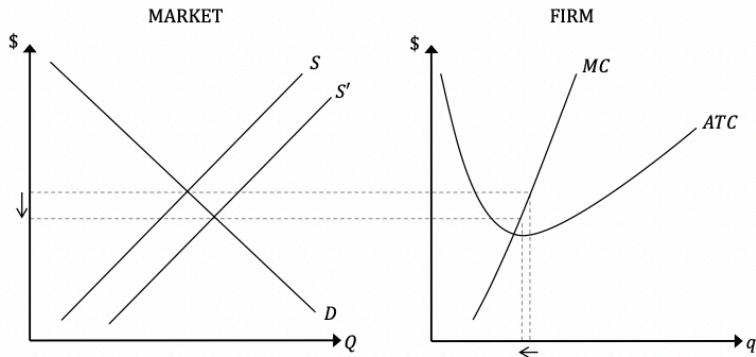
- With free entry and exit in the long run, if a firm chooses to exit, it will incur no costs unlike the FC incurred in the short run. A firm will choose to exit the market if its total revenue is less than its total costs:  $P < ATC_{MIN}$ .
- A firm's long-run supply curve is the section of its long-run MC that lies above the LR  $ATC_{MIN}$ .



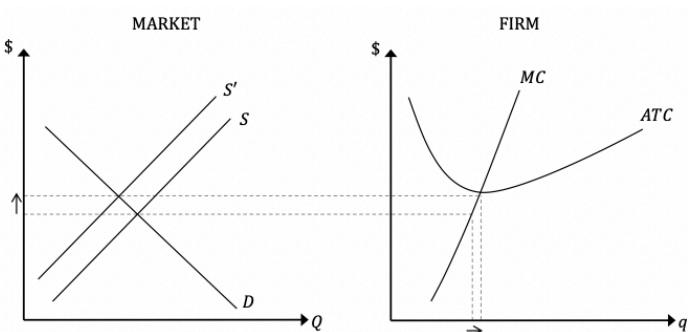
The long-run supply curve of a firm is traced out by the part of the (LR)MC curve that lies above (LR)ATC<sub>MIN</sub>.

### Elimination of Profits and Losses

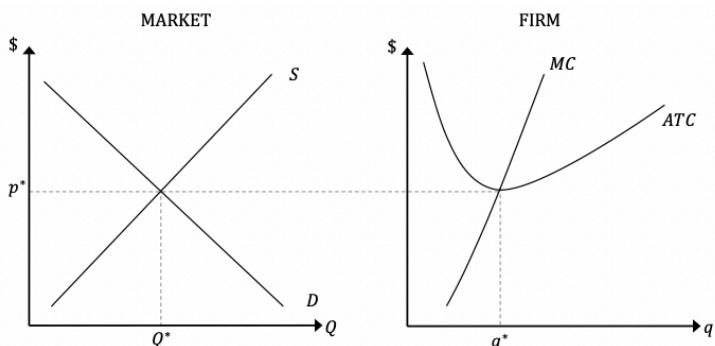
- In the long run, firms can enter or exit depending on whether they are going to make a profit or loss. When firms in the market are profitable ( $P > ATC_{MIN}$ ) firms will want to enter the market.
- The entry of more firms into the market will progressively shift the short-run market supply curve to the right, driving the equilibrium price downwards.
- 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 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.

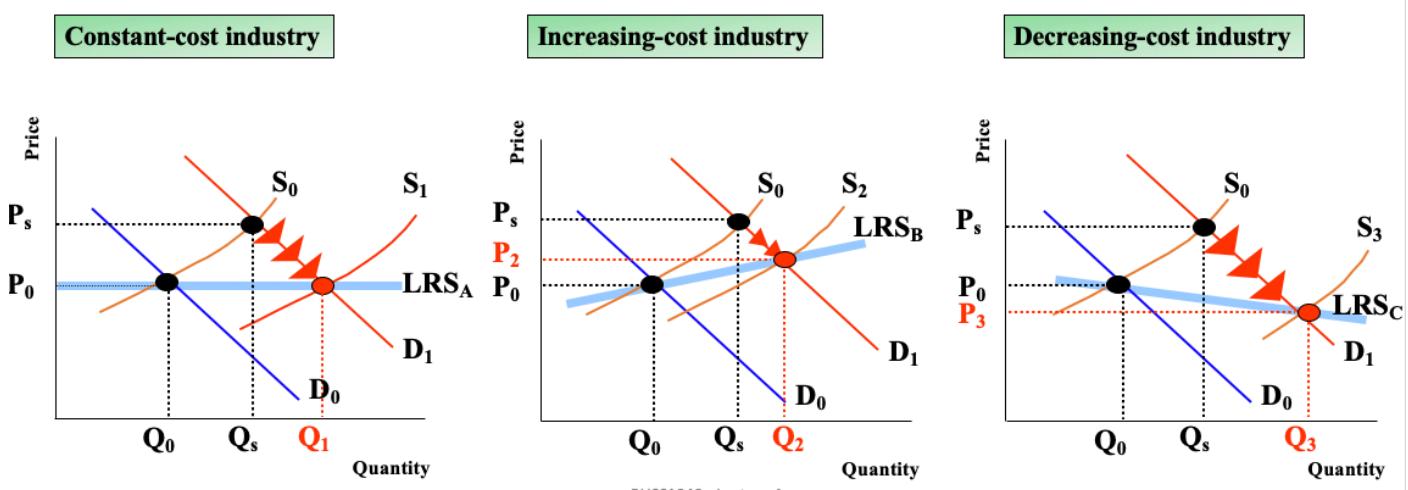


When the market price is below average total cost, firms in the market make a loss. This encourages exit, shifting the supply curve left from  $S$  to  $S'$  (decrease in supply), causing price to rise.



In the long run, there are zero profits in a perfectly competitive market. This requires  $p = ATC_{MIN}$ . Because there are zero profits, there is no incentive for any further exit or entry. The long-run equilibrium price is  $p^*$ , the quantity traded in the market is  $Q^*$  and the output of a firm is  $q^*$ .

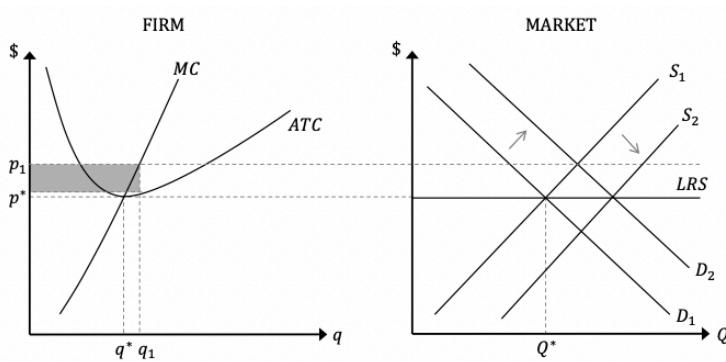
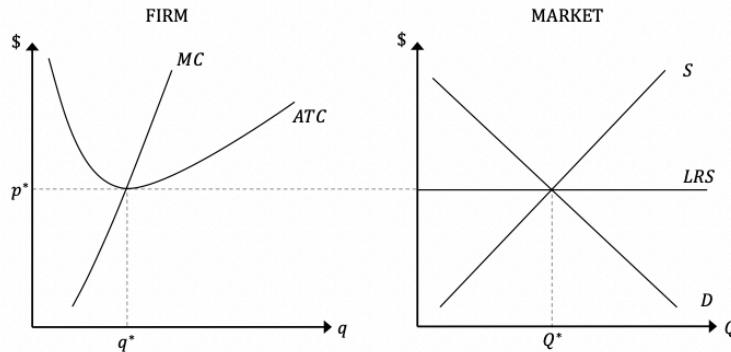
## Market Supply Curve in the Long Run



### Constant-Cost Industry

- 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.

- In the long run, price adjusts back to the minimum of ATC, no matter what the quantity traded in the market is. Taking account of exit/entry, the long-run industry supply curve is horizontal at  $ATC_{MIN}$ .
- An industry with a perfectly elastic long-run industry supply curve is a constant-cost industry. Unless otherwise stated, a competitive industry is assumed to be a constant-cost industry.

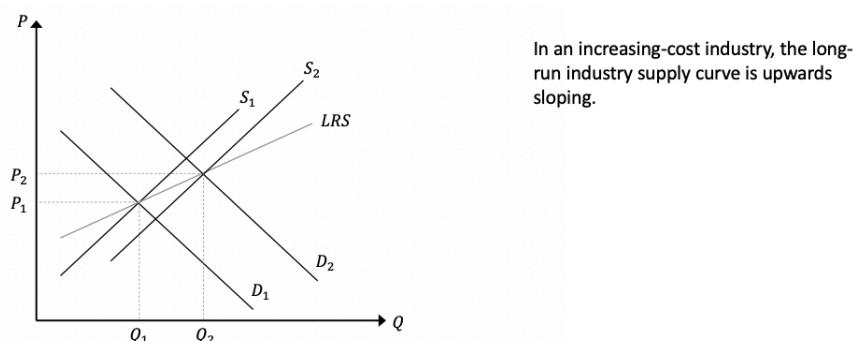


Following an unanticipated increase in demand, in the short run price rises and firms in the industry increase output ( $q_1$ ) and make positive economic profits. However, in the long run, entry forces prices back down to the  $p^* = ATC_{min}$ . Each firm again sells  $q^*$  units and economic profits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

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

### Increasing Cost Industry

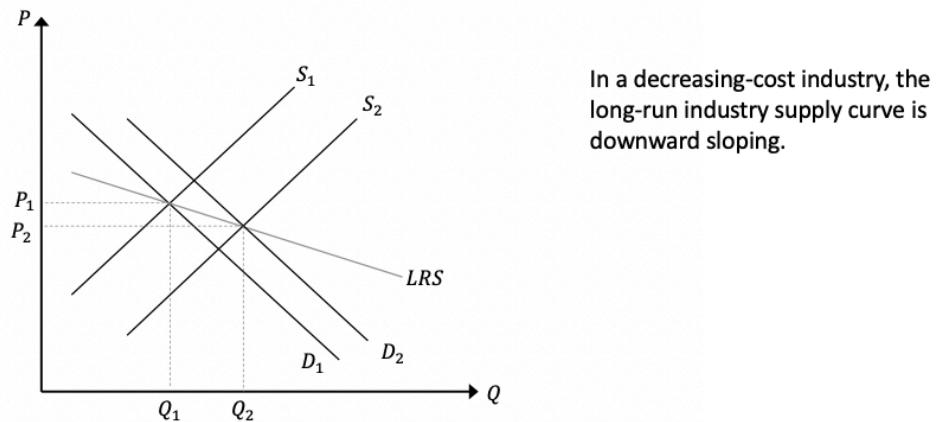
- In a constant-cost industry, entry and exit in the long run ensures that all firms earn zero profits and the price is  $P^* = ATC_{MIN}$ .
- This assumes that all firms have access to the same technology and have the same cost structure, and this cost structure does not change as the industry grows.
- The long-run industry supply curve need not be perfectly elastic. The long-run supply curve can be upward sloping; this is known as an increasing cost industry.
  - If potential entrants have higher costs than the incumbent costs.
  - Some resources used in production may be available only in limited quantities (input prices rise as industry expands), thus costs for all firms rise.
  - Congestion may rise with industry output e.g. airlines.



In an increasing-cost industry, the long-run industry supply curve is upwards sloping.

## 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.
- If this is the case, 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, the long-run industry supply curve is downward sloping – this is a decreasing cost industry.



# Lecture 5 – Monopoly and Market Power I

## Monopoly

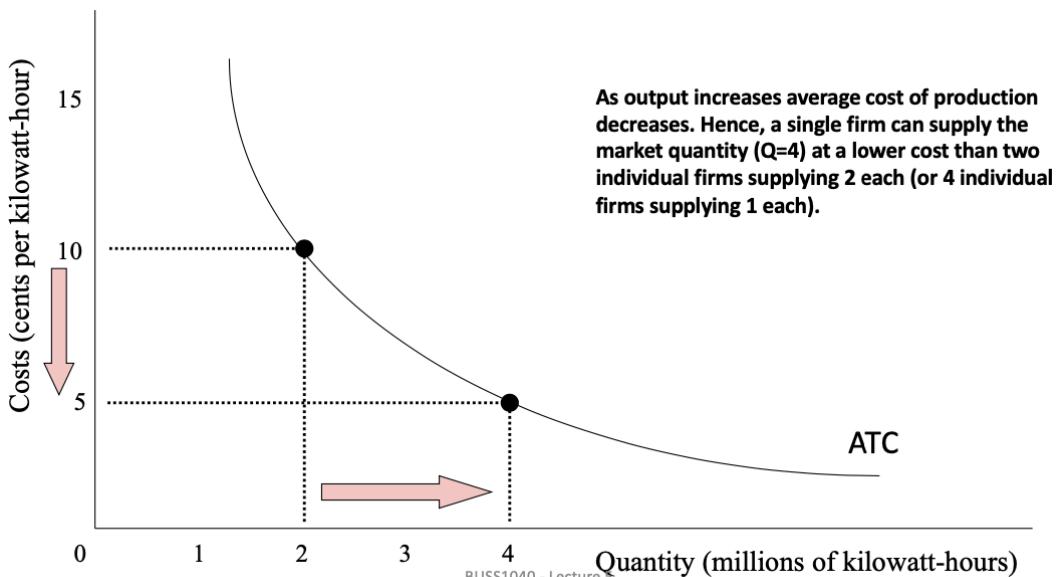
- A market with a single seller is a monopoly and that seller is a monopolist (many buyers).
- Because the monopolist is the only firm in the market, it has market power to determine the price in the market – that is, it is a price maker.
- Barriers to entry to potential entrants (cost that must be incurred by a new entrant in the market that incumbents do not bear). There 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):
  - Legal Barriers to Entry: exclusive right over a goods production (patent, copyright), public franchise (Australia Post), government licences (taxis, practice of medicine).
  - Natural Barriers to Entry:
    - Control over an essential input not available to other firms (BHP and natural gas fields in Victoria – know how, distribution network).
    - May simply be lower cost of production that effectively allows them to prevent other firms from entering the market e.g. favourable access to raw materials, geographic location, learning curve advantages.
    - Technology/level of demand make one producer more efficient than a number of producers.

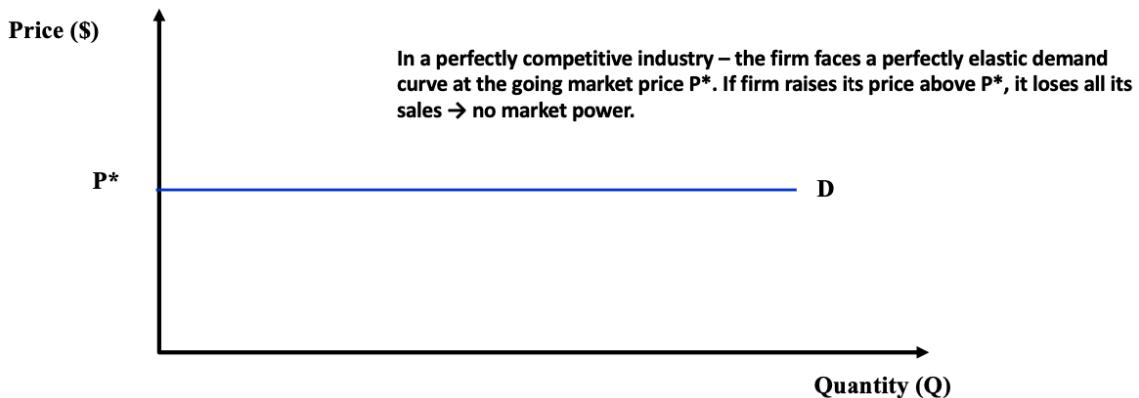
## Natural Monopoly

- 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 e.g. telecommunications network, water provision, electricity transmission.
  - Declining LT 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.

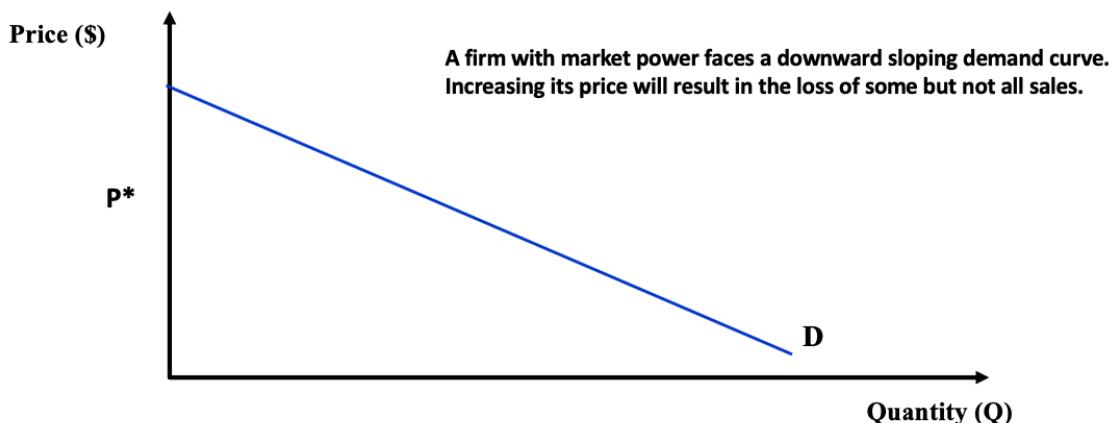


## Market Power

- A monopoly is an industry comprised of a single firm, with 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.



- This is compared to a firm that has LOW price elasticity of demand for its output which 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.



- Market power exists not only for monopolists , but whenever there is imperfect competition in the market e.g. firm in a monopolistically competitive market, oligopoly.

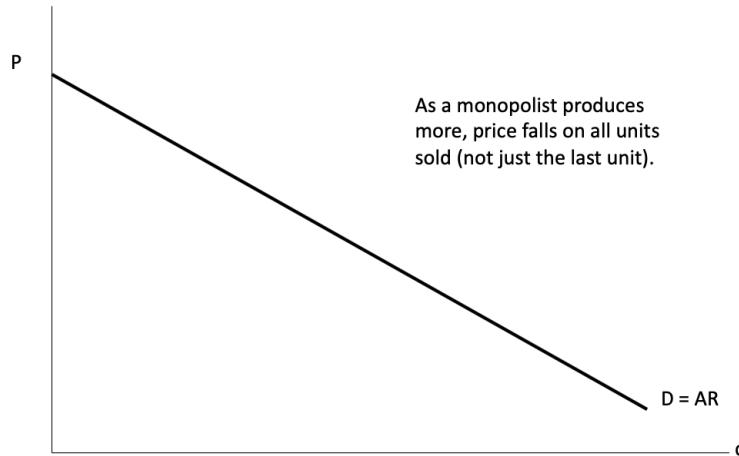
## Monopoly Pricing Strategies

- A single-price monopolist is a firm that must sell each unit of output for the same price (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 – they set a variety of prices to maximise profits.

### Single-Price Monopolist

- We examine a monopolist who charges the same price to all of its consumers. As the monopolist is the sole producer, it faces all the demand in the market.  
→ Face a downward-sloping market demand curve.

- Firm has market power (or monopoly power) – it can raise the price and not have the quantity demanded drop to zero.
- Monopolist has to choose the price (or the quantity it wants to sell).
- A monopolist can alter the price in the market by changing quantity.
  - If it increases output by one unit, the price will fall by some amount. This causes a trade-off for the monopolist: sell less quantity for a higher price, or sell more quantity for a lower price.



## Monopolist and Marginal Revenue

- Marginal revenues (MR) is the additional revenue that the firm receives from selling one extra unit of a good.
- For a monopolist, the marginal revenue incorporates two effects:
  - i) output effect: as you sell more units, you obtain extra revenue from the additional units sold; and
  - ii) 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.

Quantity	Price	Total revenue	Average revenue	Marginal revenue
Q	P	$TR=PxQ$	$AR=TR/Q$	$MR=\Delta TR/\Delta Q$
0	\$11	\$ 0	—	—
1	10	10	\$10	\$10
2	9	18	9	8
3	8	24	8	6
4	7	28	7	4
5	6	30	6	2
6	5	30	5	0
7	4	28	4	-2
8	3	24	3	-4

↓  
demand curve!

average revenue is  
just the price!

Note that MR is  
decreasing.  
And  $MR < P = AR$

## Deriving MR from Monopolist's Demand Curve

- MR is the change in total revenue when the firm sells one more unit. Can be obtained by differentiating TR with respect to q.

$$MR = \frac{dTR}{dq}$$

- Consider when the demand curve is linear and given by:

$$P = a - bq \quad (\text{inverse D-curve; where } a \text{ and } b \text{ are constants})$$

hence  $AR = a - bq$

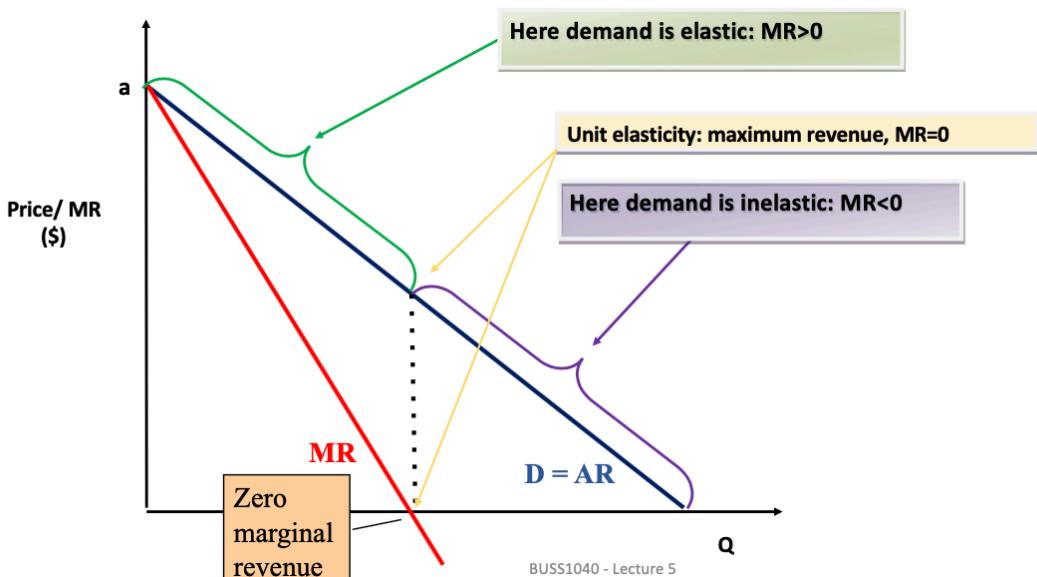
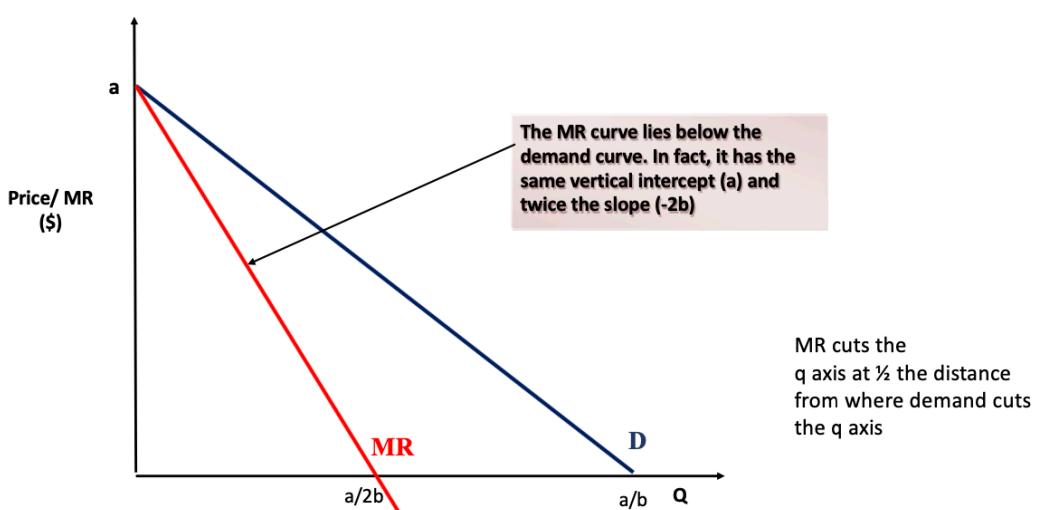
$$TR = P(q)*q = (a - bq)*q$$

$$= (aq - bq^2)$$

- So:

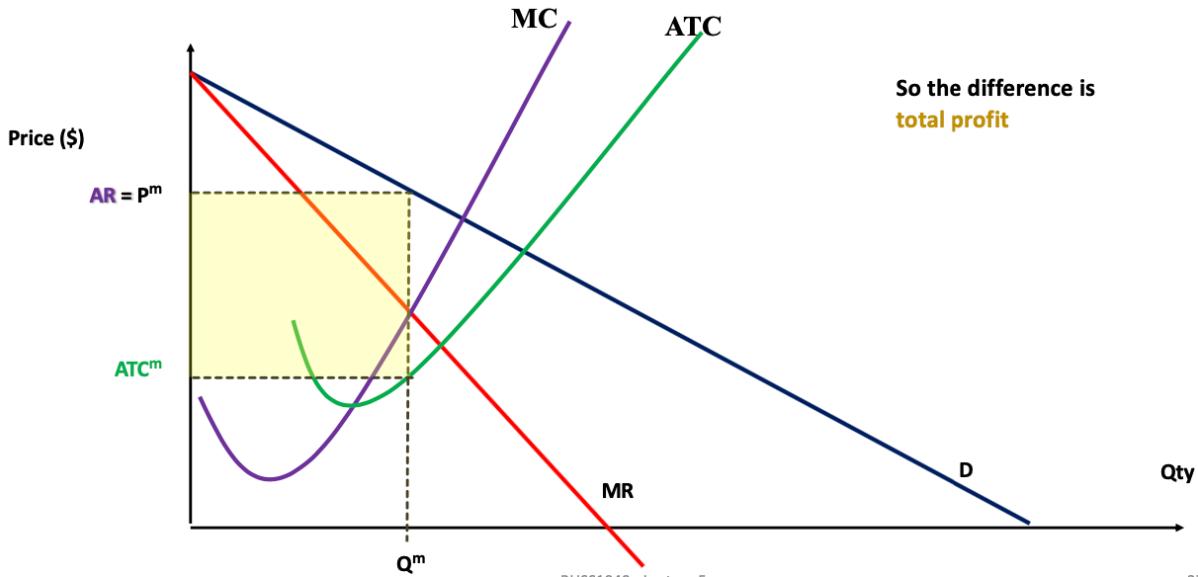
$$MR = \frac{dTR}{dq} = a - 2bq$$

- For example, if  $P = 100 - 2q$ , then  $MR = 100 - 4q$ .
- Note two things about MR when the demand is a straight line:
  - MR has the same vertical intercept as the demand curve at  $a$ .
  - MR is linear and has twice the slope of the demand curve: the MR curve has a slope of  $-2b$ , whereas the demand curve has a slope of  $-b$ .
- This is a rule you can choose to remember (or derive it as above).



## Monopoly and Profit Maximisation

- Profits will be maximised when a monopolist sets MR equal to MC:  $MR = MC$ .
  - 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 that it would be better off from not selling that unit.
- For a competitive firm:  $P = MR = MC$ .
- For a monopolist:  $P > MR = MC$ .
- This means that for a single-price monopoly,  $P > MC$  at the optimal quantity supplied (which competitive firms produce until  $P = MC$ ).



1. First consider the demand curve and the associated MR curve.
2. Add in the MC and ATC curves.
3. Identify the quantity where  $MC = MR$ . Call with  $Q_m$ .
4. Now identify the price at which this quantity is.
  - The monopolist's profit is

$$\begin{aligned}\pi &= TR - TC \\ \pi &= (TR/q - TC/q)*q\end{aligned}$$

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

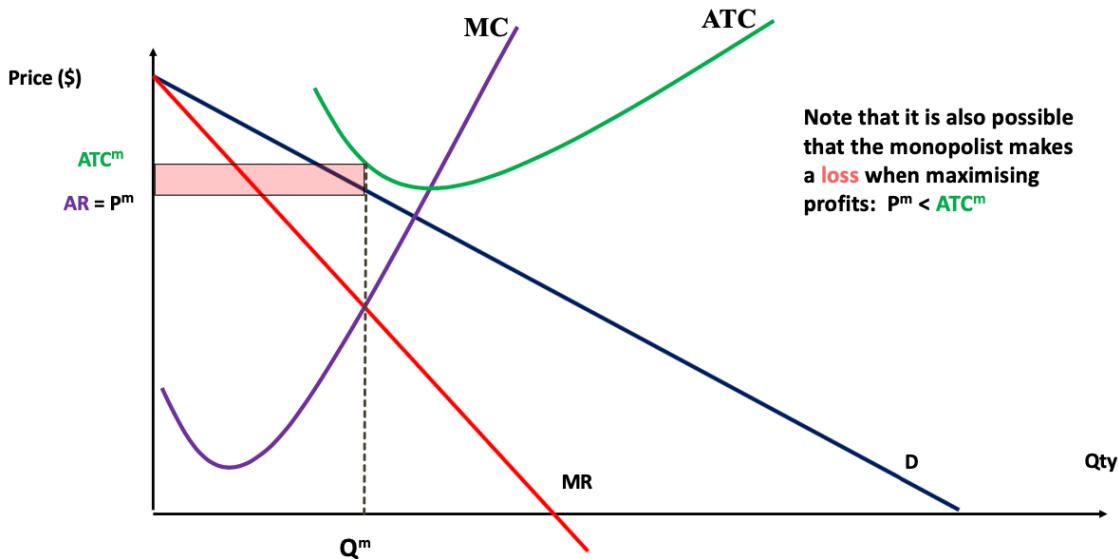
$$\begin{aligned}\pi &= (AR - ATC)*q \\ &= (P - ATC)*q\end{aligned}$$

- $(P - ATC)$  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

5. Now we can identify the monopolist's profits given AR per unit sold and ATC per unit sold.
6. The total revenue =  $AR * Q = P_m * Q_m$ .
7. The total cost is given by  $ATC * Q_m$ .

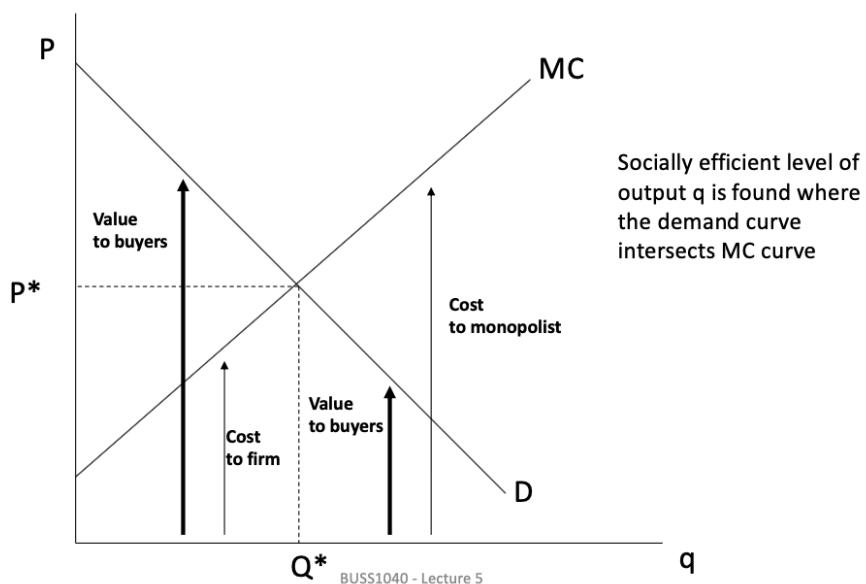
### Monopoly Operating at a Loss

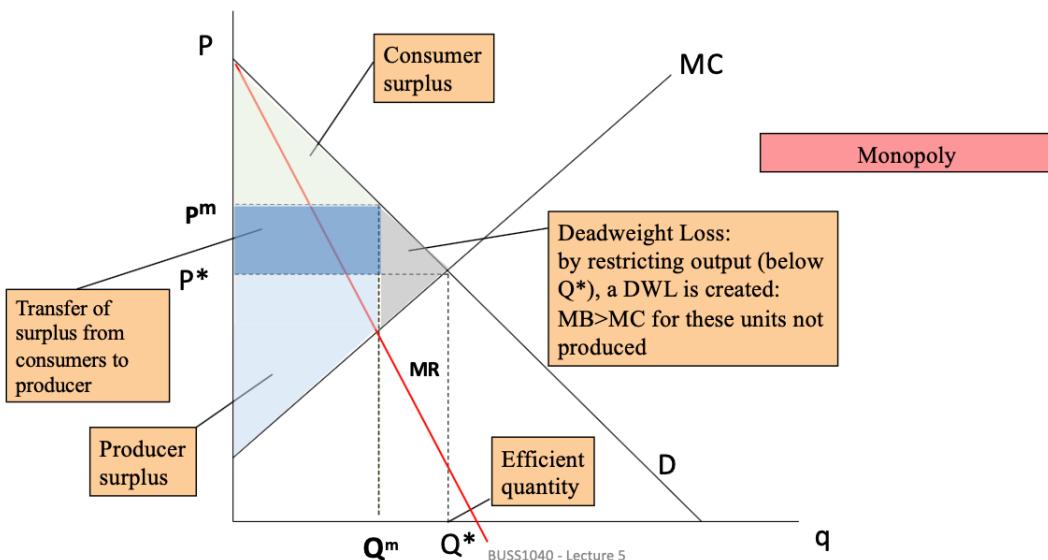
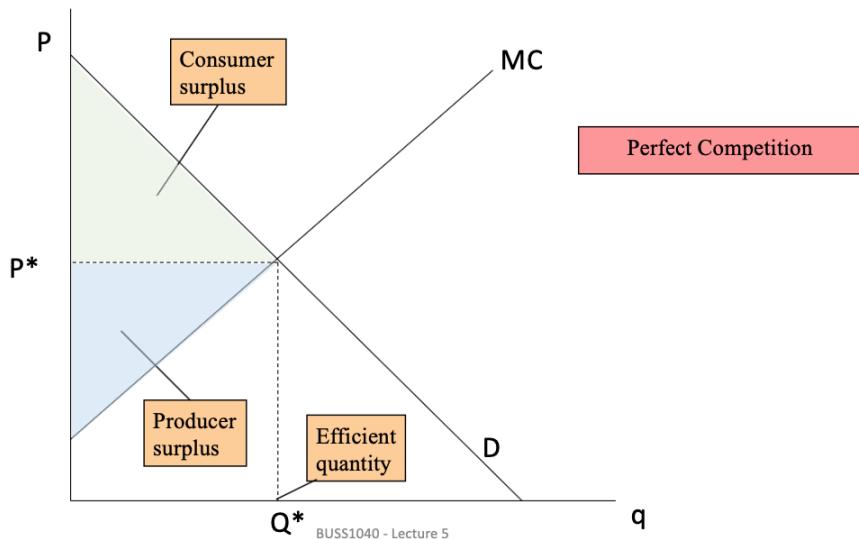
- It is also possible that the monopolist makes a loss when maximising profits. This happens when  $P_m < ATC_m$ .



## Welfare and 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 very first unit sold):  $MR < MB = P$ .
  - The monopolist thus restricts output to  $Q_m < Q^*$ , so the surplus is not maximised.
  - A monopolist's price is too high, reducing quantity demanded. Using its market power, a monopolist can create a wedge (like a tax) between consumers' WTP and the producer's costs.
  - A deadweight loss (DWL) results.





## Deadweight Loss (DWL)

- A monopoly causes a deadweight loss because it reduces output from socially efficient level (not because it earns profits per se).
  - Higher prices transfer surplus from consumers to producers.
  - Higher prices reduce output, causing DWL.
- A possible additional loss of a monopoly is rent seeking behaviour e.g. bribing politicians to maintain government monopoly.

## Summary and Example Question

### 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

- Consider a monopolist whose demand curve and marginal cost are given by the below. Calculate the monopolist's price, quantity, profit and DWL.

$$\text{Demand: } Q = 10 - \frac{P}{2}$$

$$\text{Costs: } MC = 5 + Q$$

1. Draw the demand and MC curves

2. In monopoly: monopolist produces  $Q^m$  to satisfy  $MR = MC$  (profit-maximisation)

o  $P = 20 - 2Q$ , thus  $MR = 20 - 4Q$

o Profit-maximisation:  $MR=MC$ , thus  $Q^m=3$ ,  $P^m=14$  + indicate on your figure

3. DWL of monopoly?

o = loss in welfare because of under- or overproduction relative to competitive market outcome

o Indicate DWL in figure:  $DWL = \frac{1}{2} * (P^m - MC) * (Q^* - Q^m) = 6$ . Loss in welfare because monopoly (market power) restricts output below efficient output ( $Q^*$ ).

### Alternative Method

- Profit maximisation occurs when  $MC = MR$

$$\pi(q) = q * P(q) - c(q)$$

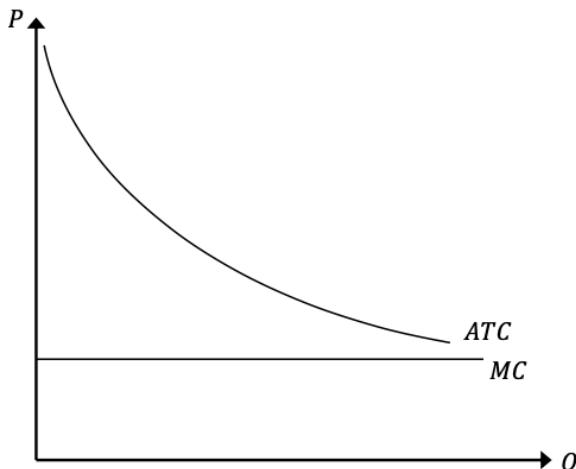
where  $P(q)$  is the demand curve and  $c(q)$  is the cost curve

$$d\pi(q)/dq = 0$$

(also check the second-order condition)

### Public Policies Towards Monopolies

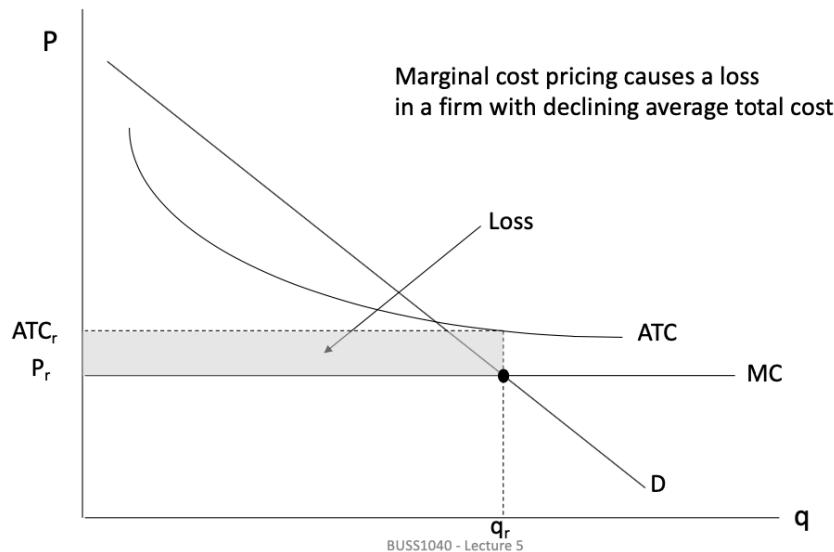
- Given that it creates a DWL, governments might try to regulate a monopoly, in order to increase competition in monopolised industries.
- Australian Competition and Consumer Commission (ACCC): cartels (price-fixing agreements), oppose mergers, misuse of market power.
- Price regulation: regulate the price of a monopolist (typically monopolist with declining ATC, a natural monopoly). Two basic forms: MC-price regulation, ATC-price regulation.



When a firm has a large fixed cost and a constant marginal cost, the average total cost curve will be downward sloping for all values of  $Q$ ; this industry will be a natural monopoly.

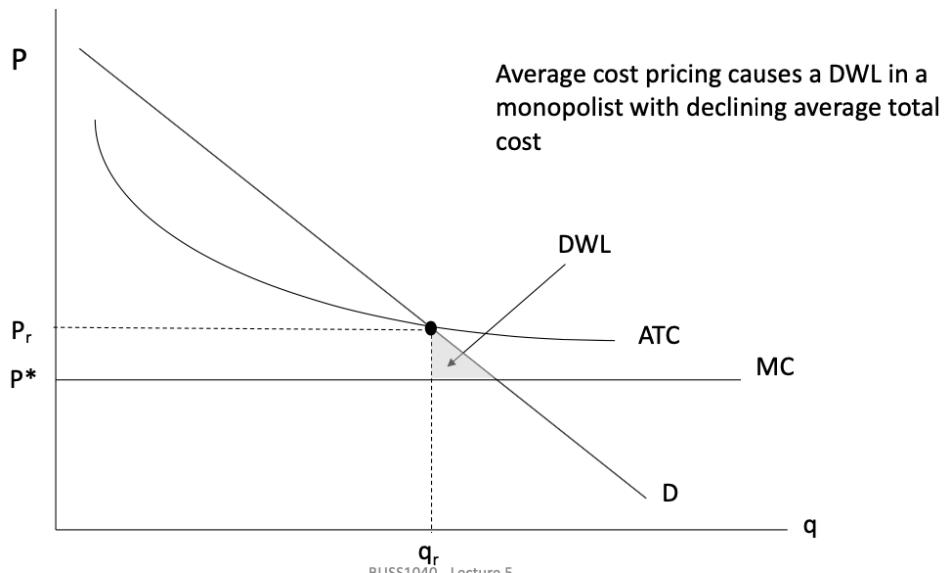
## Marginal-Cost Price Regulation

- Under marginal-cost price regulation, the government sets the monopoly price at  $P=MC$  (assuming constant MC for simplicity). This means that  $DWL = 0$ .
- 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 subsidise 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.



## 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 (it 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.



## Public Policies

- Problems with price regulations:
  - MC pricing: if a monopolist makes a loss when marginal cost pricing is enforced, a 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 – assess relative success of regulation vs ownership.
- Do nothing.

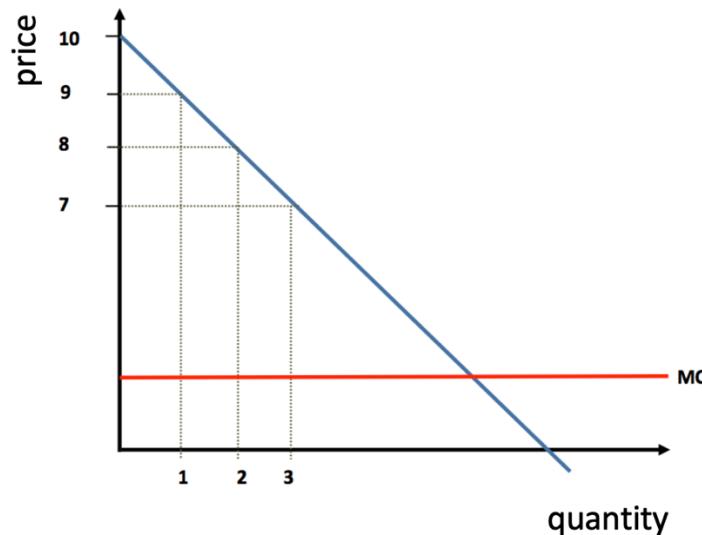
## Lecture 6 – Price Discrimination and Monopolistic Competition

### Price Discrimination

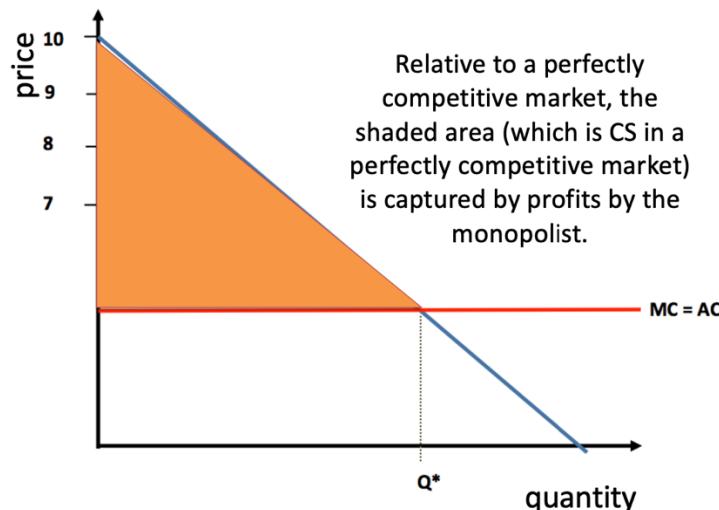
- Price discrimination is charging a different price for different units of output that are not related to the cost of production. There are three types.

### First Degree or Perfect Price Discrimination

- Monopolist charges different price for each unit sold.
- They charge the maximum willingness to pay.
- They extract all consumer surplus.
- Requires knowledge of willingness to pay for every unit consumed by every consumer.
- Alternatively, the monopolist can use a two-part tariff.



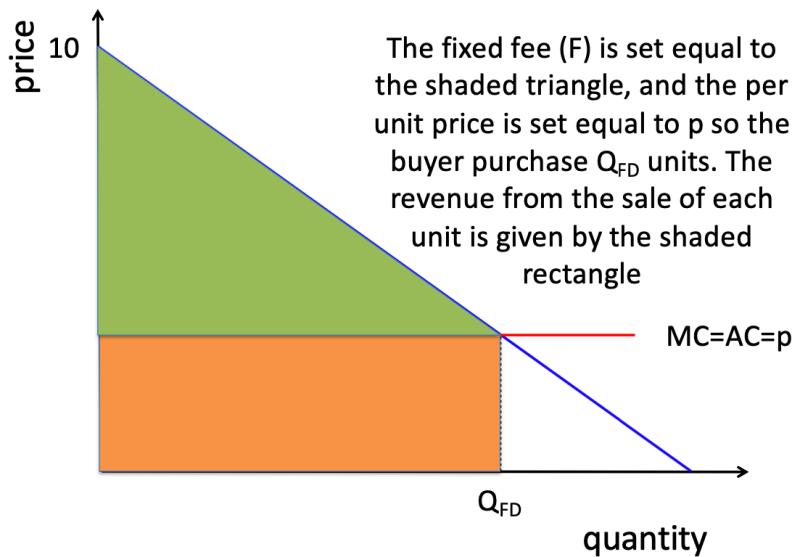
- The monopolist's MR curve when there is first degree price discrimination is the same as demand curve because the monopolist sells each unit exactly at the consumer's willingness to pay. There is NO deadweight loss.
  - The monopolist would sell the first unit for \$9, the second for \$8, the third for \$7 etc.
  - They will continue to sell units as long as  $MR > MC$ .
  - Called perfect price discrimination because the monopolist extracts all consumer surplus.
  - The knowledge of willingness to pay for every unit consumed is needed to implement this.



- There is no DWL, however, the consumer surplus that exists in a perfectly competitive market is captured by the monopolist. It is critical that the monopolist is able to prevent arbitrage.

## Two Part Tariff

- Can also be implemented using a two-part tariff consisting of:
  - a fixed fee,  $F$ .
  - a per unit fee,  $p$ .
- Consider the example that the demand curve is that for a single consumer and MC is the constant marginal cost. The monopolist sets  $p = MC$  and uses  $F$  to extract consumer surplus. It is more difficult if consumers are heterogeneous.



Consider a firm selling Ancient Spring Water sourced from the Great Artesian Basin. The demand curve faced by the firm is given by:

$$Q=240-P$$

Assume that  $AC=MC=20$ . If the firm can practice first degree price discrimination, which of the following is true?

A. The firm will earn profits of 24,200

A first degree price discriminating monopolist they will sell each unit at the buyer's willingness to pay or using a two part tariff.

That means that they will sell 220 units and earn total profit of 24,200.

Common mistake: answer it as though the monopolist was a single price monopolist and chose the point where  $MR=MC$ . For a single price monopolist the MR curve is given by  $MR = 240-2p$ .

## **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 willingness to pay of different groups.
- Need to design prices so as 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 tax for example).

- The customer chooses the version that gives them the highest consumer surplus. They are self-selecting.
- Consider the following valuations placed on the software by different types of buyers and the alternative pricing options.

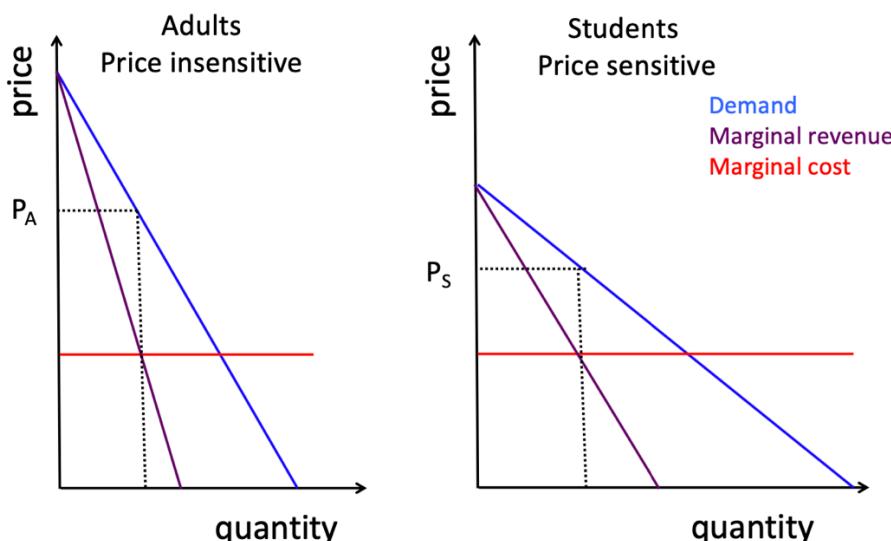
	<b>Business</b>	<b>Personal</b>
<b>Standard</b>	\$35	\$20
<b>Deluxe</b>	\$100	\$20

<b>Pricing</b>	<b>Standard sold</b>	<b>Deluxe sold</b>	<b>TR</b>
$P_D = \$100 P_S = \$20$	2	0	40
$P_D = \$84 P_S = \$20$	1	1	104
$P_D = \$86 P_S = \$20$	2	0	40
$P_D = \$100$	0	1	100
$P_S = \$20$	2	0	40

- Examples include airlines, offering business and economy tickets. Each product is differentiated, and buyers choose the type of seat that best suits them.
- Other examples include quantity discounts, hard and soft cover books. There is no need to worry about arbitrage here.

### Third Degree Price Discrimination

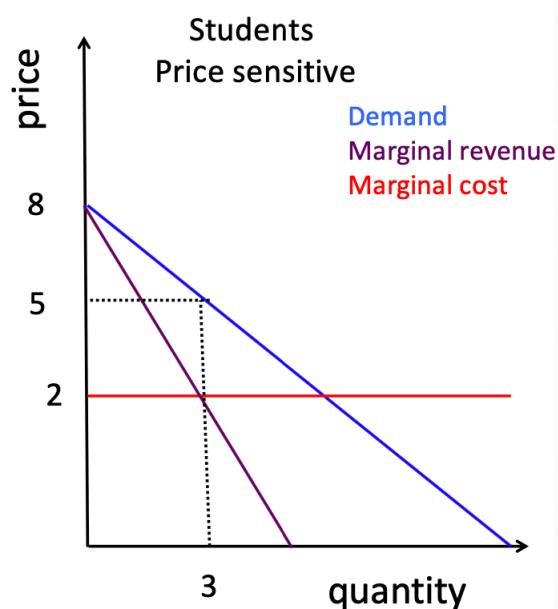
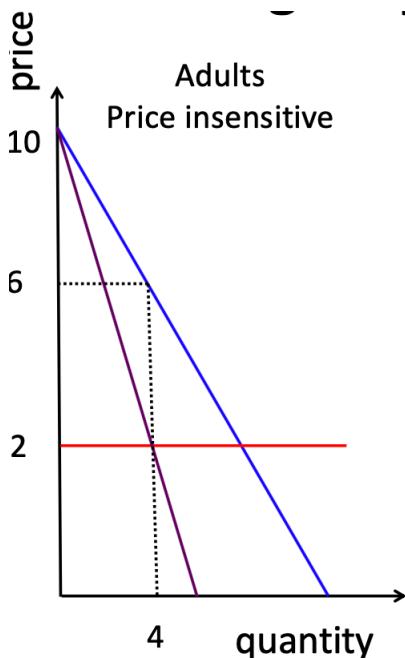
- Monopolist charges different prices to different groups of consumers.
- Monopolist must be able to distinguish between groups.
- Monopolist knows demand curve of different groups.
- Intuition is that you charge a higher price to the more inelastic segment of the market e.g. student or pensioner discounts for movies, haircuts.



- Effectively, what the monopolist wants to do is maximise profits, by acting like a monopolist in each of the separate markets → the monopolist should equate marginal cost and revenue in each of the markets in which they operate.

### Example

- How should a price discriminating monopolist set prices to maximise profit? Each demand is given by P.
  - Student
$$p_s = 8 - Q_s \rightarrow MR_s = 8 - 2Q_s$$
  - Adult
$$p_A = 10 - Q_A \rightarrow MR_A = 10 - 2Q_A$$
  - MC=2 (constant and = to AC)
  - The monopolist sets  $MR=MC$  for each consumer:
  - $MR_A = 10 - 2Q_A = 2 \rightarrow Q_A = 4 \text{ & } p_A = 6$
  - $MR_s = 8 - 2Q_s = 2 \rightarrow Q_s = 3 \text{ & } p_s = 5$
  - Total profit =  $Q_A * p_A + Q_s * p_s - AC(Q_A + Q_s) = 24 + 15 - 14 = 25$



- Classic examples include movies, public transport, haircuts and clothes. It is important to be able to identify different groups (sometimes this is easy).
- Preventing arbitrage is important – it is sometimes easy, sometimes difficult.

Which of the following statements is true?

- A. Firms practicing price discrimination must **always** be able to prevent arbitrage — *false because not necessary under second degree price discrimination*
- B. Firms practicing price discrimination must **always** be able to distinguish the type of customer they are selling to — *false because firms cannot distinguish customers under second degree price discrimination*
- C. **Firms practicing price discrimination must always exhibit some market power**
- D. All of the above are correct
- E. Not sure, but I think haircuts are priced too high

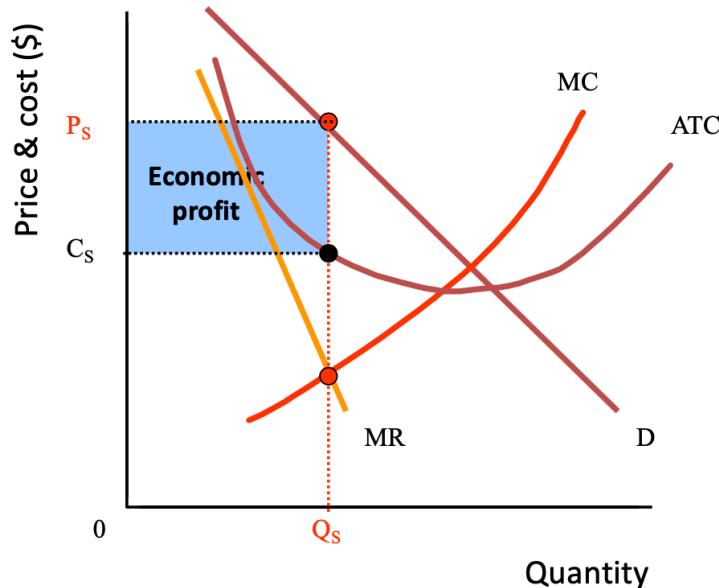
### **Monopolistic Competition**

- In monopolistic competition, there are many buyers and sellers. Firms produce similar but differentiated products and there is freedom of entry and exist.

- As a result, no one firm can influence what others do, firms face a downward sloping demand curve, firms earn zero economic profit in the long run.
- Examples of this include the Thai restaurants in Newtown.

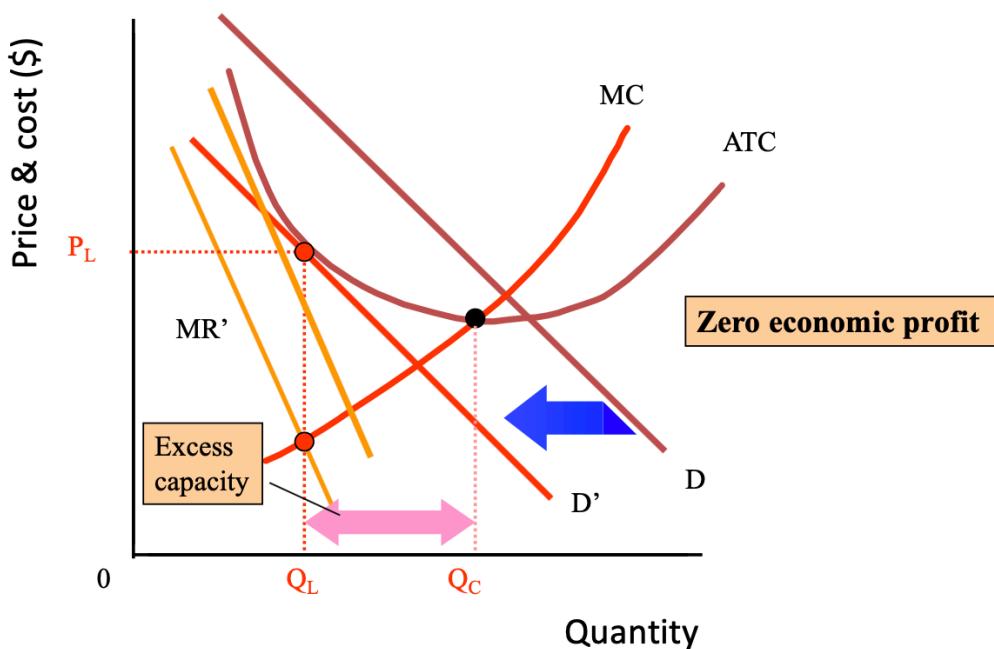
### Short Run

- Firms behave like monopolists. They produce where  $MR = MC$ .
- Firms can earn short run economic profit.
- They produce less than capacity, that is less than the level of output that minimises average total cost.



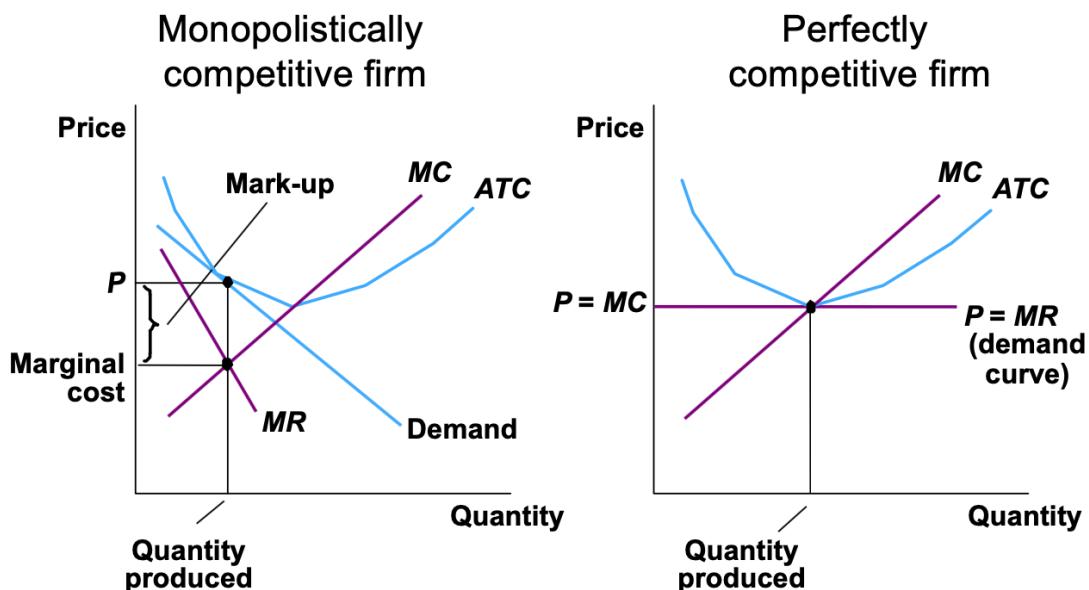
### Long Run

- In the long run, economic profit must equal zero. Economic profit attracts new entrants.
- When a firm enters the industry, the firms 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 maximising quantity and price fall.



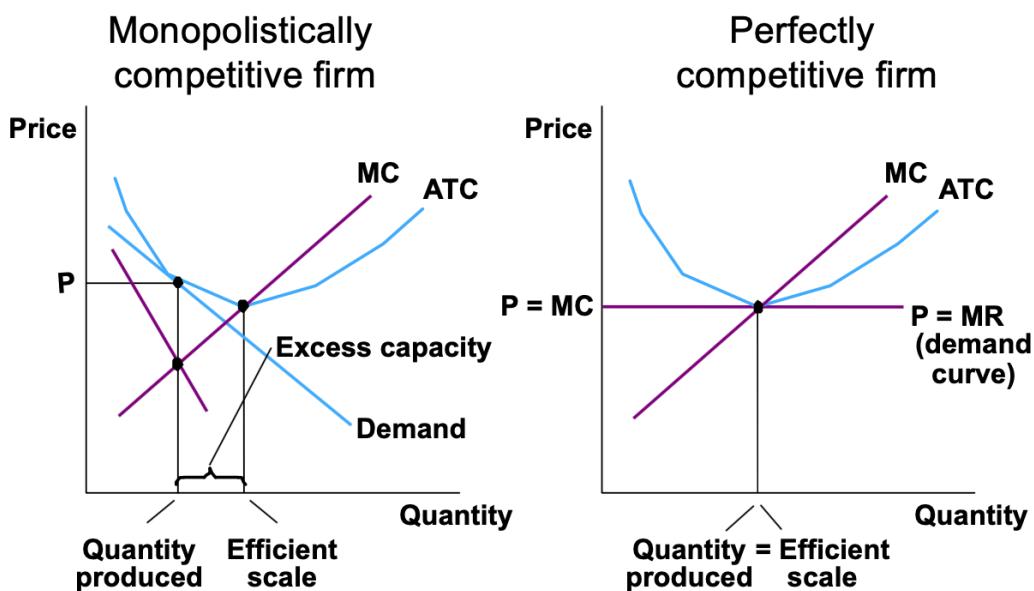
## Mark Up

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



## Excess Capacity

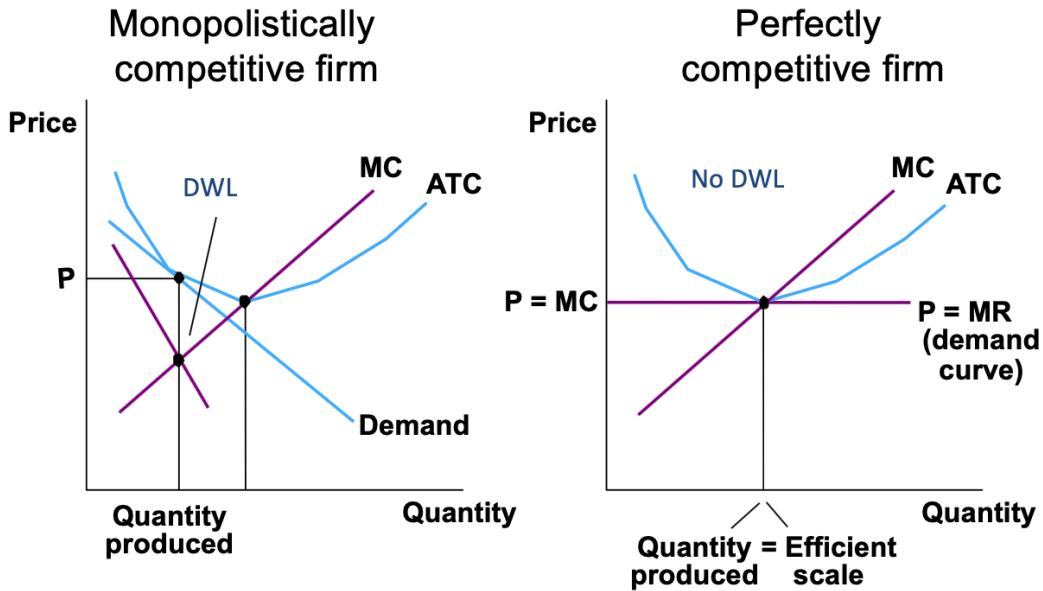
- In the LR, in a perfectly competitive industry, firms produce at the minimum of average cost. That is, firms produce at the minimum efficient scale.
- In a monopolistic competitive industry, costs exceed minimum of average cost.  
→ Firms produce less than the minimum efficient scale.



## Efficiency

- Firms charge a price that exceeds marginal cost, leading to deadweight loss.
- However, 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. The markets offer greater range of products to consumers.



- Are zero economic profits in the LR inevitable?

→ You can maybe stay one step ahead of your rivals by innovating i.e. offering new products that differentiate yourself from rivals, or reducing costs quicker than rivals.

## Comparison of models

Model type	Price	Deadweight loss	ATC minimised?	LR profits?
<b>Perfect Competition</b>	$P=MC$	no	yes	no
<b>Monopolistic Competition</b>	$P>MC$	yes	no	no
<b>Monopoly</b>	$P>MC$	yes	no	yes

## Lecture 7 – Strategic Behaviour in Oligopoly

### Oligopoly

- An oligopoly is an industry, where a small number of firms compete, they may produce identical or differentiated products, firms have some market power and there are barriers to entry, namely scale economies, entry or exit costs, patents and strong brands.
- Some examples include Coke vs Pepsi, Apple vs Dell, Coles vs Woolworths.

### Strategic Interaction

- Because there are only a small number of firms, firms recognise that:
  - actions of rival firms can have large impacts on profits
  - firm's own action 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

- Components of a 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.

### Prisoners' Dilemma

- Imagine that two suspects of anti-competitive behaviour, Alf and Bob, have been captured by police.
- Without a confession, the police have insufficient evidence to convict Alf and Bob.
- Suspects are put in separate rooms and cannot communicate with each other, where they are then questioned by police.

### Choices

- If only one of the suspects confesses, he can go free. The partner will then be convicted and face a heavy 10-year sentence for uncooperative behaviour.
- If they both confess, they will be convicted and face a moderate 5-year sentence.
- If neither confess, they only face minor 1-year charges.
- Strategies are the same because suspects play simultaneously and cannot condition their action on what the other one does: confess or deny.
- The payoff matrix describes the payoffs to both players for every possible outcome, called a normal form representation.

		Alf				
Bob	Confess Deny	Confess Deny				
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;"><b>-5,-5</b></td><td style="text-align: center;"><b>0,-10</b></td></tr> <tr> <td style="text-align: center;"><b>-10,0</b></td><td style="text-align: center;"><b>-1,-1</b></td></tr> </table>	<b>-5,-5</b>	<b>0,-10</b>	<b>-10,0</b>	<b>-1,-1</b>
<b>-5,-5</b>	<b>0,-10</b>					
<b>-10,0</b>	<b>-1,-1</b>					

- Can firms avoid a Prisoners' Dilemma?

→ Pre-game communication: players communicate before they make their move or choice in which case, they promise to make a choice. The issue is when the promises are not fulfilled.

→ Commitment is possible: an industry group or government removing the option to cheat by banning advertising or regulating prices using law (minimum price). Repetition: future punishments make cheating less attractive.

### Definitions

- A dominant strategy is a strategy that is optimal for every possible strategy of your rival/does not depend on what the other player chooses.
- 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.
- A Nash equilibrium (NE) is a stable state of a system that involves several interacting participants in which no participant can gain by a change of strategy as long as all the other participants remain unchanged.

### In Terms of This Example

- Confessing is a dominant strategy for Bob (and WLOG Alf):
  - Suppose Alf denies. If Bob confesses, he is free. If Bob denies, he gets 1 year. Confessing is better.
  - Suppose Alf confesses. If Bob confesses, he gets 5 years. If Bob denies, he gets 10 years. Confessing is better.
- Nash equilibrium: Alf confesses, and Bob confesses.
  - It may happen that Nash equilibrium is not Pareto optimal (as in this case).
  - The prisoners' dilemma illustrates why it is difficult to cooperate even when it is in the best interest of both parties.
  - Games like the prisoners' dilemma can be used to study strategic interaction in oligopolies.

### **Prisoner's Dilemma in Oligopoly**

- Consider an industry with two firms, a duopoly.
- ABC Vitamins and Doug's Drugs would like to raise profits in the market for vitamins. They can increase profits by forming a cartel.
- 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.

### Choices

- To maximise profits, ABC and Doug would like to collude and charge the same price that a monopolist would choose. However, if ABC charges the monopoly price, Doug could charge a lower price and capture a larger market share.
- The profit when both charge the monopoly price is 50.
- By undercutting a rival's price, the cheater can make a profit of 100.
- A firm that charges a monopoly price when the other firms cheats makes a loss of 50.

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

- Is there a dominant strategy? Cheating is the best response to whichever action your rival chooses.
- Nash equilibrium: Both cheat. If one firm cheats, the other firm's best response is to cheat.
- ABC and Doug failed to coordinate on the higher price.
- Can they avoid the Prisoner's Dilemma?
  - Pre-game communication? Not credible, and they would need a binding commitment.
  - Interact repeatedly with punishment for not cooperating.

## Co-ordination Game

- Two people would like to meet, but they can't remember where they had agreed upon. Indifferent about location, they just want to be at the same place.

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

- There are no dominant strategies, but there are two Nash Equilibria.
- Analogies in business: technology choices, positive location 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 (if credible).
- How can they avoid coordination failure?
  - Pre-game communication: here, it is credible because the parties have no incentive to deviate from the agreement.

## Other Applications for Business

- We can use game theory to study other business problems
  - How much to spend on product differentiation? Innovation and new product launches, R+D, 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 the price.

## Research and Development Game

- To find new vitamins with high absorption rates, ABC and Doug are thinking about investing in research and development.
- ABC and Doug have to decide whether to invest without knowing the choice of the other. If one invests, it must have the cooperation of the other company to make a breakthrough discovery and introduce a new profitable product.
- Each firm investing in research and development individually will not be able to discover new vitamins on its own.

		Doug	
		Invest	Not invest
		Invest	<b>20, 20</b>
ABC	Invest	<b>20, 20</b>	0, 10
	Not invest	10, 0	<b>10, 10</b>

- There is no dominant strategy, but there are two Nash equilibria. Both invest → payoff dominant equilibrium. Neither invest → risk dominant equilibrium (regardless of what the other does, they get 10).

## Location Game

- A pub and kebab shop owners decide where to locate their businesses.
- The pub owner prefers a location in the city, the kebab shop owner prefers a location near the beach.
- If they choose the same location, they earn extra profit since people enjoy consuming both at the same time.

		Kebab	
		City	Beach
		City	<b>30, 20</b>
Pub	City	<b>30, 20</b>	10, 10
	Beach	10, 10	<b>20, 30</b>

- There is no dominant strategy, but there are two Nash equilibria: both locate in the City, both locate near the Beach. The equilibria are not fair, since one does better than the other.

## **Assumptions Underlying Nash Equilibria**

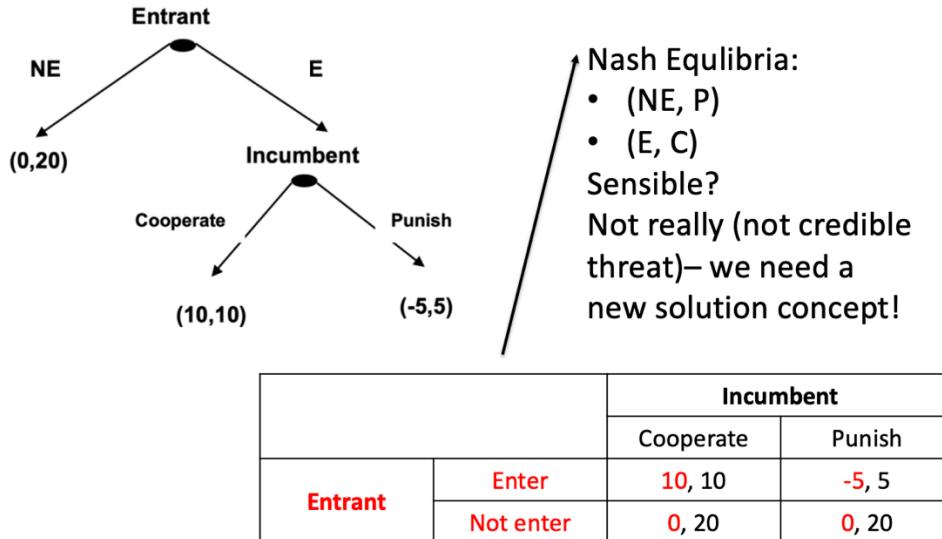
- Rationality
- Common Knowledge: each player needs to know the other player is rational, and that they know the other player knows that they are rational.
- The payments in the payoff matrix need to represent utility, especially relevant for individuals.
- Perfect information: players need to know the structure of the game and the payoffs (profits of the other firm).

## **Sequential Games**

- So far only considered games where firms take actions without observing what the rival has chosen.
- In many business situations, one firm moves first and then the other one responds. They move sequentially e.g. Honda chooses to build a small or large car after observing the choice of Toyota.

## Entry Game

- There are 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.
- Extensive form represents the sequential game.

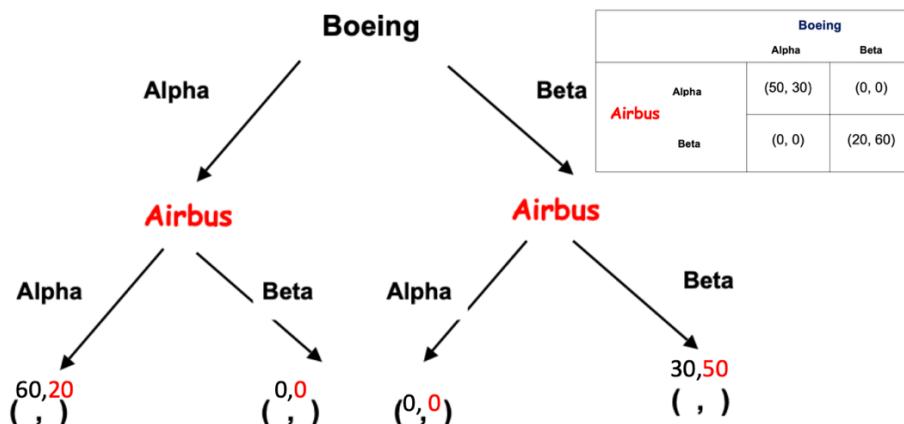


## Subgame Perfect Equilibrium

- Each player's strategy must be a Nash equilibrium in every subgame. Threats will be credible because strategies would be adopted if needed.
- We solve the game by backward induction.
- The Subgame Perfect Equilibrium of the Entry game is (Enter; Cooperate if Enter).

## First Mover Advantage

- Sometimes, it is better to go first, other times it is better to learn from the mistakes of others before having a go.
- It is advantageous to be the first mover if it forces the follower to adapt to our preferred choice.
  - Examples include: a firm builds a hotel first. They choose how much output to produce and a rival responds. Leader makes a choice over technology.
- Nash Equilibria: (Alpha, Alpha) or (Beta, Beta). Airbus prefers the former, Boeing prefers the latter.
- By moving first, Boeing can pick their preferred Nash equilibrium. Subgame Perfect Equilibrium is (Alpha; Alpha if Alpha, Beta if Beta).



## **Second Mover Advantage**

- Sometimes it is better to be the second mover to learn from other's mistakes. iPhone was not the first smartphone. Microsoft was not the first operating system.
- Consider an investment game where NE: (I, W) and (W, I).
- Both would be better off if the other invested first.

		Apple	
		Invest	Wait
Nokia	Invest	4, 4	2, 6
	Wait	6, 2	1, 1

- Business applications: investment free-riding, group assignments, advertising new products.

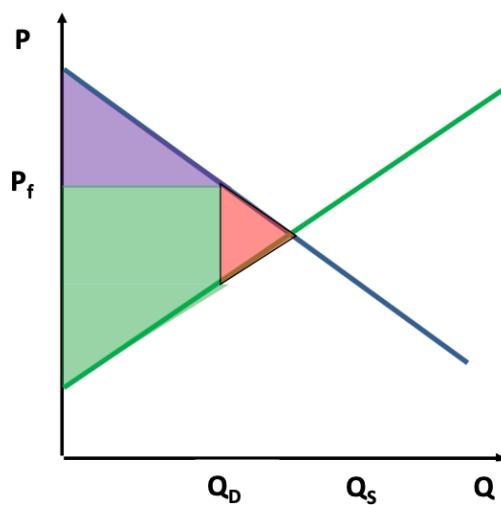
## Lecture 8 – Market Interventions: Price Regulation, Taxes and Subsidies

### 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 subsidy, the amount paid by the consumer doesn't equal the amount received by producers and firms i.e. price signals are no longer consistent.
- Public good
  - goods for which one person's consumption does not detract from another's consumption or enjoyment of the good e.g. defence, police, roads (up to a point).
  - generates a free rider problem
- External costs and benefits
  - costs imposed on agents other than the consumers or producer of the good e.g. pollution from a factory, loud music, public education.
  - Marginal benefit and marginal cost curves do not reflect total or society's benefits/costs.

### Price Controls or Regulation

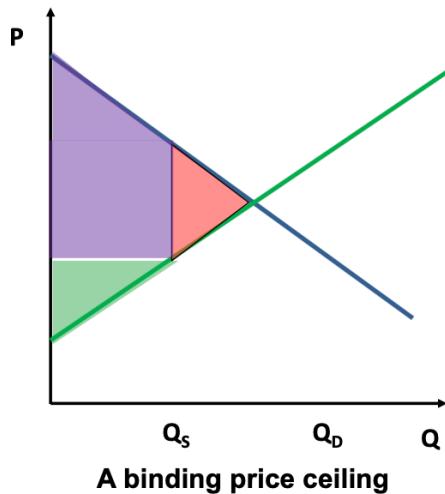
- Usually enacted when the market price is deemed unfair. Examples include minimum wages, public housing, agricultural price support schemes.
- A price floor ( $P_f$ ) establishes a minimum price at which a good can be sold.
  - Not binding if set below the equilibrium or market clearing price. This has no effect.
  - If binding, this causes excess supply.
- A binding price floor causes a surplus.
- Non-price rationing means determine who gets to sell the good or service e.g. agricultural price supports for wool, minimum wages.
- A binding price floor creates a DWL (red) or loss of total surplus – some gains from trades are not realised. Relative to a competitive outcome, CS (purple) is lower, and PS (green) is higher.



**A binding price floor**

## Price Ceilings

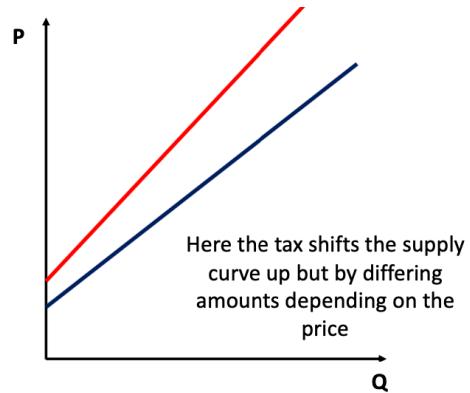
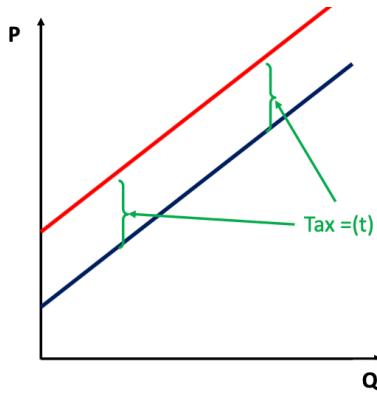
- A price ceiling ( $P_c$ ) is a legally established maximum price at which a good can be sold.  
→ If non-binding, it has no effect. If it is binding, it causes excess demand.
- A price ceiling is not binding if it is set above the equilibrium or market clearing price.
- A binding price ceiling causes a shortage or excess demand. Non price rationing means determine who gets to buy the good or service e.g. rents and housing price controls in the US.
- A binding price ceiling creates a DWL (red) or a loss of total surplus – some gains from trades are not realised.
- Relative to a competitive outcome, CS (purple) is higher, and PS (green) is lower. The DWL could be even higher if it is not the consumers with the highest MB who actually buy the good.



## 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/sellers respond to post/pre-tax prices.
- Why have taxes and subsidies? To raise revenue, correct market failures i.e. externalities, income support.
- Types of taxes: excise taxes, ad valorem or proportional taxes, taxes on buyers/sellers.

## Taxes

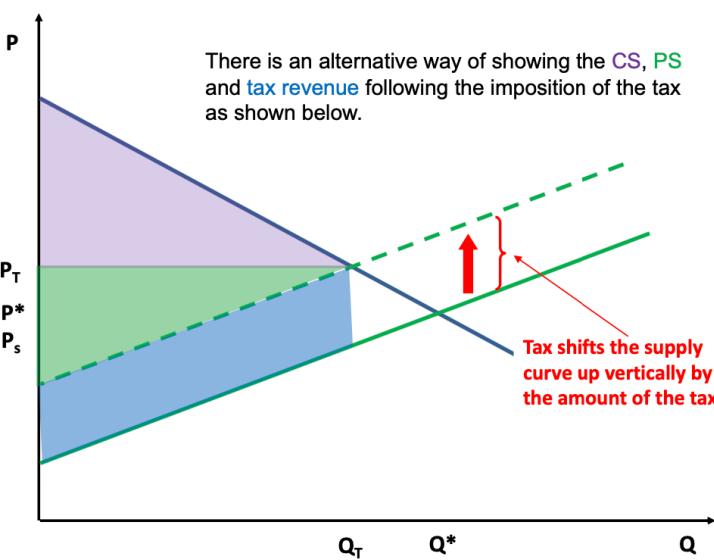
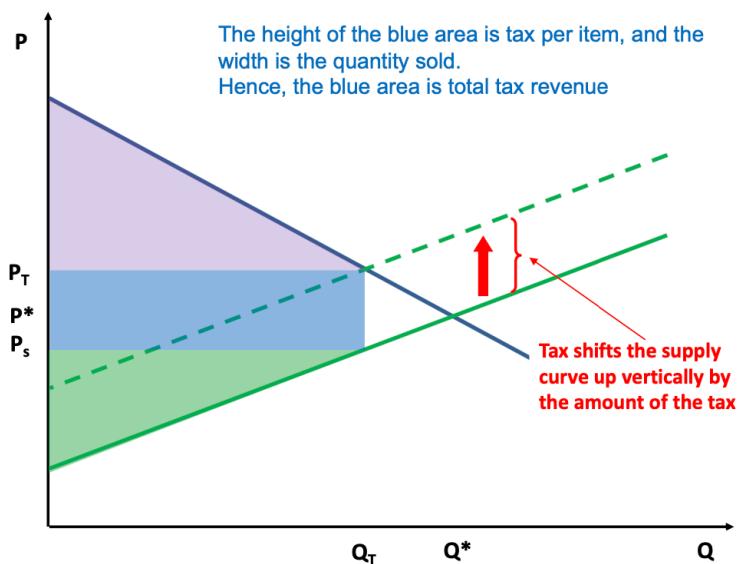


## Incidence of Taxation

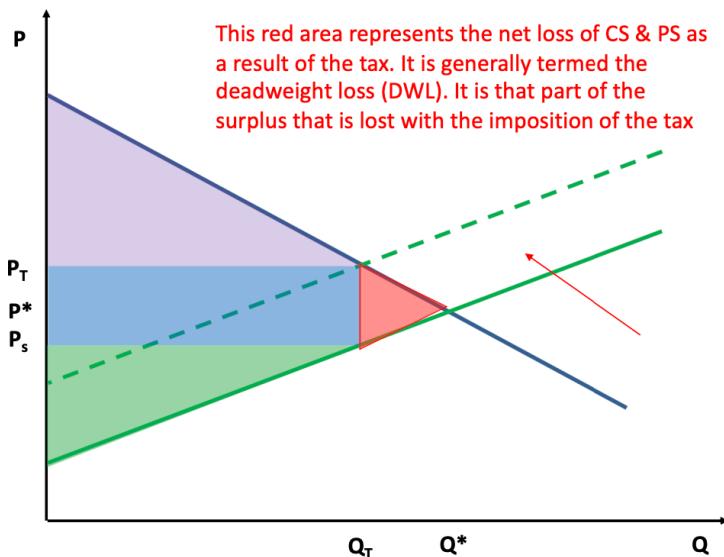
- Describes who bears the economic burden of taxation. In general, the economic burden falls partly on the buyer and partly on the seller.
- The economic burden of taxation is distinct from the legal requirement to pay the tax. This requirement (the legal requirement) may rest with the seller/buyer.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

### Tax on Sellers

- Initially, the equilibrium price was  $P^*$ . Imposition of the tax shifts the supply curve up vertically by the amount of 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).
- The height of the blue area is tax per item, and the width is quantity sold. Hence the blue area is total tax revenue.

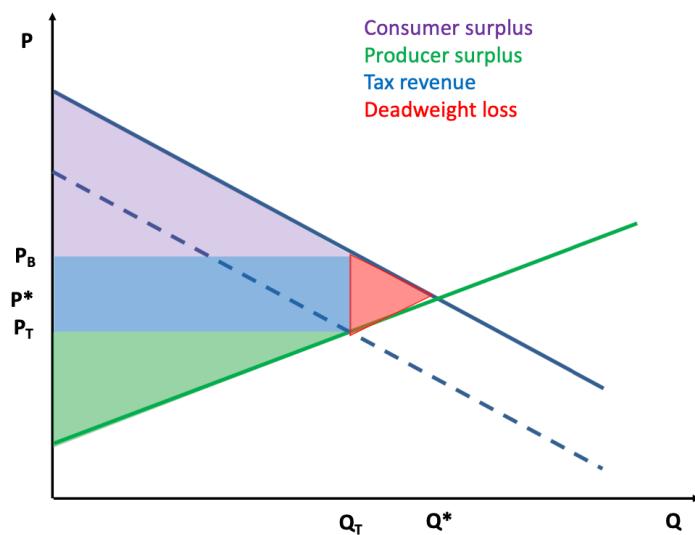


- Furthermore, taxes generate DWL or a loss in total surplus. This can be thought as the lost net surplus/benefits from engaging in trade. It occurs because the quantity traded moves away from what we get in a competitive equilibrium → the tax revenue does NOT represent a loss in surplus, merely a transfer.



### Taxes on Buyers

- Imposition of tax shifts the demand curve down vertically by the amount of tax. This gives a demand curve perceived by sellers.
- 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 buyer for each unit is  $P_B = P_T + \text{tax}$ .
- $P_T$  is the price that the sellers get.

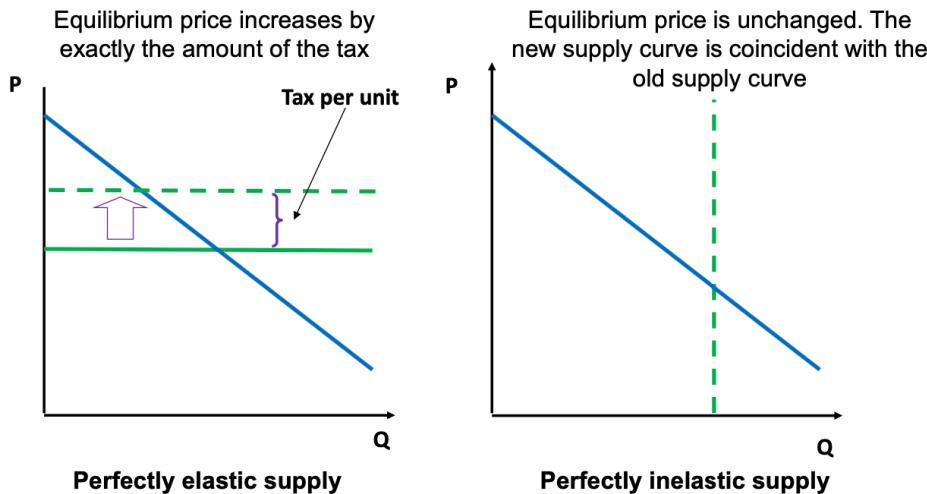


### **More on Incidence of Taxation**

- The incidence of tax is unaffected by who must legally pay the tax.
- The incidence of a tax depends on elasticity
  - the more inelastic/elastic the supply, the more the seller/buyer pays.
  - The more inelastic/elastic the demand, the more the buyer/seller pays.
- In general, the burden of the tax falls on the more inelastic side of the market.

### **Incidence of Taxation and Supply Elasticity**

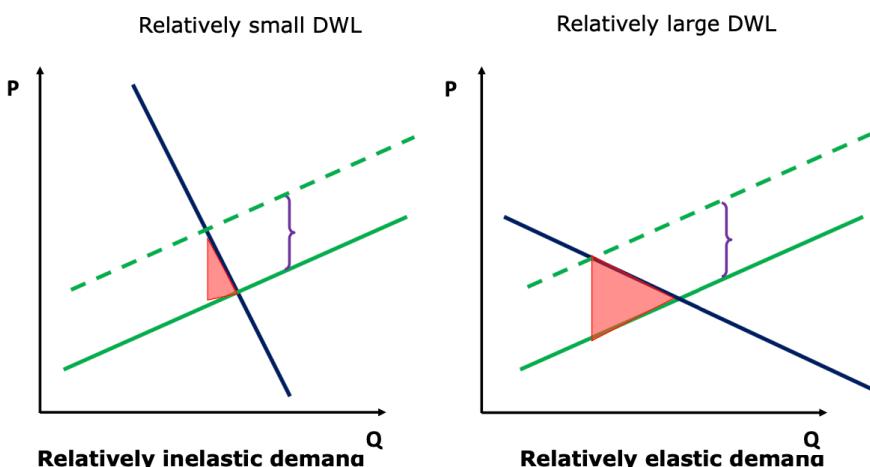
- Consider perfectly elastic/inelastic supply, the buyer/seller pays all the tax or bears the full economic burden.



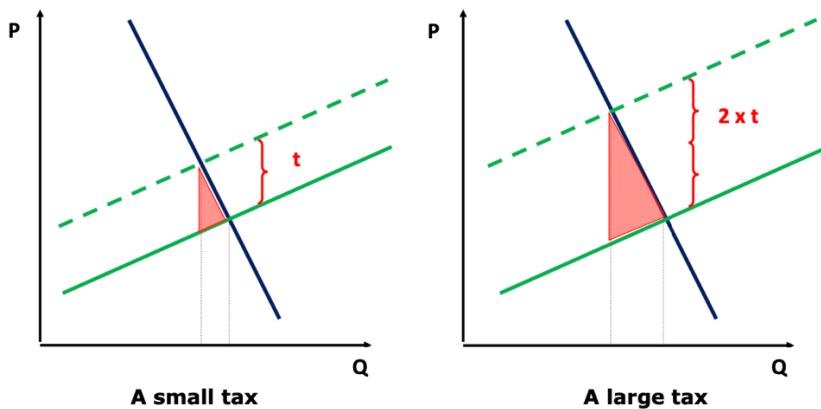
- When neither the supply nor the demand curve is perfectly inelastic or elastic, the economic burden of the tax is shared.
- Consider a relatively inelastic demand and relatively elastic supply → the price rises by a large amount when the tax is imposed on sellers. That is, the economic burden of the tax is largely borne by buyers.
- Consider a relatively elastic demand and relatively inelastic supply → the 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.

## Determinant of Deadweight Loss

- Size of the DWL will depend on the 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 that supply and demand are, the larger the DWL.

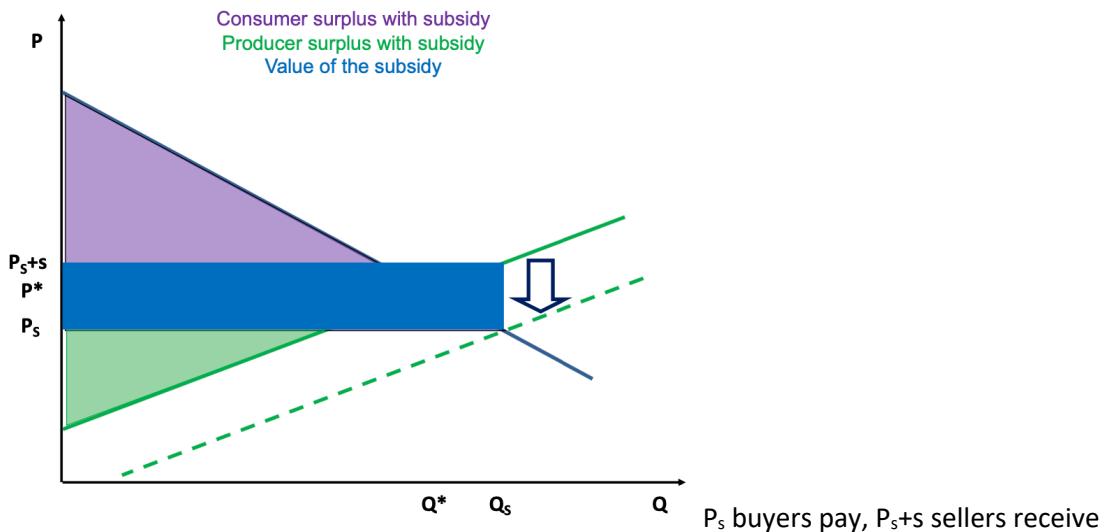


- A tax creates a DWL because it induces buyers and sellers to change their behaviour compared to the market outcome with no tax. The market “shrinks”.
- In general, the DWL increases more rapidly than the tax. Doubling the size of the tax leads to a quadrupling of the DWL.

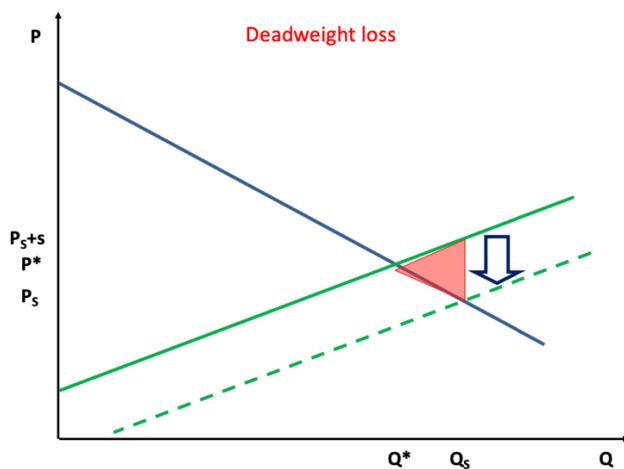


## Subsidies

- 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 DWL.
- Consider a subsidy on production (or a subsidy paid to producers).
- Post subsidy equilibrium: the supply curve is shifted down by the amount of the subsidy. Notice that at the new equilibrium,  $MC > MB$ .



- The subsidy payments are effectively negative surplus (think about where the money for the subsidy comes from).

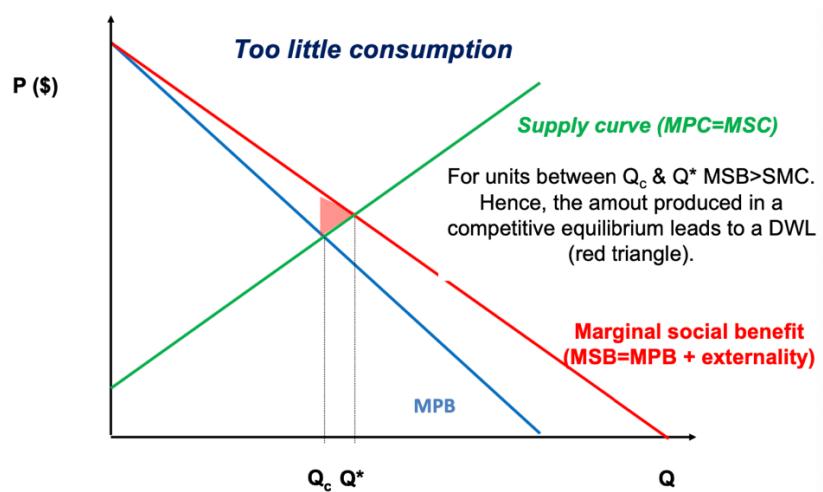
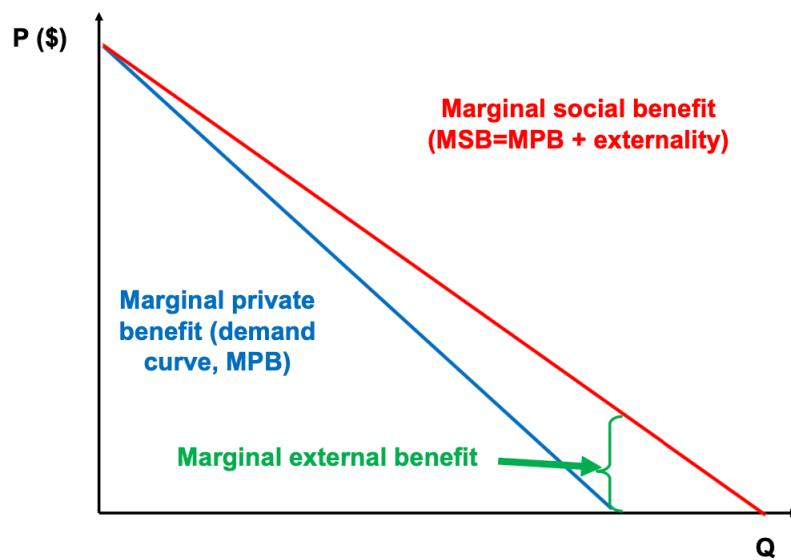


## Lecture 9 - Market Failures: Externalities and Public Goods

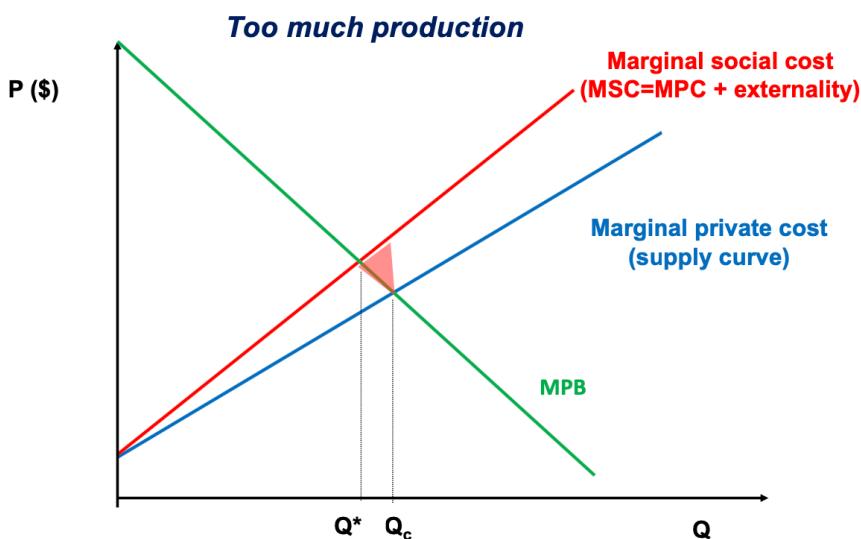
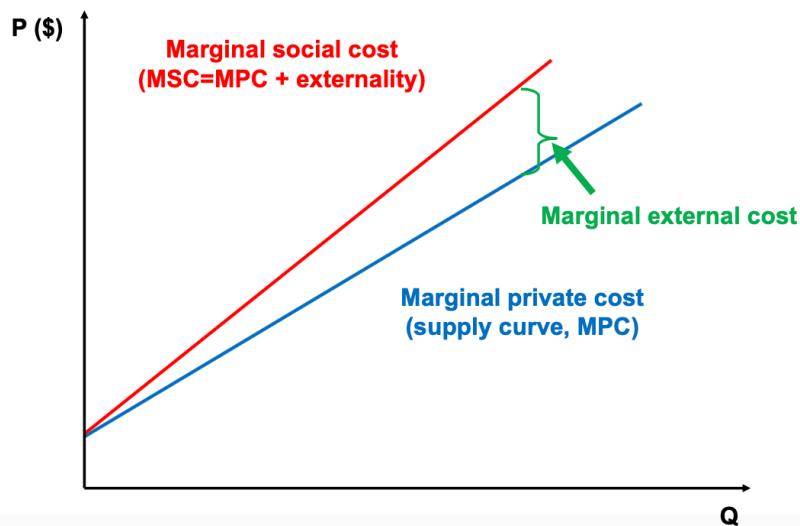
### Externalities

- Externalities are costs or benefits to parties other than those in a transaction e.g. pollution from a factory, education and immunisation.
- The optimal level of externalities (or production) depends on the marginal social costs and benefits.
- In the absence of an externality, efficiency requires that private MB = private MC.
- Externalities represent a market failure. Consumers or producers don't take into account costs/benefits to others so inefficiency (i.e. DWL) results:
  - negative externalities such as pollution generally result in over production.
  - positive externalities such as immunisation or education are generally under consumed/produced.

### Positive Production Externality



## Negative Production Externality

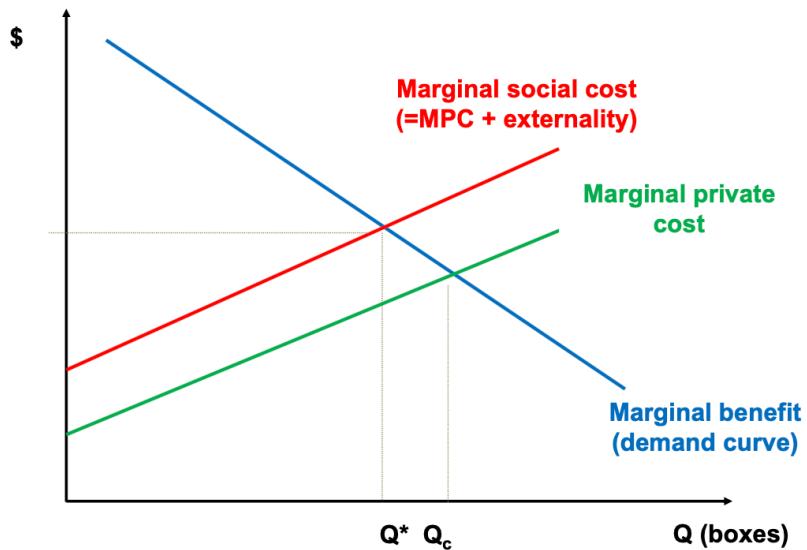


## Solutions to Externality Problems

- Regulate pollution for each firm.
- Emission charges i.e. charge each firm for each unit of production.
- Others include:

## Property Rights

- One explanation for externalities are 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.
- We can resolve externalities (or more to the point the inefficiency resulting from an externality) by defining property rights → in resolving externalities, it does not matter if we think about the optimal level of production or consumption of the good/service, or the optimal level of the externality e.g. pollution.



- The efficient outcome is where MB equals MSC,  $Q^*$ . The outcome we expect in a perfectly competitive market is where the marginal private cost and MB are equated i.e.  $QC \rightarrow$  there is DWL.

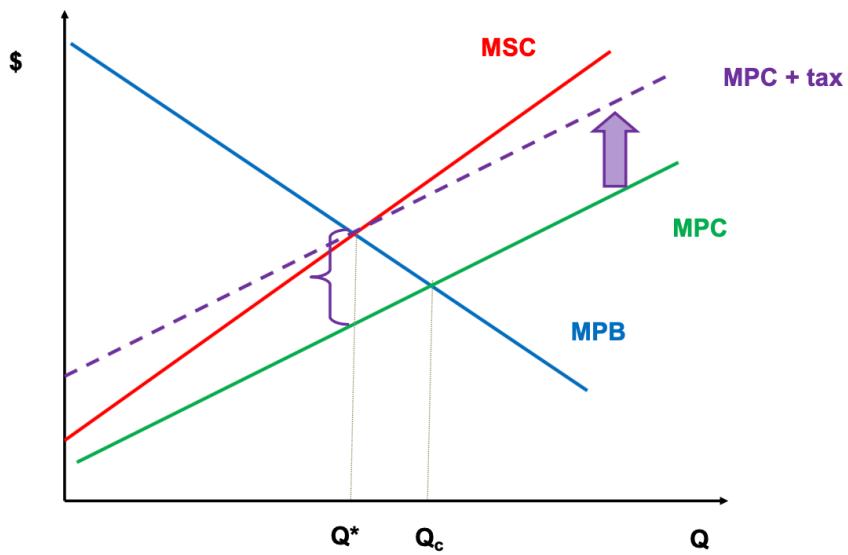


### Coase Theorem

- With low transaction costs and complete property rights, the efficient outcome will be achieved. The owner ensures that the 'polluter' compensates him/her for his actions i.e. pollution.
  - If a factory owns the river, the fishing club pays the factory to reduce their pollution.
  - If a fishing club 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 property rights are vested in – we still get the efficient outcome → privately bargained solution.
- Limitations include transaction costs and distributional concerns.

### Pigouvian Tax

- A tax on the output that generates the externality equal to the level of the externality at the efficient level of output.

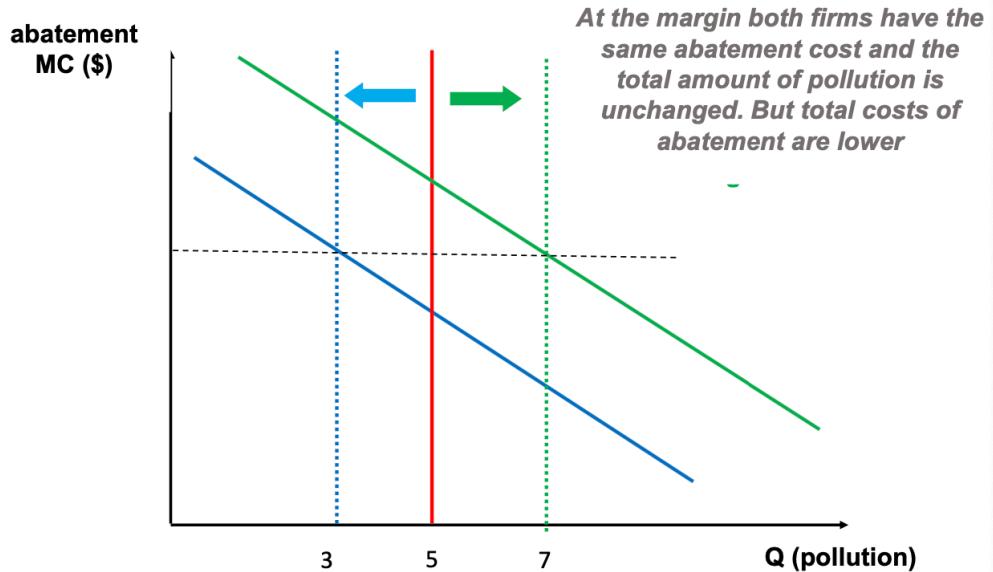


### Pigouvian Subsidy

- In the case of a positive externality, rather than using a tax we could simply use a subsidy, shifting the MPC down.
- An alternative to a Pigouvian tax might a tax on the pollution itself.

### **Marketable Permits**

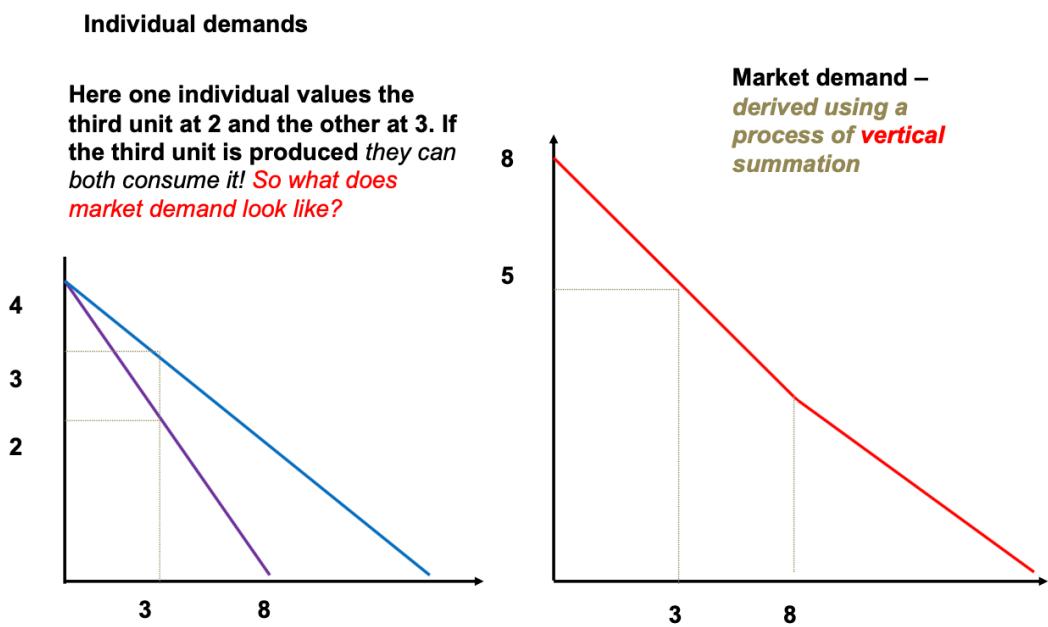
- Marketable permit schemes directly regulate the total quantity of pollution. Having established the total level of pollution, the firms can then buy and sell the 'right to pollute'.
- An issue with such a scheme is that the regulator still needs to know the optimal level of overall pollution.
- Consider two firms with the same licence to pollute. One has relatively high abatement costs (green), the second has low abatement costs (blue).



### **Public Goods**

- Private goods have two characteristics:
  - rivalry in competition i.e. if I eat a donut, you don't eat it.
  - excludability i.e. you can be excluded from eating the donut unless you pay for it.

- Public goods are:
  - non-rivalrous i.e. my consumption of the good (e.g. public broadcasting) doesn't detract from yours.
  - non-excludable i.e. individuals cannot be excluded from consuming it, they cannot be forced to pay for it.
- Public goods lead to the free-rider problem → those who don't pay for them cannot be excluded from consuming them.
- The problem with private provision of the goods in the presence of the free-rider problem is that there is no financial incentive to provide public goods.
- An alternative solution is provision financed by taxes. Efficient provision is when marginal social cost is equal to marginal social benefit. For a public good:
  - MSC is the total marginal opportunity cost of providing the good.
  - MSB is found by asking individuals about their willingness to pay to identify benefit for society.



- 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 person's 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 i.e. individuals consume as long as the private MB exceeds the MC. Examples include public cubicles, fishing waters.

	Excludable	Non-excludable
Rivalrous	Private goods	Common resources
Non-rivalrous	Quasi public goods	Public goods

## Theory of the 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.
  - 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.

# Lecture 10 – GDP and Business Cycles

## Macroeconomics

- Macroeconomics studies aggregate phenomena for the entire economy (e.g. the business cycle, inflation, long-run growth).
- Developed as separate from microeconomics out of the Great Depression and considers the effects of fiscal and monetary policy → they are, however, still connected.

## Gross Domestic Product

- GDP is a measure of total economic activity for a country → measured as a flow over time (e.g. GDP for Australia from July 2019 – June 2020 was AUD\$1.98 trillion).
- Contributions of different activities aggregated by using their money value (dollar prices): allows adding up “apples and oranges”.
- Only final goods and services are included to avoid double-counting of intermediate inputs (e.g. silica used to make computer chips).
- Domestic means measurement is by geographic location of production, not by nationality (that would be “GNP” instead).

## Nominal vs Real GDP

- A difficulty in comparing GDP in different years is that its nominal value can change because the prices of goods and services change rather than just a change in the total amount of production.
- Real GDP tries to control for changes in the general price level to allow comparisons of the volume of production in different years. Consider:
  - 6 bananas x \$0.50/banana + 3 books x \$20/book = \$63 GDP in 2019.
  - 8 bananas x \$1/banana + 5 books x \$25/book = \$133 nominal GDP in 2020.
  - 8 bananas x \$0.5/banana + 5 books x \$20/book = \$104 real GDP in 2020.
- Although nominal GDP seemed to double, production did not. The real GDP better reflects changes in volume of production.

## GDP Deflator and Chain Weighting

- The GDP deflator is an index measure of the general price level in a given year that converts nominal GDP into real GDP.
- Real GDP = nominal GDP/GDP deflator x 100.
- Index means that the GDP deflator is set to 100 in a base year, and a value such as 140 means that the price level has increased by 40%.
- To minimise distortions from large changes in relative prices, chain-weighting is used to construct real GDP in a given year.
- Chain-weighting uses the average of prices in the current/previous year to add up quantities rather than prices in the base year.

## Measuring GDP

- There are three approaches to measuring GDP:
  - Final goods approach
  - Value added approach
  - Income approach
- In principle, these should all be equivalent due to the circular flow of production and income.



### Final Goods Approach

- Add up expenditures on domestic production of final goods and services by different groups.
  - Households: Consumption (C)
  - Firms: Investment (I)
  - Government: Government Purchases (G)
  - Rest of the World: Exports (X) – Imports (M)
- $GDP = C + I + G + X - M$
- Investment includes residential construction and inventory accumulation/depletion for production that is not sold in the same period as it is produced.
- Government purchases do not include transfer payments or interest paid on government debt.

### Value Added Approach

- Add up value added at each stage of domestic production.
- Value added = firm's revenue – costs of intermediate goods.
- $GDP = \text{sum of value added of all firms}$ .

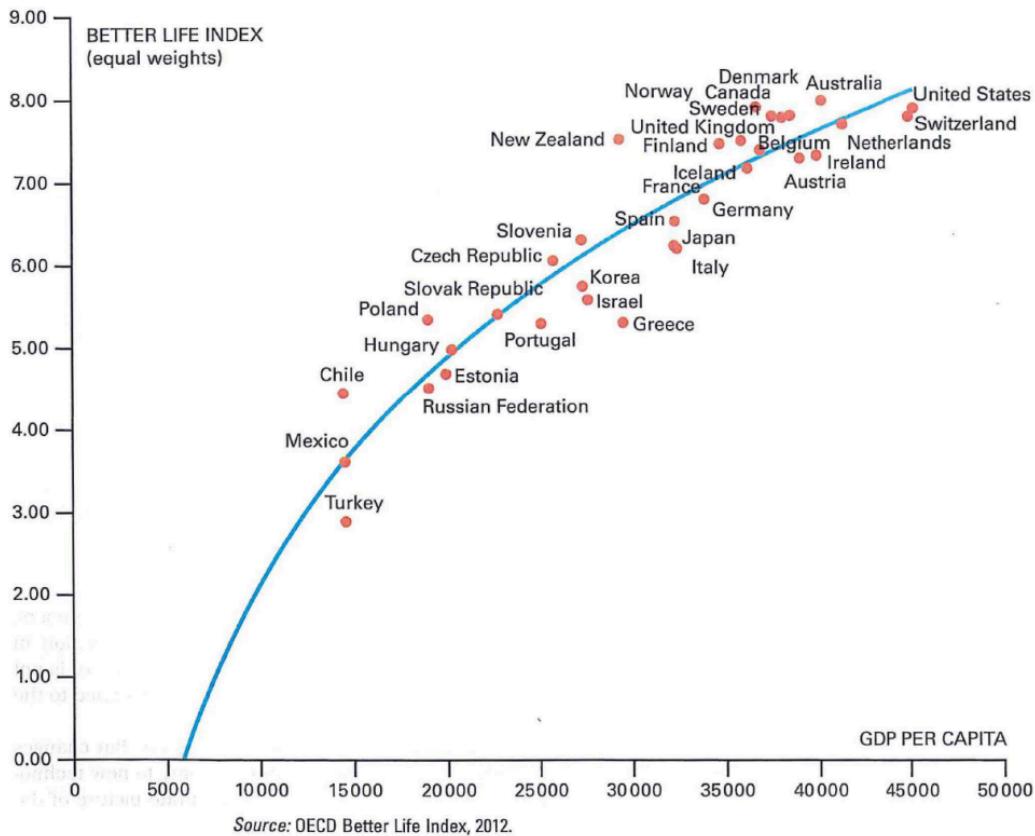
### Income Approach

- Related to value added approach:
  - Revenue – costs = profit → Revenue = costs + profit
  - Revenue = wages + interest payments + cost of intermediate inputs + indirect taxes + depreciation + profit
  - Value added = firm's revenue – costs of intermediate goods SO  $GDP = \text{wages} + \text{interest payments} + \text{indirect taxes} + \text{depreciation} + \text{profit}$

- Presence of depreciation explains why it is 'Gross' Domestic Product i.e. it includes investment to replace old equipment.

### **Problems with Measuring GDP**

- GDP does not include many valuable non-market activities e.g. environmental quality and resource depletion, poverty and economic inequality.
- Per capital real GDP is correlated with standards of living and there has been convergence in incomes for the world as a whole.
- Also, real GDP growth will be an accurate measure of changes in activity even if there is a bias in the level due to missing activities.



### **The Business Cycle**

- The GDP allows us to quantify the severity of economic crises and estimate the effects of the macroeconomic policies.
- One definition of the business cycle is the recurring deviations of real GDP ( $Y$ ) from its potential level ( $Y^*$ ) given full employment of resources.
- Full employment of resources must be estimated, with percentage deviations (i.e.  $100\% \times (Y - Y^*/Y^*)$ ) often referred to as the 'output gap'

### **The Keynesian Cross Model**

- A model is an abstraction from reality to explain how things work and to make predictions.
- In a world where consumption influences income and income influences consumption, the Keynesian Cross model solves what aggregate income will end up being.

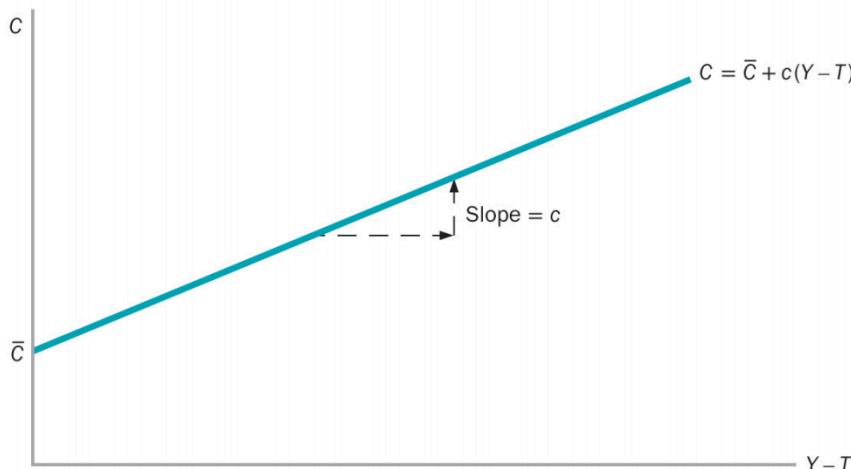
- The model assumes firms respond to changes in demand by selling different quantities rather than immediately changing their prices due to so-called “menu costs”.
- By fixing the price level, the model is equivalently a model of both nominal and real GDP.
- It also takes potential output  $Y^*$  as given.
- Thus, the model is of the business cycle in the short run and only explains the output gap, not inflation or long-run growth.

### Planned Aggregate Expenditure

- The model builds off of the expenditure approach to measuring GDP.
- Aggregate expenditure:  $Y = C + I + G + X - M$
- Planned aggregate expenditure:  $PAE = C + I^P + G + X - M$
- $I - I^P$  is unplanned inventory ‘investment’.

### The Consumption Function

- Largest component of PAE is consumption (around 55% of Y for Australia).
- In the model, C is assumed to depend linearly on disposable income ( $Y - T$ ), where T is net taxes (taxes minus transfers).
- Consumption function:  $C = \bar{C} + c(Y - T)$
- $\bar{C}$  captures everything other than disposable income that affects consumption (e.g. wealth).
  - c is the marginal propensity to consume (MPC) out of an additional dollar of income.



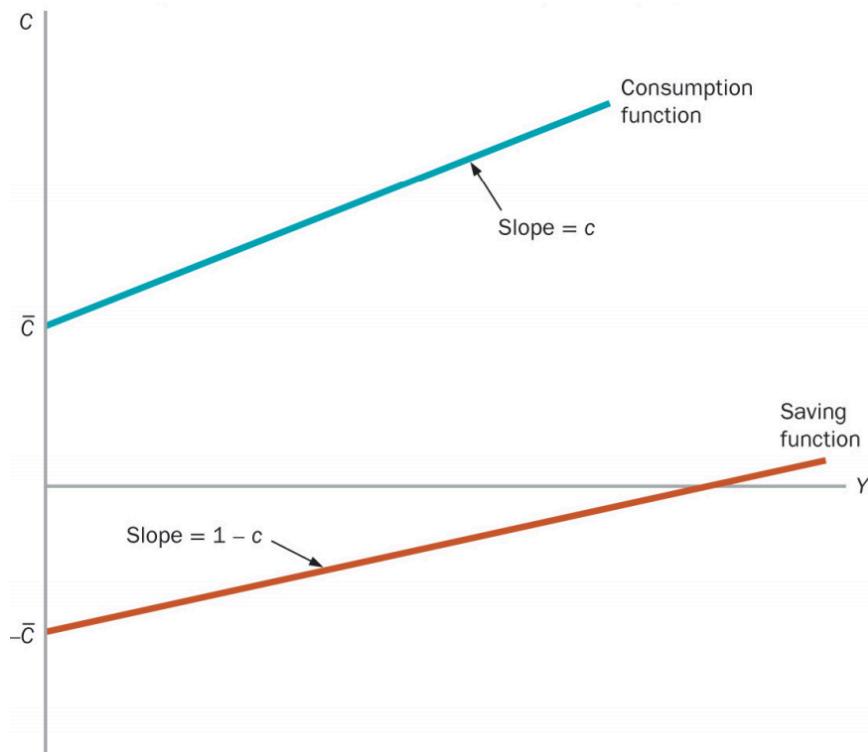
### Exogenous vs Induced Consumption

- $\bar{C}$  is exogenous consumption that is assumed to be a fixed value determined outside of the model.
- $c(Y - T)$  is induced consumption, the value of which will be determined within the model.
- If  $C = 620 + 0.8(Y - T)$ , we can solve the value of C if we know the value of  $(Y - T)$ , such as  $C = \$8,620$  if  $(Y - T) = \$10,000$ .

### Simplified Two Sector Version of the Model

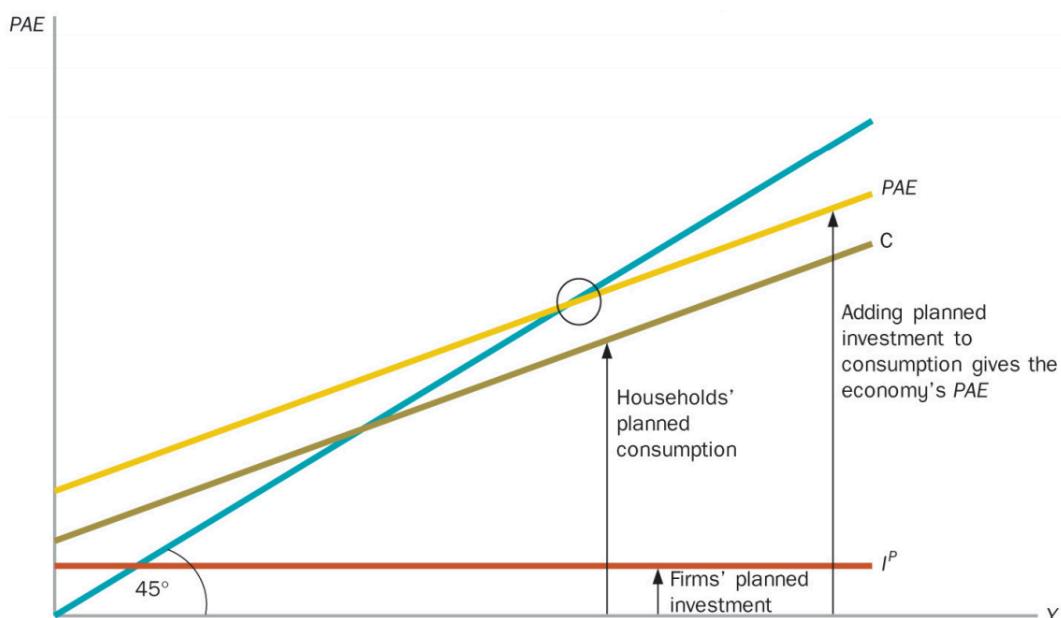
- For simplicity, assume no government or foreign sector ( $G = T = X = M = 0$ ).
- Given  $Y = C + S$ , where S is saving, the consumption function implies a saving function  $S = -\bar{C} + Y(1 - c)$
- Note if  $\bar{C}$  is around 0, the MPC is around  $1 - S/Y$ , where  $S/Y$  is the saving ratio.

- Keynesian assumption that  $S$  is affected more by income than the interest rate, motivated by the ZLB in the Great Depression.



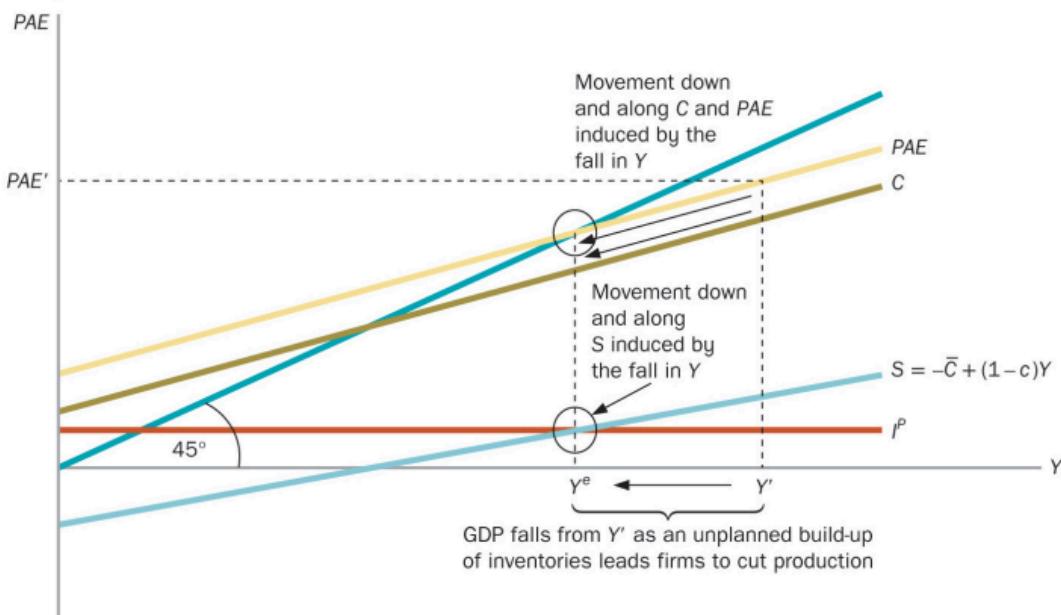
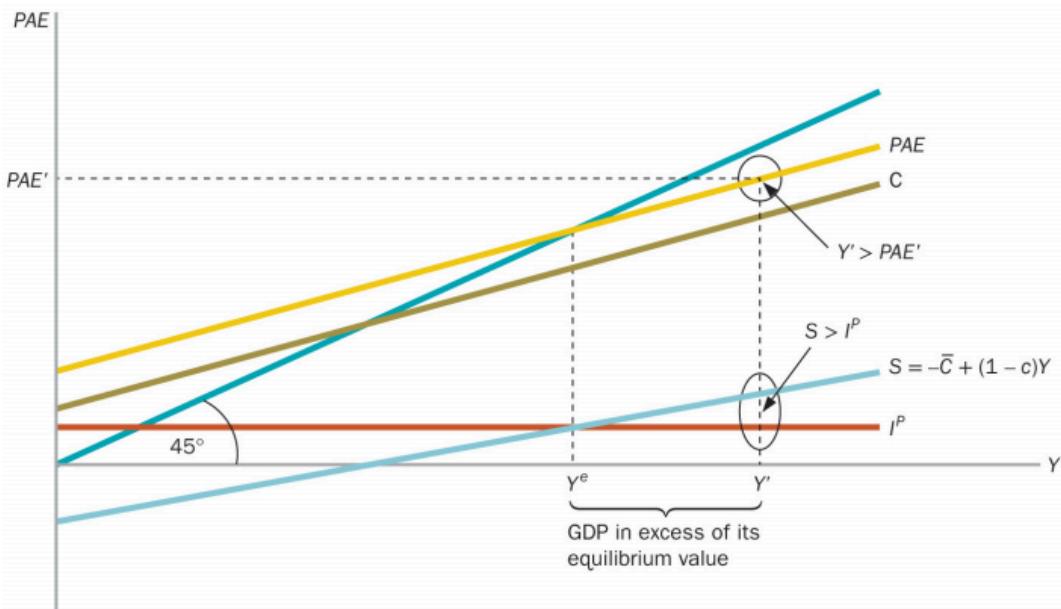
### Investment

- Planned investment  $I^P$  is also assumed to be an exogenous fixed value determined outside of the model (like  $\bar{C}$ ).
- It could be affected by the interest rate, but this assumed to a relatively small effect, again motivated by the ZLB in the Great Depression.
- It could also be affected by expectations about future profits, which Keynes called animal spirits, and thought were an important source of shifts in PAE.
- In equilibrium, saving equals planned investment ( $S = I^P$ ) and output equals planned aggregate expenditures ( $Y = PAE$ ).



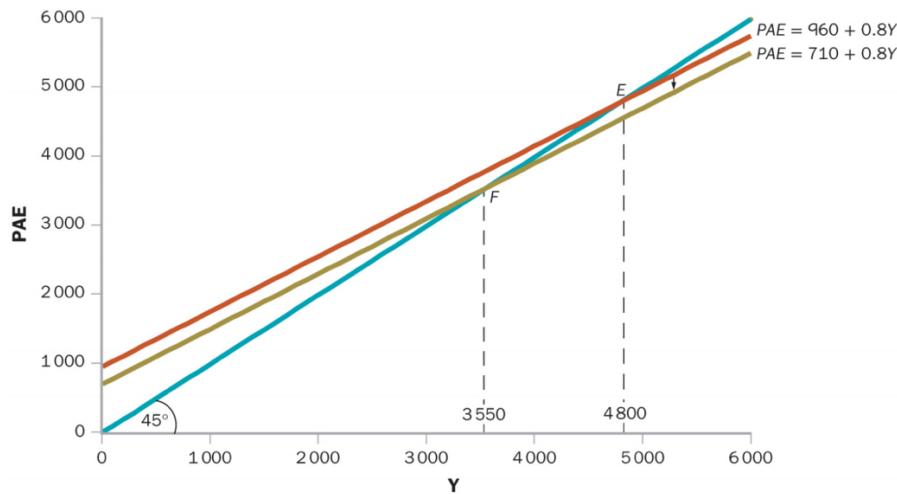
## Equilibrium and Unplanned Inventories

- If  $S \neq I^P$  and  $Y$  does not equal PAE, then there will be unplanned inventory investment and a resulting change in production until  $S = I^P$  and  $Y = PAE$ .
- In this sense,  $Y = PAE$  defines an equilibrium in which there is no more change.



## Using the Model

- Suppose there is a decrease in consumer confidence and households want to save more. What happens?
  - We know that an exogenous change in  $C$  will change  $Y$  in equilibrium (i.e.  $C \rightarrow Y$ ).
  - But we also know that a change in  $Y$  will induce a change in  $C$  (i.e.  $Y \rightarrow C$ ).
  - This model will allow us to solve for exactly how  $C$  and  $Y$  will change given their simultaneity.
- E.g. suppose MPC  $c = 0.8$  and  $\bar{C}$  falls from \$960 to \$710. What will happen to output?



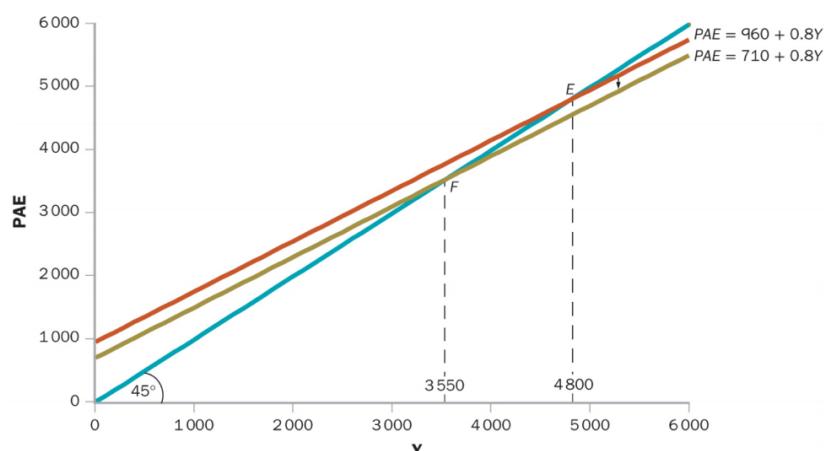
## Full Four-Sector Version of the Model

- Let's add in the government sector ( $G$  and  $T$ ) and foreign sector ( $X$  and  $M$ ) to make  $Y = C + I + G + X + M$ .
- Government spending  $G$  is assumed to be an exogenous fixed value determined outside of the model.
- Net taxes  $T$  are assumed to be a mix of lump-sum and proportional taxes:  $T = \bar{T} + tY$  where  $t$  is the marginal tax rate.
- The consumption function is then:  $C = \bar{C} + c(Y - \bar{T} - tY)$ .
- Exports  $X$  are assumed to be an exogenous fixed value determined outside of the model.
- Imports  $M$  are assumed to be proportional to income:  $M = mY$ , where  $m$  is the marginal propensity to import.

## Planned Aggregate Expenditures

$$\begin{aligned}
 PAE &= C + I^P + G + X - M \\
 &= \bar{C} + c(Y - \bar{T} - tY) + I^P + G + X - mY \\
 &= \bar{C} - c\bar{T} + I^P + G + X + [c(1 - t) - m]Y
 \end{aligned}$$

- So a change in any of  $\bar{C}$ ,  $c$ ,  $\bar{T}$ ,  $I^P$ ,  $G$ , or  $X$  will shift the level of the PAE curve and change equilibrium  $Y$
- A change in any of  $c$ ,  $t$ , or  $m$  will change the slope of the PAE curve and change equilibrium  $Y$
- E.g., suppose  $[c(1 - t) - m] = 0.8$  and the exogenous component  $\bar{C} - c\bar{T} + I^P + G + X$  of PAE changes from \$960 to \$710



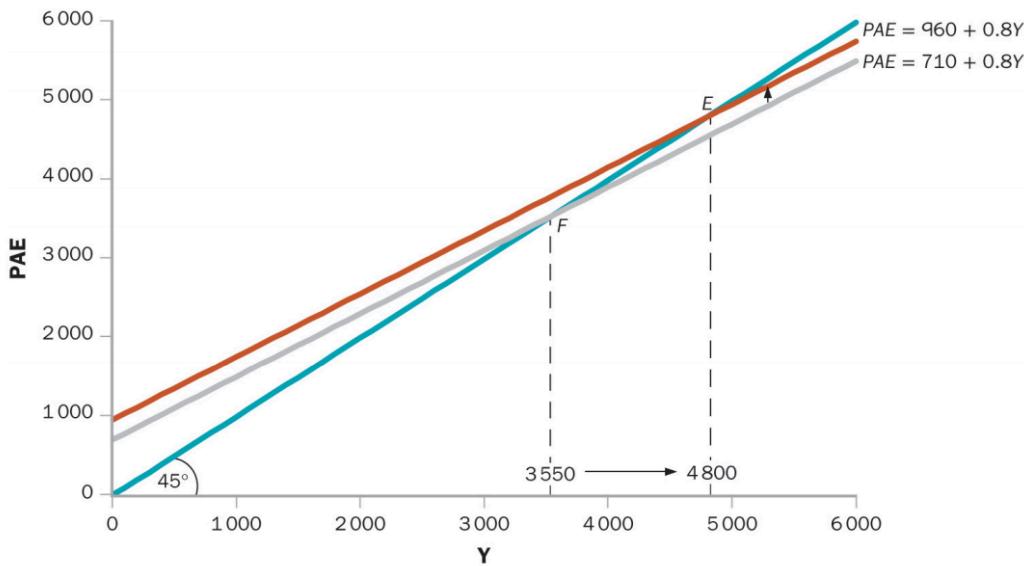
## The Multiplier

- Notice that  $Y$  fell by more than the exogenous change in PAE. This is due to the multiplier process, where a change in  $Y$  induces further changes in PAE that lead to further changes in  $Y$ .
- Where does this feedback loop between PAE and  $Y$  end?
- The multiplier is how much a \$1 exogenous change in PAE leads to a total change  $Y$  in equilibrium.
- Letting  $x = [c(1 - t) - m]$ , the model suggests that the multiplier will be  $1 + x + x^2 + x^3 + \dots$
- If  $x = 0.8$ , the multiplier is 5 i.e. a \$250 decline in planned spending leads to a \$1250 decline in  $Y$ .

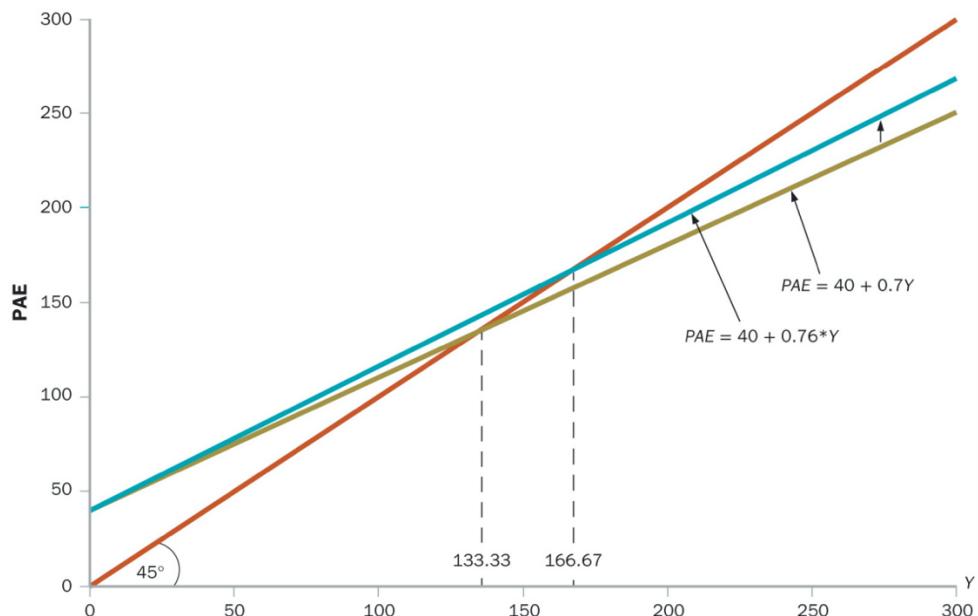
## **Stabilisation Policy**

- The larger the multiplier, the more prone the economy is to large swings in economic activity given economic shocks.
- Automatic stabilisers like progressive taxation and counter-cyclical monetary policy can reduce the multiplier, at least in principle.
- The Great Moderation seems to have been due more to smaller shocks and better inventory management than better policy.
- The model suggests that fiscal policy can be used to offset a negative shock like the COVID crisis.
- The multiplier in practice: Fazzari, Morley and Panovska estimate the multiplier using US GDP data and find it depends on the state of the economy.
- The multiplier is large where there is a large negative output gap (excess slack) than when the economy is close to potential.

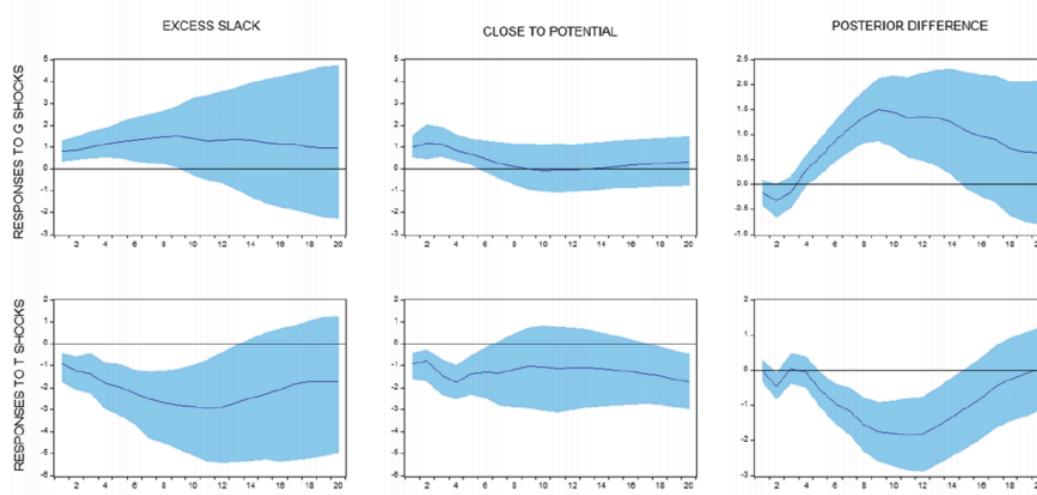
### **An Increase in Government Purchases to Eliminate a Contractionary Gap**



## A Cut in the Tax Rate to Eliminate a Contractionary Gap



## State Dependent Effects of Fiscal Policy



**Figure 3:** Dollar-for-dollar effects of government spending and taxes on output.

## COVID Crisis and Possible Sources of Economic Recovery

- The crisis involved a restriction on supply with lockdowns, but also a more persistent fall in demand.
- Precautionary saving tends to increase following pandemics. The coordination problem says that if we all try to save more, output will fall ("Paradox of Thrift").
- Monetary policy cannot stimulate by lowering interest rates. We need alternative engines of growth: exports (China is recovering) and fiscal stimulus.
- The stock market is Keynesian.
- Recover in consumer sentiment is encouraging.

## Lecture 11 – Unemployment and Inflation

### **Labour Force Definitions**

- Unemployment Rate = Unemployed Persons/Labour Force x 100%
- Labour Force = Employed Persons + Unemployed Persons
- Participation Rate = Labour Force/Working-Age Population x 100%
- Someone is unemployed if seeking work, but they do not have a job. Not all of the population participates in the labour force, such as discouraged workers.

### Underemployment and Hours

- In Australia, the unemployment rate did not increase as much as in many other countries with the COVID crisis.
- Many workers retained classification as ‘employed’, in part due to the emergency JobKeeper program, but underemployment (employed workers who would like to work more) rose and hours fell dramatically in the crisis.

### Types of Unemployment

- There are three major types of unemployment:
  - Frictional unemployment (due to time for search and matching).
  - Structural unemployment (due to skills-mismatch).
  - Cyclical unemployment (due to the business-cycle).
- Frictional and structural unemployment mean that zero unemployment would be inefficient.
- Different policies are needed to address structural and cyclical unemployment.

### The Natural Rate of Unemployment ( $u^*$ )

$$u^* = \frac{\text{frictional} + \text{structural unemployment}}{\text{labour force}} \times 100\%$$

- The natural rate varies over time for many reasons including demographics, sectoral shifts, changes in matching technologies.
- Natural in the sense that unemployment rate gravitates towards it over time.

### Okun's Law

$$100\% \times \left( \frac{Y - Y^*}{Y^*} \right) = -2 \times (u - u^*)$$

- Labour is the main input into production and full employment corresponds to zero cyclical unemployment.
- Cyclical unemployment and the output gap have a strong negative relationship.
- The 1ppt increase in the US unemployment rate in October led to a 1.9% increase in the output gap nowcast.

### **Measuring Inflation**

- Inflation is a persistent general increase in prices.
- Deflation is a persistent general decrease in prices, while a ‘disinflation’ is a fall in the rate of inflation.

- Beyond the GDP Deflator, other measures of the general price level used to calculate inflation include the CPI, PPI, and the PCE Deflator.
- The CPI (Consumer Price Index) is the most widely used measure in contracts and focusses on the cost of living for households.
- It measures the cost of a basket of goods and services for a typical household based on surveys of household purchases and posted prices.
- Like the GDP deflator, it is measured as an index equal to 100 in a base year, but keeps quantities fixed rather than prices.

### **Calculating the CPI**

- Suppose a typical household buys 40 bananas and 4 books every year. If the prices in 2019 were \$0.50/banana and \$20/book, the cost of the basket is  $\text{CPI}_{2019} = \$100$ .
- If prices in 2020 change to \$1/banana and \$25/book, the cost of the basket increase to  $\text{CPI}_{2020} = \$140$ .
- The inflation in 2020 will be 40%.

### **Measurement Issues**

- The CPI may overstate inflation given substitution bias and quality adjustments.
- Headline CPI inflation can include temporary shocks such as to bananas following Cyclone Yasi in 2011.
- Policymakers also look at underlying measures of inflation that strip out volatile food and energy prices.

### **Costs of Inflation**

- High inflation tends to be volatile. Surprise inflation hurts lenders, which may lead to higher real borrowing costs.
- Bracket creep for taxes may make taxes less progressive than intended.
- Cash holders suffer an “inflation tax” via loss of purchasing power (does this hurt the rich or the poor though?).
- Inflation can spiral out of control into a “hyperinflation” (inflation greater than or equal to 50%), often resulting in economic collapse.
- Policies to bring down even moderate levels of inflation can be costly in terms of high unemployment.

### **Costs of Deflation**

- Surprise deflation hurts borrowers, who face higher real debt burdens and risk financial ruin.
- Debt-deflation spiral of the Great Depression fits with the massive fall in exogenous consumption  $\bar{C}$  in the Keynesian Cross model.
- Fall in  $\bar{C}$  reflected attempts to save to pay down debts, but was self-defeating as  $Y$  (and prices) fell further.
- Deflation clearly increases chances that monetary policy will be constrained by the ZLB on nominal interest rates.
- Fisher Effect:  $\downarrow i = r + \downarrow \pi$ , where  $i$  is the nominal interest rate,  $r$  is the real interest rate and  $\pi$  is inflation.
- If  $i = 0$ , then a fall in inflation leads to an increase in the real cost of borrowing  $\uparrow r = -\downarrow \pi$ .

## What Causes Inflation?

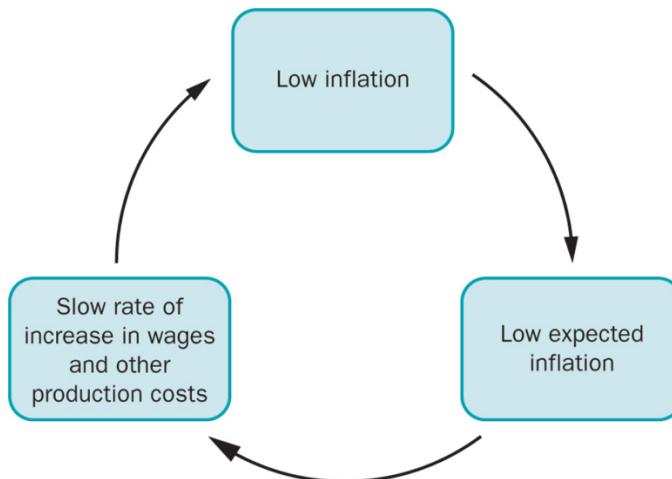
- Inflation is a monetary phenomenon (e.g. David Hume and discovery of the New World).
- Strong link over long periods of time between money growth and inflation.
- So called “Modern Monetary Theory” (MMT) idea that government spending can be financed by printing money is dangerous.
- Idea that printing money won’t be inflationary as long as there is unemployment reflects a naïve understanding of what drives inflation.

## How Does Monetary Policy Affect Inflation?

- Monetary policy influences inflation via inflation expectations and the output gap.
- Inflation in many economies also affected by external forces such as the foreign output gap, exchange rate passthrough, and oil prices.
- Research finds that forward-looking expectations have become more important and better anchored under inflation targeting.
- A Phillips curve relationship between inflation and the output gap exists and is more stable than some economists have argued. This holds for both advanced and emerging market economies.

## Understanding Inflation

- Inflation mechanically reflects price and wage setting in the economy.
- It is persistent ('inertial') due to self-fulfilling expectations.



## The Phillips Curve

Mathematically,

$$\pi_t = \pi_t^e + \beta \left( \frac{Y_t - Y^*}{Y^*} \right) + \epsilon_t$$

or, from Okun's law,

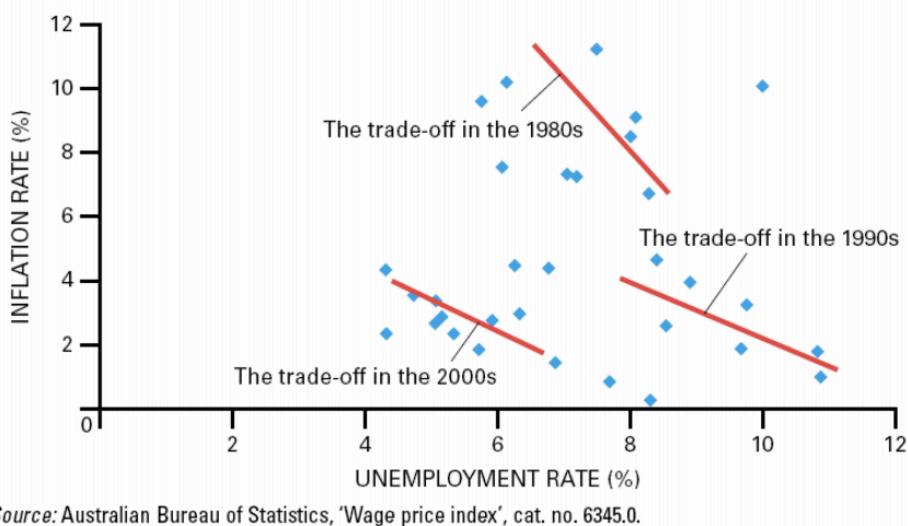
$$\pi_t = \pi_t^e - b(u_t - u^*) + \epsilon_t$$

where  $b = 2 \times \beta$

- $\beta > 0$  is the slope of the Phillips Curve that reflects wage/price pressures given the output gap/cyclical unemployment.
- Cost-push shock,  $\epsilon_t$ , captures exogenous forces such as large changes in oil prices.

- $\pi_t^e$  is expected inflation, where traditional “accelerationist” assumption  

$$\pi_t^e = \pi_{t-1} \Rightarrow \Delta\pi_t = \beta \left( \frac{Y_t - Y^*}{Y^*} \right) + \epsilon_t \Rightarrow v. \text{ persistent } \pi$$
- “Hybrid” Phillips curve assumption:  $\pi_t^e = (1 - \gamma)\pi_{t-1} + \gamma E_t [\pi_{t+1}]$ , where  $E_t [\pi_{t+1}]$  corresponds to forward-looking expectations.
- A change in the output gap due to a change in monetary policy or any change in PAE will cause a trade-off along the Phillips curve.
- A cost-push shock (e.g. a temporary spike in the price of bananas) will cause a temporary movement off the Phillips curve.
- A change in inflation expectations will cause a shift in the Phillips curve.



### The Sacrifice Ratio and the Failure of MMT

- Sacrifice ratio corresponds to lost output/higher unemployment needed to bring inflation expectations down.
- The larger the weight  $(1 - \gamma)$  on  $\pi_{t-1}$ , the more persistent expectations  $\pi_t^e$  and the larger the sacrifice ratio.
- Inflation targeting seems to anchor inflation expectations, increasing weight  $\gamma$  on forward-looking expectations  $E_t [\pi_{t+1}]$  and lowering the sacrifice ratio.
- MMT forgets that printing money to pay the bill doesn't just affect the output gap, but will also increase  $E_t [\pi_{t+1}]$ , potentially creating a self-fulfilling prophecy of hyperinflation.
- Bringing expectations back down after high inflation would be costly, especially given less credibility for politically-driven central banks.

## Lecture 12 – Macroeconomic Policy

### **Monetary Policy and the Interest Rate Transmission Mechanism**

- The quantity of money in the economy affects the price level in the long run. Thought experiment: replace all “1s” with “2s” or removal of “000,000s” after a hyperinflation.
- In the short run, the quantity of money influences real economic activity via an interest rate transmission mechanism.
- Central banks can set the overnight interest rate because they can conduct open market operations buying/selling government bonds to influence the reserves held by banks.
- The OCR affects longer-term interest rates thought “Expectations Hypothesis” linking longer rates to expected future short rates.

### Nominal vs Real Interest Rates

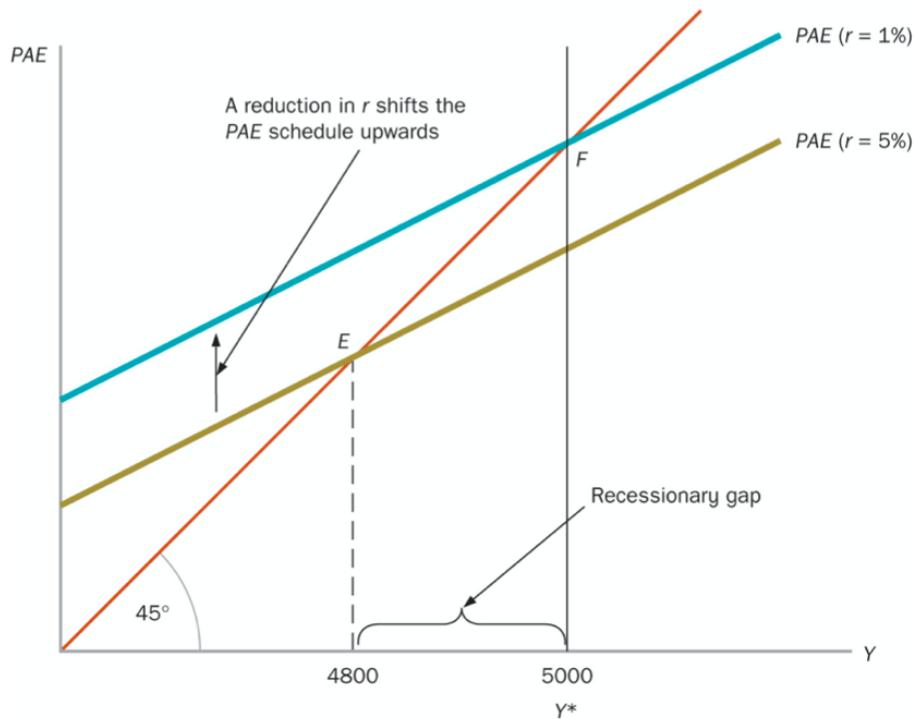
- Recall that:  $i = r + \pi$
- If inflation and expected future inflation are stable in the short run ( $\pi = \bar{\pi}$ ), a change in the OCR alters real interest rates e.g.  $\downarrow r = \downarrow i - \bar{\pi}$
- The real interest rates affect real economic activity through the following channels:
  - Intertemporal substitution ( $\downarrow r \Rightarrow \downarrow S \Leftrightarrow \uparrow C$ )
  - Interest-rate sensitive investment ( $\downarrow r \Rightarrow \uparrow I^P$ )
  - Wealth effect ( $\downarrow r \Rightarrow \uparrow P_{stocks, houses} \Rightarrow \uparrow C$ )
  - Cash flow for borrowers ( $\downarrow r \Rightarrow \downarrow \text{interest payments} \Rightarrow \uparrow C, I^P$ )
  - Exchange rate/trade ( $\downarrow r \Rightarrow \downarrow e^{TWI} \Rightarrow \uparrow X - M$ )

### **Monetary Policy in the Keynesian Cross Model**

#### Planned Aggregate Expenditures and the Real Interest Rate

- An increase in  $r$  leads to a fall in  $C, I^P, X - M$  and vice versa, that is PAE has a negative relationship with  $r$ .
- A change in  $r$  will cause a shift in the level of the PAE curve and change equilibrium  $Y$ .
- A fall in  $r$  will shift the PAE curve up and increase  $Y$  through the multiplier effect.
- A rise in  $r$  will shift the PAE curve down and lower  $Y$  through the multiplier effect.

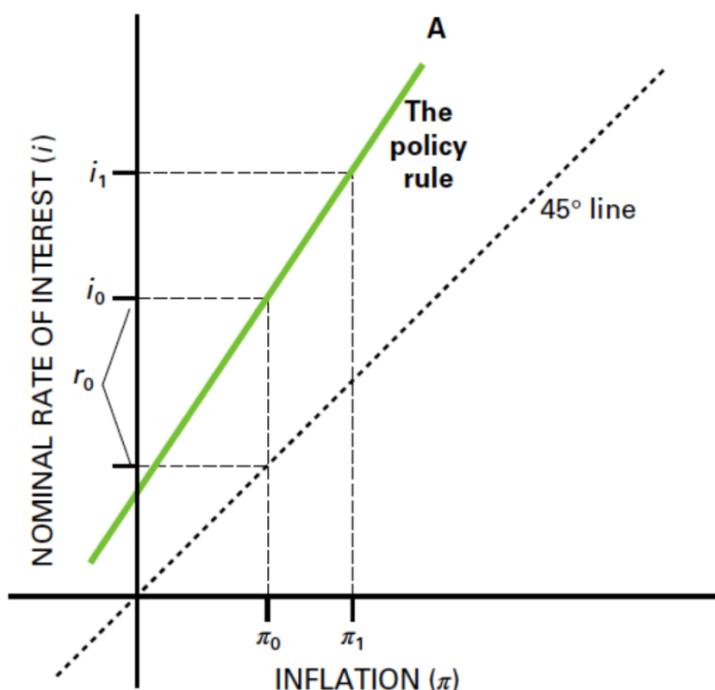
## The RBA Fights a Recession



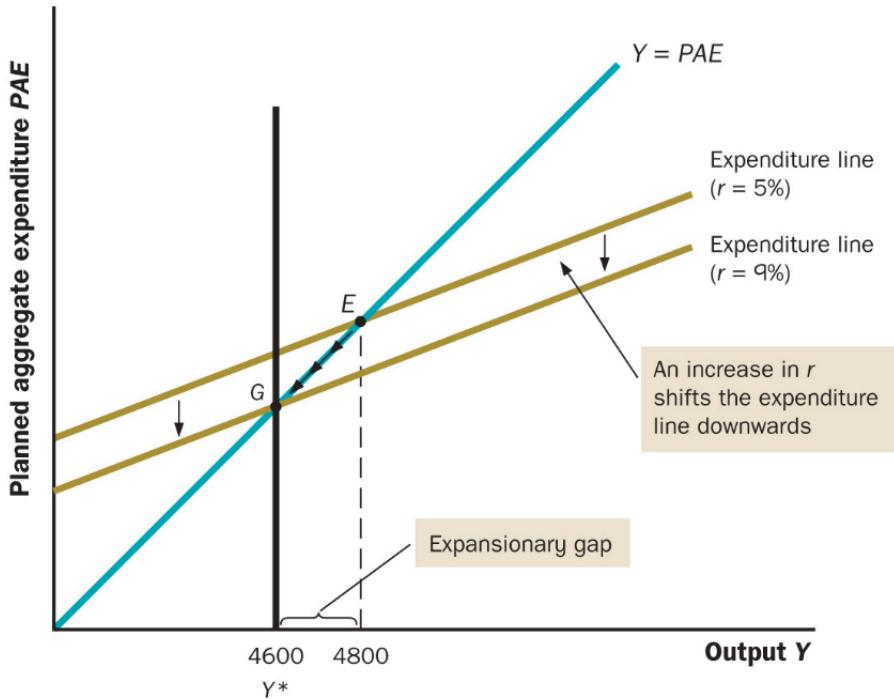
## **Inflation Targeting and the Monetary Policy Reaction Function**

- Suppose the RBA cut rates so much that it overshoots  $Y^*$  and creates an expansionary gap (i.e. a positive output gap).
- The Phillips curve suggests this would lead to higher inflation.
- In practice, the RBA tries to target inflation between 2-3%. Thus, it would respond to higher inflation by increasing the OCR to bring real GDP back to potential and inflation into its target range.
- This response can be captured by a monetary policy reaction function that describes how the policy interest rate should be adjusted more than one-for-one to inflation.

## The Policy Reaction Function



## The RBA Fights Inflation



## **The Zero Lower Bound and Unconventional Monetary Policy**

- There is an effective lower bound on nominal interest rates close to zero (ZLB).
- Cash provides a substitute store of value that pays an implicit 0% nominal interest rate.
- The ZLB occurred in the Great Depression, Japan in recent decades and in many countries during the GFC, and even more now including Australia.
- Monetary policy can use two more unconventional, yet widely used tools:
  - Large scale asset purchases (LSAP, aka Quantitative Easing).
  - Forward guidance
- LSAP can alter the portfolio of assets held by the public (e.g. maturity of government debt) and lower risk spreads, but not clear how effective it is in stimulating the economy and it can have distributional effects.
- Forward guidance about keeping interest rates lower for longer appears to be more effective.
- Commitment to deviate from regular policy reaction function until a calendar date or certain conditions are achieved.
- However, fiscal policy is a more straightforward means of stimulus when the economy hits the ZLB.

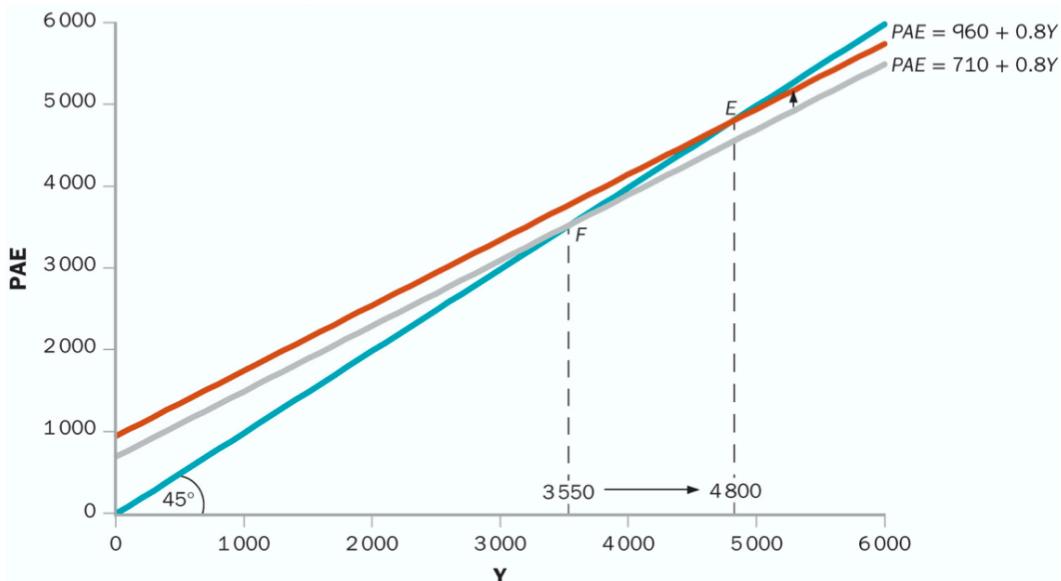
## **Fiscal Policy vs Monetary Policy**

- Discretionary fiscal policy is seen as inferior to monetary policy away from the ZLB given long inside lags, but it can address distributional issues e.g. progressive income taxation.
- Fiscal policy can create automatic stabilisers to decrease the multiplier and possibly reduce the probability of recession.

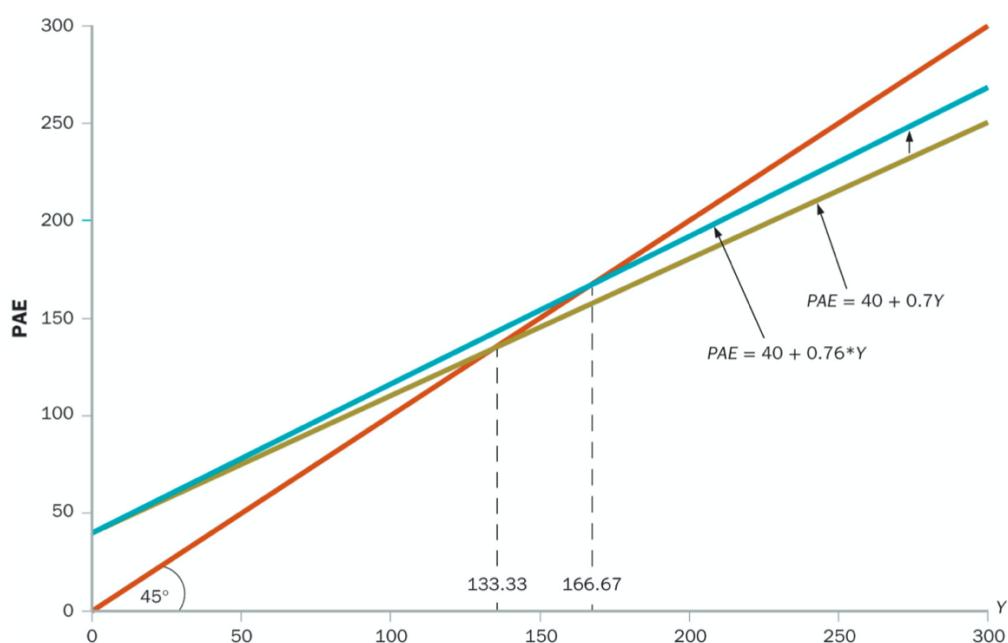
→ E.g.  $T = \bar{T} + tY$  with net transfer payments (i.e.,  $\bar{T} < 0$ ) implies progressive taxation, noting that the multiplier for the full Keynesian Cross model is  $\frac{1}{1-c+ct+m}$ .

- High levels of debt can lead to crisis if bond markets ascertain that a government will be unable to raise enough taxes to pay back its debts or catch wind of a plan to monetise debt i.e. use an inflation tax.
- The ability to pay back debts depends on the size of the economy, so economists look at debt-to-GDP ratios and structural deficits (i.e. what would the budget balance be at full employment).
- Unlike monetary policy, fiscal policy is not constrained by the ZLB and may have shorter outside lags, although marginal propensities to consume may be smaller if households anticipate higher future taxes.

### An Increase in Government Purchases to Eliminate a Contractionary Gap



### A Cut in the Tax Rate to Eliminate a Contractionary Gap



### **Macroeconomic Policy Response to the COVID-19 Crisis**

- RBA monetary policy response involved:
  - immediately cutting OCR to 25bps (now 10bps)
  - yield curve control (3-year AGS target now 10bps)
  - forward guidance

- term funding facility
- some LSAP (\$100b of 5-10 year government bonds)
- Treasury fiscal policy response involved:
  - JobKeeper social insurance program
  - Estimated deficit for 2020-21 is \$213.7b, which is 11% of real GDP
  - Mix of tax cuts and increased government purchases, but will tax cuts just be saved?
  - Deferring budget repair until “the unemployment rate is comfortably below 6 per cent”
  - Cost of borrowing is low and recovery in GDP should help keep debt-to-GDP at manageable levels

### **Policy Trade-Offs**

- Clearly important to manage health crisis to allow economic recovery.
- Evidence suggest behavioural responses would have led to recession even without lockdowns.
- News about possible vaccine is promising.
- Paradox of thrift applies if we all try to save given uncertainty, so deficit-financed stimulus is timely.
- Many challenges in emerging market economies with less fiscal space.