Summary of Macroeconomic Models – ECS2602

COMPILED BY S KENNEDY-PALMER & T UYS 2015
(REVISED MARCH 2017)

Important information

- The purpose of this summary is to show you how the various models developed in this module are connected. This is a compliment to the study plan laid out in the MO001 and does not replace it.

- In this summary we will only refer to an expansionary fiscal policy (increase in government spending and/or a decrease in taxes) and an expansionary monetary policy (money supply increases). The relevant curves will shift in the opposite direction for a contractionary fiscal and monetary policy. **You must be able to illustrate and evaluate both contractionary and expansionary policies for examination purposes.**

- Unless otherwise specified, diagrams are taken from the MO001, if you do not understand the diagram refer back to the MO001 before you continue.

The Goods Market Model

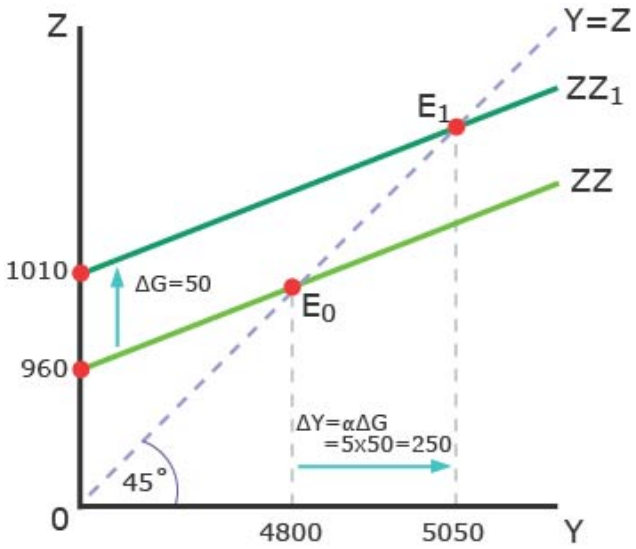


Diagram 2.12. Increase in government spending

Equation for the demand curve (ZZ):
$Z = c_0 + \bar{I} + G - cT + cY$

A change in I, c_0, G or T will shift the curve.
eg T↓ ⇒Y_D↑ ⇒ C↑ ⇒ Z↑⇒ Y↑

A change in c (marginal propensity to consume) will change the slope of the curve.

Diagram 2.12: an expansionary fiscal policy shifts the ZZ curve upwards which increases the demand for goods and services and increases the level of output and income.
Chain of events: G↑ ⇒ Z↑⇒ Y↑

Equilibrium condition: $Y = \frac{1}{1-c}(c_0 + \bar{I} + G - cT)$

How to Derive the IS curve

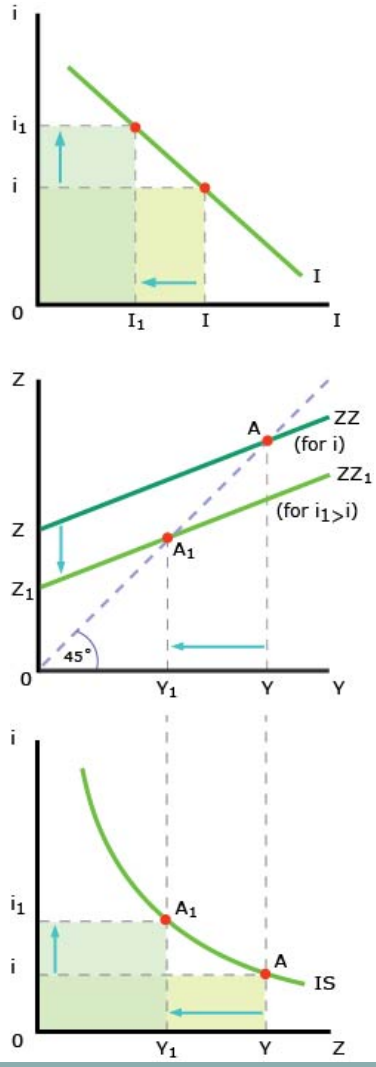


Diagram 4.3: the IS curve is derived from the ZZ curve in the goods market model.
By assuming a change in the interest rate which changes investment spending and shifts the ZZ curve which leads to a change in the level of output and income.

A change in any of the **autonomous or exogenous** components of ZZ will **shift** the IS curve. ie c_0, $\bar{I}$, G or cT

- An increase in consumer confidence: $c_0\uparrow$ will shift the IS curve to the right
- An increase in investor confidence: $\bar{I}\uparrow$ will shift the IS curve to the right
- Expansionary fiscal policy: $G\uparrow$ and/or $T\downarrow$ will shift the IS curve to the right

Note that both investment and consumption have **endogenous** components. Part of investment reacts to a change in the interest rate and part of consumption spending reacts to changes in income. A change in the endogenous components result in a **movement** along the IS curve.

Diagram 4.3. Derivation of an IS curve

The Financial Market Model

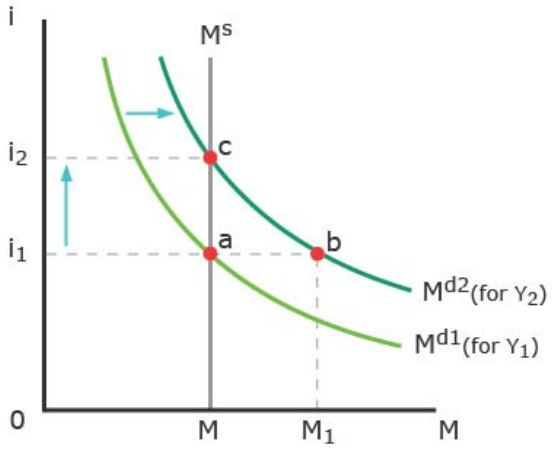


Diagram 3.6. A change in income and the interest rate

The money demand curve is determined by the active and passive demand for money.

$i\downarrow \Rightarrow$ passive demand for money$\uparrow \Rightarrow M^d\uparrow$ (**movement** along M^d upwards)
$Y\uparrow \Rightarrow$ active transactions$\uparrow \Rightarrow M^d\uparrow$ (**shift** of M^d to the right)

An increase in income (Y is **endogenous**) shifts the M^d curve to the right which results in a higher interest rate given the money supply. See diagram 3.6.

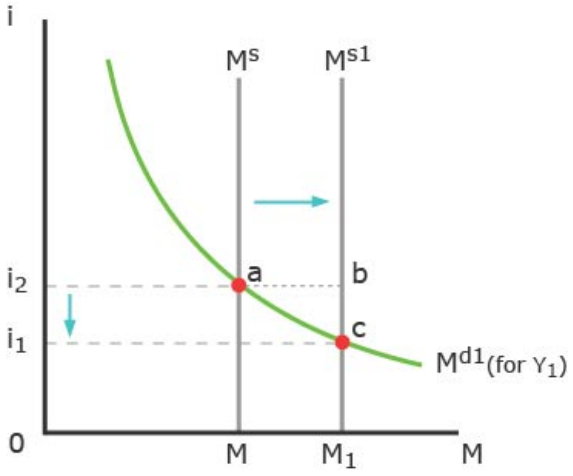


Diagram 3.7. An increase in the supply of money

Money supply (M^s) is **exogenously** determined by the central bank. When the central bank wants to stimulate economic activity (increase the level of output and income) it buys bonds through the open market. Money flows from the central bank into the market, thus the money supply increases, M^s shifts to the right and as a result the interest rate declines.

Diagram 3.7: Expansionary monetary policy:
$M^s\uparrow$: $D_B\uparrow \Rightarrow P_B\uparrow \Rightarrow i\downarrow$

How to Derive the LM curve

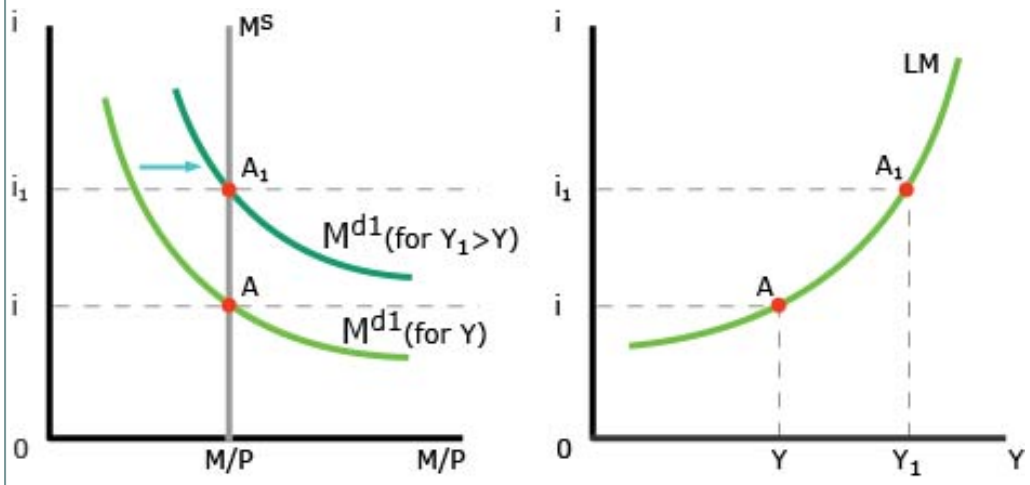


Diagram 4.7: the LM curve is derived from the M^d curve in the financial market.

By assuming a change in the level of output and income which shifts the demand for money curve and results in a change in the interest rate.

Diagram 4.7. Derivation of an LM curve

A change in the level of output and income (**Y**) is an **endogenous** variable and results in a **movement** along the **LM** curve.

A change in the money supply (**M^s**) is an **exogenous** variable and results in a **shift** of the **LM** curve.
Eg. An increase in the money supply will shift the LM curve downwards (to the right).

IS-LM Model in a Closed Economy

Monetary and fiscal polices have different effects on the interest rate so a policy mix can be used to achieve certain objectives.

For example, expansionary policies result in an increase in the level of output and income (**Y↑**) but an expansionary monetary policy results in a decrease in the interest rate (**i↓**) whilst an expansionary fiscal policy results in an increase in the interest rate (**i↑**).

If the macroeconomic goal is to increase output without a change in the interest rate, then an expansionary fiscal policy combined with an expansionary monetary policy could be used. See diagram 4.21.

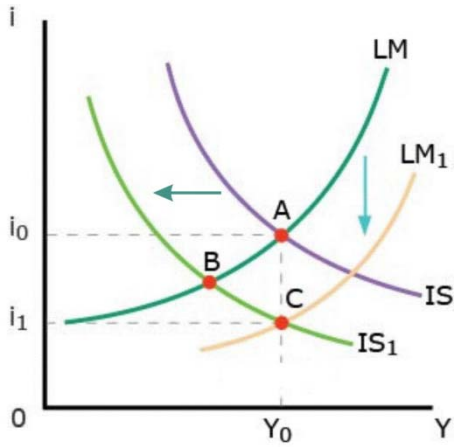


Diagram 4.20. The use of a policy mix in the IS-LM model

If the goal is to decrease the budget deficit (budget deficit is where taxes < government revenue therefore to decrease a deficit either G↓ and/or T↑) whilst not worsening the unemployment problem (ie without decreasing output), then a contractionary fiscal policy can be combined with an expansionary monetary policy. See diagram 4.20.

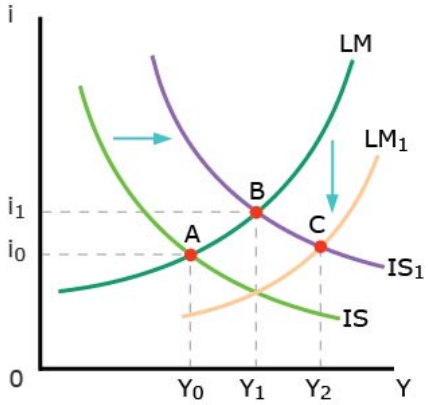


Diagram 4.21. Using a policy mix to keep the interest rate the same

Note: you must understand the limits to policy. For example, in a liquidity trap monetary policy is not effective.

The Foreign Sector – Current Account

The foreign sector primarily affects the local economy through the Current Account and the Financial Account of the Balance of Payments.

Current Account

- Two main components are imports and exports
- Affects the goods market, IS curve and the trade balance
- **Exports (X)** are:
  - Positively related to the level of output of a countries trading partners ($\mathbf{Y^*\uparrow \Rightarrow X\uparrow}$)
  - Negatively related to the real exchange rate ($\mathbf{\varepsilon\uparrow \Rightarrow X\downarrow}$)
  - Not affected by the local level of output ($\mathbf{Y\Delta \neq X}$) ie it is an **exogenous** variable. But an increase in exports increases local output ($\mathbf{X\uparrow \Rightarrow Y\uparrow}$)
- **Imports (IM)** are:
  - Not affected directly by changes in the level of output in a countries trading partners ($\mathbf{Y^*\Delta \neq IM}$)
  - Positively related to the real exchange rate ($\mathbf{\varepsilon\uparrow \Rightarrow IM\uparrow}$)
  - Positively related to the level of output of the local economy ($\mathbf{Y\uparrow \Rightarrow IM\uparrow}$). Ie it is an **endogenous** variable
- We assume an increase in the relative price of South African goods (EP) compared with foreign goods (P*) increases the real exchange rate. Therefore there is a positive relationship between E and ε. ($\mathbf{E\uparrow \Rightarrow \varepsilon\uparrow}$)
- Example: A depreciation will lead to an increase in exports which will shift the NX curve to the right, imports become more expensive and decrease, thus improving the trade balance ($E\downarrow \Rightarrow X\uparrow \Rightarrow NX\uparrow \Rightarrow Z\uparrow \Rightarrow Y\uparrow$ and $E\downarrow \Rightarrow IM\downarrow \Rightarrow NX\uparrow \Rightarrow Z\uparrow \Rightarrow Y\uparrow$). The higher level of Y will shift the ZZ curve upwards and cause a rightward shift of the IS curve. The increase in output will also increase imports therefore the trade balance deteriorate, whilst the depreciation will make the imports bill more expensive. We assume that the **Marshall-Lerner condition holds**, thus a depreciation will lead to an improvement in the trade balance (the positive effect outstrips the negative).

The Foreign Sector – Financial Account

Financial Account

- We look at capital flows, ie investment that follows the highest rate of return (interest)
- Affects the financial market, LM curve and the exchange rate
- An increase in the interest rate creates an inflow of capital and leads to an appreciation of the local currency because an increase in the domestic interest rate relative to that of the rest of the world increases the attractiveness of domestic bonds since the rate of return offered on domestic bonds is higher than that offered in the rest of the world therefore there is an increased demand for the local currency, which appreciates.
- A decrease in the interest rate creates an outflow of capital and leads to a depreciation of the local currency

Example: an increase in government spending (IS shifts to the right) will lead to a rise in the interest rate which increases the nominal exchange rate and the domestic currency appreciates. This is represented by an upward movement along the interest parity relation in diagram 7.3(b). As the domestic currency appreciates, exports decrease and the trade balance deteriorates.

The appreciation of the currency also causes imports to be cheaper, and imports thus increase, which contributes to a further worsening of the trade balance.

$$i\uparrow \Rightarrow Capital_{inflow} \Rightarrow E\uparrow$$
$$E\uparrow \Rightarrow X\downarrow \Rightarrow NX\downarrow$$
$$E\uparrow \Rightarrow IM\uparrow \Rightarrow NX\downarrow$$

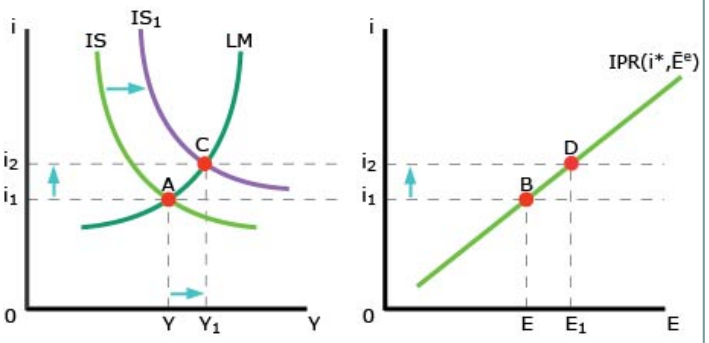


Diagram 7.3. Increase in government spending and exchange rate

How to Derive the AD curve

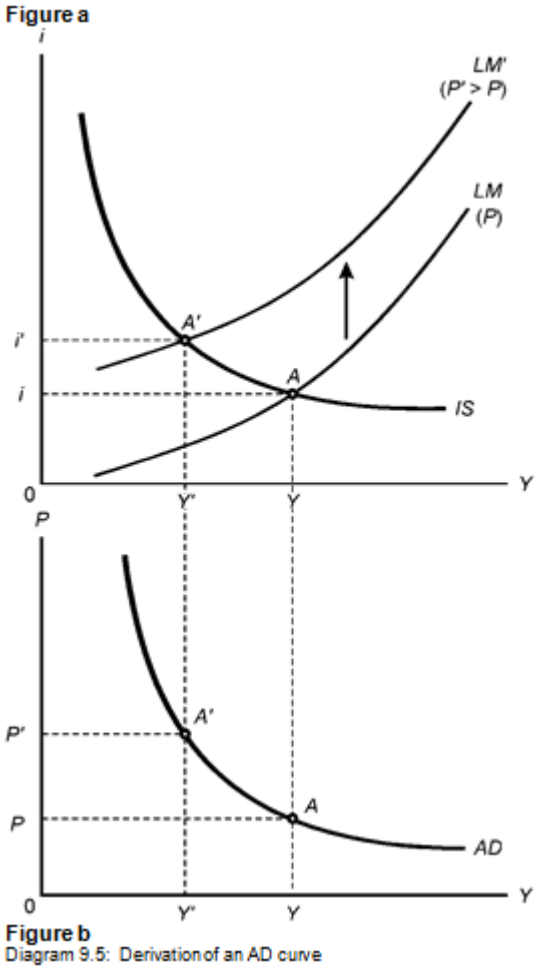


Figure b
Diagram 9.5: Derivation of an AD curve

Fiscal and Monetary policy are known as demand management policies and each will influence the AD (Aggregate Demand) curve. Therefore shifts in both the IS (through fiscal policy) and the LM (through monetary policy) curves will shift the AD curve.

We assume that prices are flexible in the AS-AD model (up until now we have assumed they are fixed). This means that the real money supply is equal to the nominal money supply divided by prices (M/P).

To derive the AD curve we assume a change in the price level. An increase in the price level implies that the real money supply (M/P) is lower therefore the **LM curve shifts upwards** (to the left).
In the financial market: $P\uparrow \Rightarrow M/P\downarrow$

As the real money supply decreases, the interest rate increases therefore in the goods market: $i\uparrow \Rightarrow I\downarrow \Rightarrow Z\downarrow \Rightarrow Y\downarrow$ which is represented by a **movement up the IS curve** from A to A‘.

Expansionary fiscal and monetary policies will **shift** the AD curve to the right.

The Labour Market

Up until now we have only looked at the demand side. We now introduce the **supply side**. In the labour market we assume that the actual price level is equal to the expected price level ($P = P^e$).

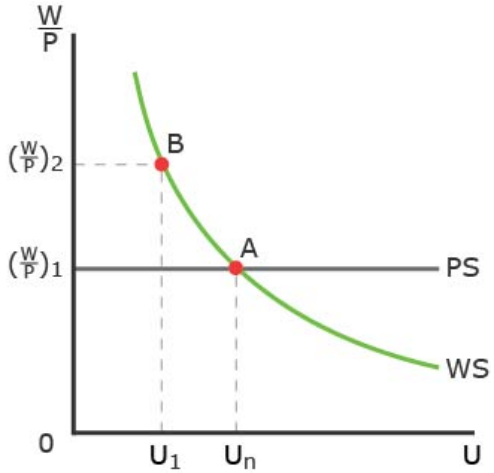


Diagram 8.8. Unemployment rate and targeted real wage

A change in the **unemployment rate** will lead to a **movement** along the wage-setting relation (WS curve).

A change in any of the other factors that affect the **bargaining position** of workers will **shift** the WS curve.
eg. An improvement in workers bargaining position shifts the WS curve upwards and the natural rate of unemployment is higher.

A change in the **mark-up** will lead to a **shift** of the price-setting relation (**PS curve**).
eg. An increase in the mark-up shifts the PS curve downwards and the natural rate of unemployment increases.

At the equilibrium position (point A in diagram 8.8) the targeted real wage implied by wage setting is equal to the real wage implied by price setting. At the equilibrium point, the rate of unemployment is equal to the natural rate of unemployment.

The AS curve

The AS (Aggregate Supply) relation captures the effects of output and income (Y) on the price level (P) and is derived from the behaviour of wages ($W = P^eF(u,z)$) and prices ($P = (1 + m)W$) in the labour market.

Remember that actual prices are only assumed to be equal to the expected price level ($P = P^e$), in the short run. That is why we distinguish between the short run and the medium run when dealing with the AS-AD model.

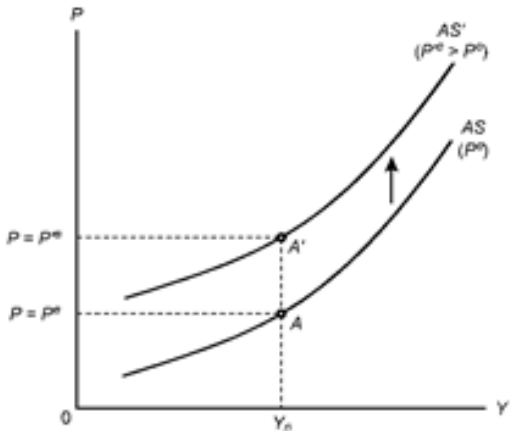


Diagram 9.3: Shift of an AS curve

The AS curve will **shift** if the **expected price level** changes.
eg. An increase in P^e shifts the AS curve upwards (to the left).

The AS curve will also **shift** if the **mark-up** by firms changes.
eg. An increase in the mark-up by firms shifts the AS curve upwards.

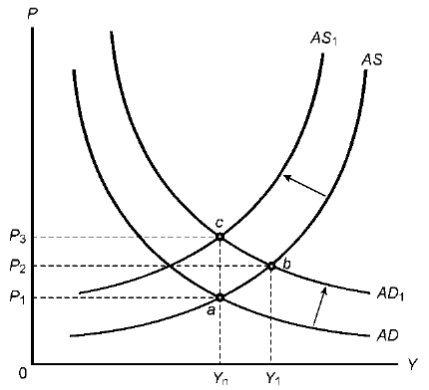
A **movement** along the AS curve could be due to a change in **the level of output and income, employment, unemployment, nominal wages** and the **price level**.

You need to understand the short run and medium run effects of monetary and fiscal policy on the various variables in the AS-AD model and you be able to explain policy changes on the AS-AD model through a chain of events and by illustration of the curves. Two examples on the next two slides are provided.

Expansionary Fiscal Policy in the AS-AD Model

An expansionary fiscal policy (G↑ and/or T↓) will shift the AD curve to the right to AD_1. **Goods Market: G↑ ⇒ Z↑ ⇒ Y↑**. The increase in output affects the **Financial Market: Y↑ ⇒ M^d↑ ⇒ i↑**. Back to the **Goods Market i↑ ⇒ I↓ but Y ↑ ⇒ I↑** therefore investment spending is indeterminate. The increase in output also affects **the Labour Market: Y↑ ⇒ N↑ ⇒ u↓ ⇒ W↑ ⇒ P↑**. This increase in prices results in a movement up the AS curve to point b. This is the **short run** equilibrium position. At this point the level of output and income is higher and the actual prices are higher than the expected price level.

Impact of an expansionary fiscal policy



The expected price level is revised upwards. **Labour Market: P^e↑ ⇒ W↑ ⇒ P↑** When this happens, the AS curve will shift and a new equilibrium will be reached, this is the **medium run equilibrium**. In this case the AS curve shifts upwards to AS_1 because price expectations were revised upwards. The higher prices affect the **Financial and Goods Market: P↑ ⇒ M/P↓ ⇒ i↑ ⇒ I↓ ⇒ Z↓ ⇒ Y↓**. In the medium run, the economy returns to the natural level of output and employment. The new equilibrium is at point c, with higher prices than before.

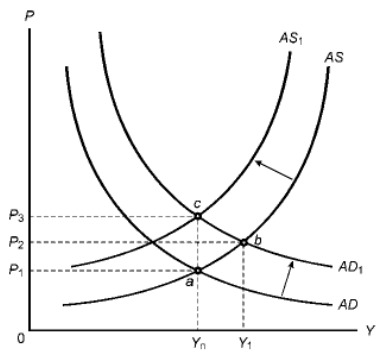
Impact of an Expansionary Fiscal Policy

Variable	Short Run	Medium Run
Expected Price Level (P^e)	Unchanged	Higher
Actual Price Level (P)	Higher	Higher
Nominal Wages (W)	Higher	Higher
Real Wages (W/P)	Unchanged	Unchanged
Real Money Supply (M/P)	Unchanged	Lower
Nominal Money Supply (M^s)	Unchanged	Unchanged
Interest rate (i)	Higher	Higher
Investment Spending (I)	Indeterminate	Lower
Level of output and income (Y)	Higher	Back to Y_n / Unchanged

Expansionary Monetary Policy in the AS-AD Model

An expansionary monetary policy ($M^s\uparrow$) will shift the AD curve to the right to AD_1. **Financial Market: $M^s\uparrow \Rightarrow M/P\uparrow \Rightarrow i\downarrow$**; the decrease in interest rates affects the goods market. **Goods Market: $i\downarrow \Rightarrow I\uparrow \Rightarrow Z\uparrow \Rightarrow Y\uparrow$**; the increase in output will increase the level of employment which will increase the bargaining power of workers, as a result nominal wages increase and firms respond by increasing the price level. **Labour Market: $Y\uparrow \Rightarrow N\uparrow \Rightarrow u\downarrow \Rightarrow W\uparrow \Rightarrow P\uparrow$**. This increase in prices is reflected by a movement up the AS curve to point b. This is the **short run equilibrium position.** At this point the level of output and income is higher and the actual prices are higher than the expected price level.

Impact of an expansionary monetary policy



The expected price level is revised upwards. **Labour Market: $P^e\uparrow \Rightarrow W\uparrow \Rightarrow P\uparrow$** When this happens, the AS curve will shift and a new equilibrium will be reached, this is the **medium run equilibrium**. In this case the AS curve shifts upwards to AS_1 because price expectations were revised upwards. The higher prices affect the **Financial and Goods Market: $P\uparrow \Rightarrow M/P\downarrow \Rightarrow i\uparrow \Rightarrow I\downarrow \Rightarrow Z\downarrow \Rightarrow Y\downarrow$**. In the medium run, the economy returns to the natural level of output and employment. The new equilibrium is at point c, with higher prices than before.

Neutrality of Money: Note that in the medium run, **money is neutral** meaning that only the nominal variables change. The real variables are unchanged because the increase in M^s is completely offset by an increase in the price level.

Impact of an Expansionary Monetary Policy

Variable	Short Run	Medium Run
Expected Price Level (P^e)	Unchanged	Higher
Actual Price Level (P)	Higher	Higher
Nominal Wages (W)	Higher	Higher
Real Wages (W/P)	Unchanged	Unchanged
Real Money Supply (M/P)	Higher	Back to initial level/ Unchanged
Nominal Money Supply (M^s)	Higher	Higher (Assuming authorities do not change M^s again, it will be at the same level as the short run)
Interest rate (i)	Lower	Back to initial level/ Unchanged
Investment Spending (I)	Higher	Back to initial level/ Unchanged
Level of output and income (Y)	Higher	Back to Y_n / Unchanged

Exogenous vs endogenous variables pg. 1

An exogenous (autonomous) variable is independent of the endogenous variable – the variable we are trying to explain – and, while it influences the endogenous variable, it is not influenced by it. In the models that we are developing, the main endogenous variable is the level of output and income (Y).

For example, an increase in the money supply (which is an exogenous variable) will start a chain of events working through the various endogenous variables that has an effect in all the models we have built in this module, up to the AS-AD model:

Financial market: $\mathbf{M\uparrow \Rightarrow M/P\uparrow \Rightarrow i\downarrow}$ (illustrated by a rightward shift of the M^s curve in the financial market. In the IS-LM model it is illustrated by a downward shift of the LM curve).

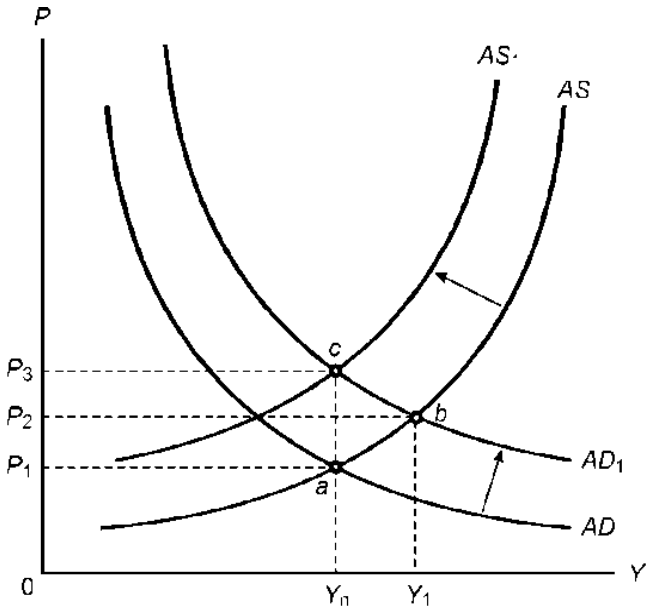
Goods market: The change in the interest rate will affect the goods market in the IS-LM or AS-AD models through the negative relationship between the interest rate and investment spending.
$\mathbf{i\downarrow \Rightarrow I\uparrow \Rightarrow Z\uparrow \Rightarrow Y\uparrow}$ (illustrated by a movement down the IS curve and these first two chain of events are illustrated by a rightward shift of the AD curve in the AS-AD model).

Labour market: An increase in the level of output and income increases the level of employment, decreasing the unemployment rate in the labour market and resulting in an increase in the bargaining position of workers who demand higher nominal wages leading to higher prices.
$\mathbf{Y\uparrow \Rightarrow N\uparrow \Rightarrow u\downarrow \Rightarrow W\uparrow \Rightarrow\ P\uparrow}$ (Illustrated by an upward movement along the WS curve in the labour market and an upward movement along the AS curve indicated by point b in the below AS-AD model)

– continued on next page -----

Exogenous vs endogenous variables pg. 2

Up until now we have been looking at the short run (the movement from point a to point b) where prices are fixed, however an increase in nominal wages has increased the price level from P_1 to P_2. The actual price level is now at P_2 but workers based their real wage negotiations on P_1. Workers respond to this by revising their price expectations upwards, we are now looking at the medium run (the movement from point b to point c)



Labour market: Workers revise their expected price level upwards and negotiated for higher nominal wages which again increased the actual price level.

$\mathbf{P^e\uparrow \Rightarrow W\uparrow \Rightarrow P\uparrow}$ (illustrated by an upwards shift of the AS curve)

AS-AD model: As the price level rises, the real money supply will decrease which has the effect of a contractionary monetary policy on the economy.

$\mathbf{P\uparrow \Rightarrow M/P\downarrow \Rightarrow i\uparrow \Rightarrow I\downarrow \Rightarrow Z\downarrow \Rightarrow Y\downarrow}$ (illustrated by an upward movement along AD_1 to point c)

Summary of assumptions pg. 1

Variable	Goods Market	Financial Market	IS-LM Closed economy	IS-LM Open economy	AS-AD Model
Consumption spending (C) $C = c_o + cY_D$	Exogenous AND Endogenous	Not applicable	Exogenous AND Endogenous	Exogenous AND Endogenous	Exogenous AND Endogenous
Exogenous components: Autonomous consumption (**c_o**) is influenced by access to credit, wealth, expectations etc. Marginal propensity to consume (**c**) is influenced by access to credit, wealth, expectations etc. ***Endogenous*** component: Disposable income (**Y_D**) when disposable income increases, a portion is spent according to the marginal propensity to consume (c) which is itself exogenous. (cY_D is called induced consumption.)					
Investment spending (I)	Exogenous only	Not applicable	Exogenous AND Endogenous	Exogenous AND Endogenous	Exogenous AND Endogenous
Exogenous component: Investment spending (**$\bar{I}$**) influenced by business confidence, expectations, regulations etc ***Endogenous*** component: Investment spending (**I**) is positively related to Y and negatively related to i					
Government spending and taxes (G & T)	Exogenous	Not applicable	Exogenous	Exogenous	Exogenous
Exogenous components: Government spending (**G**) and Taxes (**T**) are both controlled by Government.					
Money supply (M^s)	Assumed to be fixed	Exogenous	Exogenous	Exogenous	Exogenous
Exogenous component: Money supply (**M^s**) is controlled by the central bank					

Variable	Goods Market	Financial Market	IS-LM Closed economy	IS-LM Open economy	AS-AD Model
Money demand (M^d)	Fixed	Exogenous AND Endogenous	Exogenous AND Endogenous	Exogenous AND Endogenous	Exogenous AND Endogenous
Exogenous component: Money demand (**M^d**) is influenced by business confidence, expectations, etc. ***Endogenous*** components: Money demand (**M^d**) is positively related to the level of output and income (Y) Money demand (**M^d**) is negatively related to the interest rate (i)					
Foreign sector (X & IM)	None	None	None	Exogenous AND Endogenous	Exogenous AND Endogenous
Exogenous component: Exports (**X**) are positively related to the level of income and output of our trading partners (**Y***) ***Endogenous*** components: Exports (**X**) are negatively related to the real exchange rate (**ε**) Imports (**IM**) are positively related to the domestic level of income and output (**Y**) Imports (**IM**) are also negatively related to the real exchange rate (**ε**) Note: If prices are assumed to be fixed then the real exchange rate is equal to the nominal exchange rate. Ie ε = E					
Labour market (W, P & P^e)	Assumed to be fixed	Assumed to be fixed	Assumed to be fixed	Assumed to be fixed	Exogenous AND Endogenous
Exogenous components: Nominal wages (**W**) are positively related to institutional factors (z) eg labour laws, minimum wages etc Nominal wages (**W**) are positively related to the expected price level (P^e) Mark-up by firms (**m**) is determined by firms The expected price level (**P^e**) is fixed in the short run however in the medium run workers adjust their expected price upwards if the actual price level turned out to be higher than their expected price level when wages were bargained for last, and they will adjust their expected price level downwards if the actual price level turns out to be lower than their expected price level. ***Endogenous*** components: Nominal wages (**W**) are negatively related to the unemployment rate (u) The actual price level (**P**) is positively related to nominal wages (W) because an increase in nominal wages will result in an increase in the price of the product (because the mark-up by firms is exogenous). This will increase the price level.					