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TOPIC 1: THE IS-LM MODEL

1.1 The Goods Market

Theory: The Goods Market is determined by *demand for goods*. The demand for goods is calculated using the GDP –

$$GDP = C + I + G + NX$$

- **C: Consumption** – the goods and services purchased by *consumers*. Consumption is the largest component of GDP, accounting for 56% of Australia's.
- **I: Investment** – sometimes called fixed investment, 'I' is the sum of *non-residential investment* (the purchase of new plants and machines by firms) *and residential investment* (purchase of new houses or apartments).
- **G: Government Spending** – purchases of goods and services by federal, state and local governments. 'G' ***does not include government transfers***, such as Medicare or social security payments, ***nor interest payments on government debt***, because they are not purchases of goods or services.
- **NX: Net Exports = Imports (IM) – Exports (EX);**
    - **Im: Imports** – purchases of *foreign goods and services* by Australian consumers, firms and the government.
    - **Ex: Exports** – purchases of *Australian goods and services* by foreigners.
        - Thus, the difference between exports and imports is called ***net exports***, or the trade balance. If:
            - Exports = Imports – **trade balance**.
            - Exports > Imports – **trade surplus.**
            - Exports < Imports – **trade deficit.**

Inventory Investment

In any given year, *production and sales need not be equal*. Some of the goods produced in one year are not sold in that year, but rather in later years. On the other hand, some of the goods sold in a given year may have been produced in an earlier year. The ***difference between goods produced and goods sold in a given year*** – the difference between production and sales – is called ***inventory investment***:

- If Production > Sales – firms accumulate inventory, and inventory investment is positive.
- If Production < Sales – firm's inventories fall and inventory investment is negative.

Inventory investment is typically small, as firms prefer to sell instead of holding inventory, as inventory is costly to hold.

1.1.1 Demand for Goods

Theory: Total Demand for Goods is given by the following function –

$$Z \equiv C + I + G + X - IM$$

'Z' is referred to as an **identity**, or true by definition. 'Z' is the sum of consumption + investment + government spending + (imports – exports). However, if the economy is **closed** – that is, does not trade with the rest of the world so ***exports and imports are both zero*** (X=IM=0), the demand for goods is given by the following function –

$$Z \equiv C + I + G$$

1.1.2 Consumption (C)

Theory: Consumption decisions depend on many factors, but the main is *income* – or rather, ***disposable income***. This is the income that remains once consumers have a) *paid income taxes*, and b) *received transfers from the government*.

- When disposable income goes **up**, people buy **more goods**.
- When disposable income goes **down**, people buy **fewer goods**.

Consumption is denoted by the following function, called the ***consumption function***:

$$C = C(Y_D)$$

'C' is denoted by 2 parameters:

- **C(0)** – Consumption when Y (GDP) = 0. C(0) is what people *would consume* if their disposable income in the current year = 0. A natural restriction on C(0) is that, if income = 0, consumption *would still be positive* – people still need to survive. Thus, C(0) is always positive: people will ***dissave*** if their current income = 0; that is, they will consume either by selling assets or by borrowing. This is otherwise known as **autonomous spending** – spending independent of income.
- **C(1) -** Also known as the *marginal propensity to consume* (MPC), it gives the effect an additional dollar of disposable income has on consumption. It is given by the function **ΔC/ΔY**. For example, if C(1) = 0.6, $1 of additional disposable income increases consumption by 60c. There are 2 natural restrictions on C(1) –
  - C(1) is likely to be positive: an increase in disposable income is likely to lead to an increase in consumption.
  - C(1) is likely to be <1: people are likely to consume *only part* of any increase in disposable income and *save the rest*.

In addition:

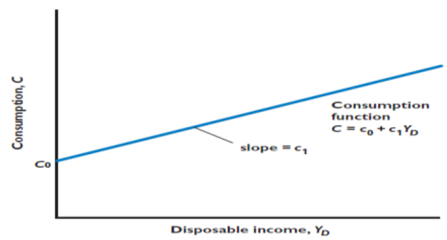
$$Y_D \equiv Y - T$$

- **Y =** Government transfers;
- **T** = Taxes. Bringing it all together, the consumption function is given by –

$$C = c_o + c_1 (Y - T)$$

Consumption and Disposable Income

Consumption, or 'C', is a function of income, 'Y' and taxes, 'T'. Higher income increases consumption, but *less than one for one* (because of the prevalence of tax). Additionally, higher taxes decrease consumption, also less than one for one. The Consumption Function is illustrated in the following graph:



Average Propensity to Consume (APC)

Average Propensity to Consume, or APC, shows the total amount of consumption at each given level of Y (considering that increases in income/taxes do not increase/decrease consumption on a 1:1 basis). It is given by the function **C/Y**.

1.1.3 Investment (I)

Theory: Investment is taken as given, or treated as an *exogenous variable*. However, this assumption is not innocuous. It implies that investment *does not respond to changes in production*. This is a bad description of reality. Firms that experience an increase in production may very well decide to increase their investment.

When investment is treated as an exogenous variable, it is given by the following function:

$$I = \bar{I}$$

1.1.4 Government Spending (G)

Theory: Government spending, 'G', together with taxes, 'T', describes *fiscal policy* – the combination of spending and taxes by the government –

- When taxes > government spending – **budget surplus**;
- When taxes < government spending – **budget deficit**;
- When taxes = government spending – **balanced budget**.

Like 'I', G and T are assumed to be exogenous.

Adding 'I' and 'G' to 'C' gives the **aggregate demand (AD) function** – given earlier by 'Z'.

1.1.5 Determination of Equilibrium Output (Closed Economy)

Theory: Assuming that X = IM = 0, the demand for goods is the sum of consumption, investment and government spending –

$$Z \equiv C + I + G$$

Equilibrium in the goods market requires that production, denoted by 'Y' be equal to the demand for goods, denoted by 'Z'; that is,

$$Y = Z$$

Thus, it can be said:

$$Y = c_0 + c_1(Y - T) + \bar{I} + \overline{G}$$

This is known as an **equilibrium condition**. In equilibrium, production – 'Y' – is equal to demand – 'Z'. Demand (Z) in turn depends on income (Y), which itself is equal to production.

Refer to APPENDIX A for illustration of Aggregate Demand

1.1.6 Income Multiplier

Theory: The Income Multiplier is given by the following calculation –

$$\mathbf{Y} = \mathrm{c}(0) + c(1)(Y - T) + \mathrm{I} + \mathrm{G}$$

$$\mathbf{Y} = \mathrm{c}(0) + c(1)Y - c(1)T + \mathrm{I} + \mathrm{G}$$

$$-c(1)Y + Y = \mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}$$

$$(\mathbf{1} - \mathbf{c}(\mathbf{1}))\mathbf{Y} = \mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}$$

$$\mathbf{Y} = \frac{\mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}}{1 - \mathrm{c}(1)} \longrightarrow \mathbf{Y} = \frac{1}{1 - \mathrm{c}(1)}[\mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}]$$

$[\mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}]$ – represents the part of the **demand for goods** that *does not depend on output* i.e. autonomous spending.

Can we be sure autonomous spending is positive?

We cannot, but it is very likely to be because:

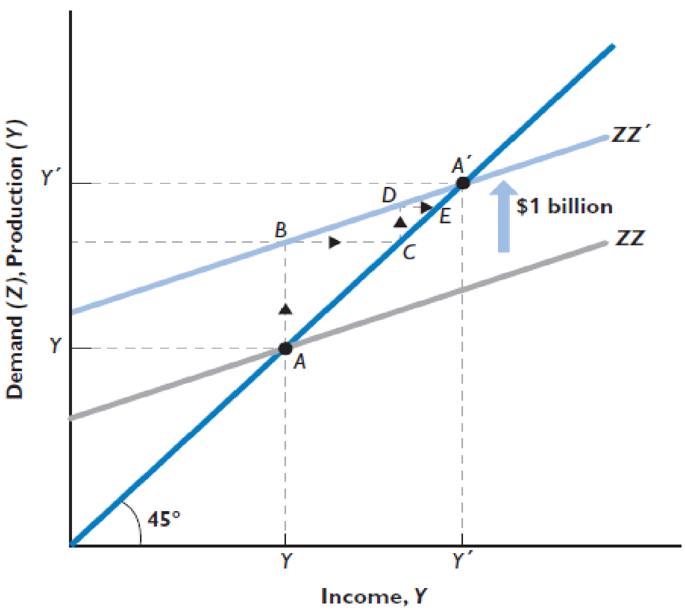
i. c(0) and I are both positive; and
ii. Suppose the government is running a **balanced budget** (where G=T). If G=T, and the *propensity to consume* (c(1)) is <1 – as assumed – then **G-c(1)T** is positive, as is autonomous spending. Only if the government was running a **very large budget surplus** – if T was much larger than G – could autonomous spending be negative. That is hardly the case.

$\frac{1}{1-c(1)}$ – because the *propensity to consume* (c(1)) is between 0 and 1, the term is a number ***greater than 1***. For this reason, this number – which *multiplies autonomous spending* – is called the **multiplier**. The closer c(1) is to 1, the larger the multiplier.

*NOTE: 'T' is assumed to be a lump sum tax; that is, where everyone has to pay the same amount.

<u>Income Multiplier – explained</u>

The income multiplier is essentially the *sum of successive increases in production resulting from an increase in autonomous demand/spending*. Refer to the diagram below for an illustration –



Aggregate Expenditure and the Income Multiplier

Suppose the economy is at the *initial equilibrium*, denoted by A, with production = Y. Now suppose c(0) increases by **$1bn**. Consumers will increase their consumption by the value between ZZ and ZZ' = $1bn.

The new intersection is at A', where the 45-degree line and the new demand curve (ZZ') intersect.

Equilibrium output increases from Y to Y'. This increase in output is ***larger than the initial increase in consumption of $1bn***. This is called the *multiplier effect*.

In other words, the *initial increase in consumption* leads to an increase in demand (ZZ → ZZ') of $1bn. At the initial level of income (Y), the level of demand is shown at 'B' – in line with initial equilibrium point A, but raised $1bn. To satisfy this higher level of demand, firms increase production (Y) by $1bn. This increase in production **implies income increases by $1bn** (as *income = production in equilibrium*), so the economy moves to point 'C'.

However, *this increase in income leads to a further increase in demand*. Demand (ZZ') is now shown by point D – in line with point C. Point D leads to a higher level of production and so on, until the economy is at A', where production = demand. This becomes the new equilibrium. Thus, it can be said that ***an increase in autonomous spending has a <u>more than 1-for-1</u> effect on equilibrium output***.

The increase in production as a factor of increase in demand can be thought of another – in **rounds**:

- The first round increase in demand, as shown by 'AB' above, equals $1bn. This leads to an *equal increase in production* of $1bn, also shown by 'AB', as well as an *equal increase in income* of $1bn, shown by 'BC'.
- The second round increase in demand, as shown by 'CD' equals *$1bn x propensity to consume* (c(1) x $1bn). This leads to an *equal increase in production*, also shown by 'CD', as well as an *equal increase in income*, shown by 'DE'.

Thus, if demand initially increases by $1bn, the *total increase in production* after 'n' rounds of increase in demand is given by -

$$1 + c_1 + c_1^2 + \ldots + c_1^n$$

This is called a **geometric series**. One property of geometric series is that, when c(1) < 1, the sum keeps increasing *but at a decreasing rate*, eventually reaching a limit given by the multiplier: $\frac{1}{1-c(1)}$. Thus,

Change in Production (ΔY) = Change in Autonomous Expenditure/Demand (ΔAE) x (1/1-c(1)).

In summary...

Production (Y) depends on demand (Z), which depends on income, as income = production = demand. An increase in demand, such as an increase in 'G', leads to an increase in production, which leads to an increase in income. This increase in income leads to a further increase in demand, which in turn leads to a further increase in production and so on. The end result is an **increase in output (production) which is larger than the initial shift in demand, by a factor equal to the multiplier**. In other words –

Any change in autonomous spending – whether I, G or T – will change output (Y) *by more than its direct effect on autonomous spending*.

FISCAL POLICY NOTE

For fiscal policy, there is a difference between a change in 'G' and a change 'T' with regards to Y (income). If both were to increase by the *same amount* (eg. $100m), and assuming an MPC of 0.5:

- Change in 'G' = $100m
- Change in 'T' = c(1) x $100 = $50m → given $(\mathbf{1} - \mathbf{c}(\mathbf{1}))\mathbf{Y} = \mathrm{c}(0) + \mathrm{I} + \mathrm{G} - \mathrm{c}(1)\mathrm{T}$.

The change in autonomous spending is not as high for 'T' as it is for 'G' because people cannot, and don't, spend all of their income when they pay tax.

1.1.7 Investment = Saving – An Alternative Approach to Goods-Market Equilibrium

Theory: Up until now, equilibrium in the goods market has been thought of in terms of the equality of production (Y) and the demand for goods (Z). Another way of thinking about equilibrium is to focus on *investment and saving* –

- **Saving** = *Private saving + Public saving*;
  - **Private Saving** = Saving by consumers; that is, disposable income (Y(D)) *minus* consumption (C). Or rather, income – taxes – consumption (Y – T – C);
  - **Public Saving** = taxes (T) *minus* government spending (G).
    - If T > G, public saving is **positive** and the government is running a **budget surplus**;
    - If T < G, public saving is **negative** and the government is running a **budget deficit**.

Now we return to the equation for **equilibrium in the goods market** (production = demand);

$$Y = C + I + G$$

Subtracting **taxes** (T) from both sides and moving consumption to the left hand side –

$$Y - T - C = I + G - T$$

The left hand side of the above equation is simply **private saving** (S), so –

$$S = I + G - T$$

Or equivalently –

$$I = S + (T - G)$$

On the left hand side is **investment**. On the right hand side is the *sum of private saving + public saving*. Thus, equilibrium in the goods market requires that **investment = saving**. Hence, the equilibrium condition for the goods market is called the **IS relation** (**I**nvestment equals **S**aving); that is to say, *what firms want to invest must be equal to what people and the government want to save*. This leads to 2 important characteristics of the goods market –

Characteristic 1: Consumption and Saving decisions are one and the same

Given their disposable income, once consumers have chosen consumption, their saving is determined by what is left. Consumption behaviour implies that –

$S = Y - T - C$, or rather, $\boldsymbol{S} = Y - T - c(0) - c(1)(Y - T)$

Rearranging gives the following equation: $\mathbf{S} = -c(0) + (1 - c(1))(Y - T)$.

Characteristic 2: The Propensity to Save

Just as 'c(1)' is called the *propensity to consume*, '(1-c(1))' is called the *propensity to save*. The propensity to save tells us **how much of an additional unit of income people save**. The assumption is that the *propensity to consume* is between 0 and 1. This implies that the *propensity to save* is also between 0 and 1. This means that:

Private saving increases with disposable income, *but by less than $1 for each additional dollar of disposable income.*

In equilibrium, I = S. Replacing **private saving** with **investment** in the equation above gives –

$$\mathbf{I} = -c(0) + (1 - c(1))(Y - T)$$

Solving for 'Y' (output):

$$\mathbf{Y} = \frac{1}{1 - c(1)}[c(0) + I + G - c(1)T]$$

It is not surprising that this formula is the same as the **income multiplier**. It is the same equilibrium, just looked at in a different way; that is, instead of *production = demand*, *investment = saving*.

The Paradox of Saving

We are often told that those who spend all their income are condemned to end up poor and that those who save are promised a happy life. Similarly, governments tell us, *an economy that saves is an economy that will grow and prosper*. However, the above model tells a different story:

Suppose that a given level of disposable income (Y – T - C), consumers decide to **save more**; that is, they *decrease c(0)*, decreasing consumption and thereby increasing saving. But what happens to output?

The equilibrium makes it clear that *equilibrium output decreases*: as people save more, they decrease consumption; but decreased consumption *decreases demand*, which *decreases production*. Hence, when looking at the equation: **S** = -c(0) + (1-c(1))(Y-T), -c(0) is higher (*less negative*). Consumers are saving more at any level of income, increasing saving, but on the other hand, the decreased output means their income is lower, decreasing saving!

Thus, given the following equation: **I** = S + (T – G), and the assumption that I, G and T are **autonomous** i.e. do not change, it suggests that in equilibrium, S cannot change either. Although people want to save more at a given level of income, their ***income decreases by an amount such that saving is unchanged***. This means that as people attempt to save more, the result is both a) a decline in output; and b) unchanged saving. Hence, the **paradox of saving**. (Note, however, that this assumes I, G and T are autonomous; an impractical assumption in reality).

NOTE: If autonomous demand (I, G and T) *do not completely offset decline in consumption*, output will not be unchanged, but rather, negative.

1.2 Financial Markets

1.2.1 Definitions

- **Income:** Received from working plus receipts of interest and dividends.
- **Saving:** The part of after-tax income that is not spent.
- **Financial Wealth:** The value of a person's *financial assets minus all financial liabilities*.
- **Money:** Financial assets that can be used directly to buy goods. Includes currency and current account deposits *but not credit cards*.
- **Investment (I):** In general, this means the purchase of new capital goods, such as machines, plants or office buildings. It also includes new residential housing construction.
  - Popular terminology uses 'investment' to refer to the purchase of shares or other financial assets. The purchase of shares or other financial assets is merely a *change in the form of holding financial wealth*; it does not affect production.

1.2.2 Money Demand, Money Supply and the Equilibrium Interest Rate

Theory: 'Financial wealth' consists of 2 items –

1. **Money** – can be used for transactions, *but pays no interest*.
   a. There are 2 types of money: i) **currency**, including coins and notes; and ii) **current account deposits** – bank deposits that can be used for direct payments. CURRENCY + CURRENT ACCOUNT DEPOSITS = **M1 definition of Money Supply**
2. **Bonds** – in contrast, bonds *pay a positive interest rate*, but cannot be used directly for transactions.

Assuming that people hold financial wealth as either money or bonds, the proportions that people wish to hold *depends on the level of their transactions* (money) and the *interest rate on bonds* (bonds):

1. **Money** – there is a positive relation between *transactions* and *nominal income*; if income goes up, money demand will rise proportionately.
2. **Bonds** – there is a negative relation between the *nominal interest rate* and *holding money*; if the interest rate goes up, people can earn more if they invest their money in bonds, and the demand for money falls.

1.2.2.1 Money Supply

Theory: The Central Bank can decide on supplying a fixed amount of money to circulate around the economy.

1.2.2.2 Money Market Equilibrium

Theory: Equilibrium in the financial market therefore requires that money supply = money demand.

Refer to APPENDIX B for illustration of Money Demand, Money Supply and the Equilibrium Interest Rate

1.2.2.3 Money Supply and the Central Bank

Theory: In modern economies, central banks change the Money Supply by *buying or selling* bonds in the bond market:

- If a central bank wants to *increase* the amount of money in the economy, it *buys* bonds and *pays* for them by *creating* money;
- If a central bank wants to *decrease* the amount of money in the economy, it *sells* bonds and *removes the money it receives from circulation*.

These actions are called **open market operations**, otherwise known as **'OMO'**.

The Open Market Operations the central bank conducts are otherwise known as **MONETARY POLICY.** There are 2 kinds of OMO:

(I) **Expansionary Policy** – where the central bank *buys* bonds, *increasing* the money supply and *lowering* the interest rate. At the same time, *demand for bonds rises*, *increasing their price*. It is expansionary policy in the sense that it encourages spending so as to stimulate the economy.

(II) **Contractionary Policy** – where the central bank *sells* bonds, *decreasing* the money supply and *raising* the interest rate. At the same time, *demand for bonds falls, decreasing their price*. It is contractionary policy in the sense that it discourages spending so as to slow down the economy.

Refer to APPENDIX C for illustrations of Expansionary and Contractionary Monetary Policy

1.2.2.4 Money Multiplier

Theory: In the economy there are 3 actors –

- **Central Bank** – or RBA in Australia;
- **Financial Intermediaries** – the banks, which *accept deposits* and *make loans*;
- **Public** – people and firms who hold money as either a) currency, or b) bank deposits.

When banks accept deposits, they keep a portion as reserves. This can serve a threefold purpose (twofold in Australia):

1) To meet depositors' withdrawals;
2) To make inter-bank payments to other banks; and
3) To maintain a legal reserve requirement i.e. a percentage of deposits have to be placed in reserve (**not required in Australia**).

Tri-Actor Interplay

In the context of an *expansionary monetary policy*, the 3 acting forces on the economy interact in the following way:

- The **central bank** buys bonds from the **public**, raising the price of the bonds and lowering the interest rate.
- The **central bank** credits the sellers of the bonds with deposits at their **bank**.
- The **bank's** reserves are now above the minimum.
- However, the **central bank** will want to keep reserves at a minimum, so –
- **Banks** issues loans to the **public**, increasing the level of economic activity and national income. Some of this increased income *returns to the banking system* in the form of deposits.
- The **bank's** reserves are again above minimum, and the process repeats itself over a series of rounds.

However, there is a **limit** to expansion for the following reasons:

(a) Some of the increase in deposits are held as reserves by banks i.e. not issued as loans;
(b) The public holds currency, so not all of the increased money supply returns to the banks as deposits.

Thus, to work out *how much* the money supply changes after the OMO, the **money multiplier** is used.

Money Multiplier

The money multiplier is comprised of 2 factors –

1) **Money Supply** – comprised of *currency* held by the public and *deposits*: $\mathbf{M(s)} = \mathrm{CU} + \mathrm{D}$
2) **Monetary Base** – comprised of *currency* held by the public and *reserves* by banks: $\mathbf{H} = \mathrm{CU} + \mathrm{R}$

The monetary base is also called **High-Powered Money** or central bank money. Each unit of the base issued *leads to the creation of more money*.

Public

The public holds financial wealth as *currency* or *deposits*; that is, they either carry around physical currency or store their financial wealth in banks in the form of deposits.

- Currency: $\mathbf{CU(d)} = \mathrm{c\ x\ M(d)}$
- Deposits: $\mathbf{D} = (1 - \mathrm{c})\mathrm{x\ M(d)}$

Banks

Contrastingly, banks hold financial wealth in the form of deposits and **reserves**. Reserves typically represent a portion of deposits, represented by 'theta' –

$$\mathbf{R} = \theta D$$

Or –

$$\mathbf{R} = \theta(1 - c)(M(d))$$

Where $\boldsymbol{\theta}$ is between 0 and 1.

Thus, the monetary base, or 'high-powered money' is shown as –

H = CU + R

Expansionary Monetary Policy

When the RBA adopts an expansionary monetary policy, money supply will increase. This will lead to an increase in deposits (D), which means an increase in reserves (R) and finally an increase in the monetary base (H). Because open market operations change 'H', the **change in 'H' is the basis of the change in the money supply.**

Hence –

$$\mathbf{H} = \mathrm{CU} + \mathrm{R}$$

$$\mathbf{H} = \mathrm{c}\big(\mathrm{M(d)}\big) + \theta(1 - \mathrm{c})\big(\mathrm{M(d)}\big)$$

$$\mathbf{H} = [\mathrm{c} + \theta(1 - \mathrm{c})]\mathrm{M(d)}$$

$$\mathbf{H} = [\mathrm{c} + \theta(1 - \mathrm{c})]\$\mathrm{YL(i)}$$

Then, so that Money Supply = Money Demand:

$$\frac{1}{[\mathrm{c} + \theta(1 - \mathrm{c})]}\, x\ \mathrm{H} = \$\mathrm{YL(i)}$$

Money Supply is the first part of the equation, which is also representative of the *money multiplier*.

Characteristics of the Money Multiplier

(a) When the money supply is changed, the amount of high-powered money (CU + R) changes.
(b) The money multiplier is **greater than 1 when $\boldsymbol{\theta}$ is less than 1**.
    a. If c = 0, *all money is held as deposits*. In this case, the multiplier is given by $1/\boldsymbol{\theta}$.
(c) The money multiplier *decreases/increases* when either 'c' or '$\boldsymbol{\theta}$' *increases/decreases*.
(d) **Fractional Reserve System** – only a fraction of deposits (D) are held as reserves (R); hence, $\boldsymbol{\theta}$.

In the money multiplier explanation of Money Supply, the Central Bank –

(a) Governs the money supply through OMO, given the **c** (public holdings of currency) and $\boldsymbol{\theta}$ (reserves);
(b) Can change the multiplier by changing the amount of deposits ($\boldsymbol{\theta}$) it holds in reserves.

Banks, on the other hand, are essentially **passive**, waiting until deposits and hence, reserves, change before adjusting loans.

Multiplier Analogy

The income and money multiplier functions are inherently similar -

- **Income Multiplier:** $\mathrm{Y} = \frac{1}{1-\mathrm{c}(1)}$ x Autonomous Expenditure
- **Money Multiplier:** $\mathrm{M(s)} = \frac{1}{\mathrm{c}+\boldsymbol{\theta}(1-\mathrm{c})}$ x H

However, their similarities extend beyond their visual composition:

- Both 'Y' and 'M(s)' change following autonomous (exogenous) changes;
- Both changes are limited by 'leakages' (c(1), t **or** c, $\boldsymbol{\theta}$).

With that said, the multipliers explain different phenomena: the *income* multiplier explains changes in output and production (Y), and the money multiplier explains changes in money supply (M(s)).

1.2.2.5 Bank Runs

Theory: Bank runs occur when there is *asymmetric information* between banks and the public; that is, where banks have more information than depositors. In general, all depositors have to go is assurances from the bank. Thus, if there are rumours than a bank is in trouble and some loans will not be repaid, people rush to close their accounts at that bank. If enough people close their accounts at one time, a bank will run out of reserves and be forced to close down. This phenomenon may spread to other banks through the medium of *contagion*

US: To avoid bank runs, the US government provides *federal deposit insurance* to banks taking deposits. Under this scheme, the government insures depositors for a certain percentage of their deposits if a bank was to encounter trouble. **Australia:** Until recently, there was no deposit insurance in Australia. Instead, depositors relied on the supervision of banks by APRA (the *Australian Prudential Regulation Authority*). But in response to the GFC in 2008, the Australian government began to guarantee bank deposits because there were signs of a future bank run.

1.3 THE IS-LM MODEL

1.3.1 The IS Model

Theory: Previously, the equilibrium condition in the *goods market* was given by –

$$Y = c_0 + c_1(Y - T) + \bar{I} + \bar{G}$$

Where **investments** (I) and **government expenditure** (G) were exogenous. Additionally, we assumed the *interest rate did not affect the demand for goods*.

However, we are now changing 2 assumptions:

(1) Investment (I) is no longer exogenous; and
(2) Central Banks target the **interest rate**, rather than the **money supply**

1.3.1.1 Investment, Sales and the Interest Rate

Theory: Investment depends primarily on 2 factors –

(1) *Level of Sales* – a firm that faces an increase in sales needs to increase production. To do so, it needs to buy additional machines or build an additional plant. In other words, it needs to ***change its investment.***
(2) *Interest Rate* – a firm that is considering whether to ***invest*** in a new machine may need to borrow money to purchase it. The higher the interest rate, the less attractive it is to borrow and buy the machine. At a high enough interest rate, the additional profits from using the new machine will not cover these interest payments, and the machine will not be worth buying.

Thus, to capture these 2 effects, investment is written as follows:

$$\mathbf{I} = \mathrm{I}(\mathrm{Y}, \mathrm{i})$$

- **Y =** Level of Sales;
- **i =** Interest Rate.

Refer to APPENDIX D for illustration of Sales and the Interest Rate on Investment

1.3.1.2 Deriving the IS Curve – Goods Market

Theory: Equilibrium in the goods market implies an increase (decrease) in the interest rate leads to a decrease (increase) in output. Hence, because there is a negative relationship between the interest rate and the level of output/production/income, **the IS Curve is downward sloping**.

Refer to APPENDIX E for illustration of the IS Curve and its Properties

1.3.1.3 Deriving the LM Curve – Financial Market

Theory: For the initial derivation of the LM Curve, assume the central bank *targets money supply and keeps it constant*. Therefore, the interest rate – 'i' – is market determined (<u>the Central Bank does not affect the interest rate</u>).

Refer to APPENDIX F for illustration of the LM Curve and its Properties

1.3.1.4 Putting the IS-LM Relations Together

Refer to APPENDIX G for illustration of the IS-LM Model

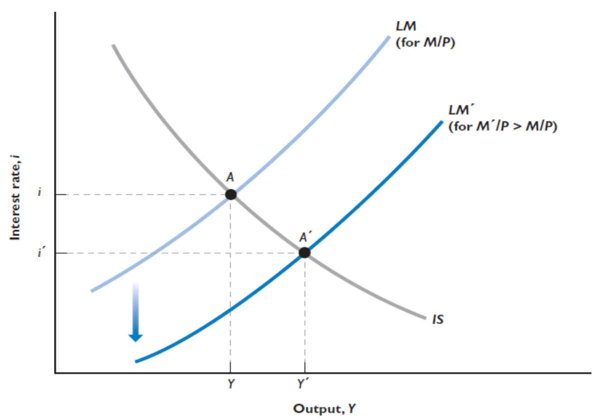
1.4 IS-LM – Policy Aspects

1.4.1 Monetary Aspects – Interest Rate Targeting

Theory: Assuming the Central Bank ***controls the Money Supply***, it may adopt one of two policies –

I. **Monetary Policy Expansion** – an *increase* in the Money Supply and a *decrease* in the Interest Rate.
II. **Monetary Policy Contraction/Tightening** – a *decrease* in the Money Supply and an *increase* in the Interest Rate.

Below is an illustration of a **Monetary Policy Expansion** using the IS-LM Model:



Monetary Expansion

IS – the money supply does not *directly* affect either the supply or demand for goods (Y, Z). Thus, a change in 'M' *does not affect the IS Curve*.
LM – an increase in the money supply shifts the LM curve <u>down</u>, from LM to LM'. At any given level of income, *an increase in money leads to a decrease in the interest rate leads to a decrease in LM*.
Y – Output *increases*. The increase in money leads to a lower interest rate which leads to an increase in investment, as well as demand and output.
i – an increase in money supply leads to a fall in the interest rate.

We can tell exactly what happens to the different components of **demand** after a monetary expansion:

- Income is higher – **greater money supply** + taxes unchanged = increased disposable income = increased consumption.
- Increased disposable income = increased consumption = increased sales = increased investment.

<u>Interest Rate Targeting</u>

Until now, it has been assumed that the Central Bank targets the *Money Supply*, meaning *interest rates* are determined by the market. However, in reality, most central banks ***do not target the money supply, but rather the short-term interest rate***.

The Central Bank uses **intermediate targets** to guide policy as a step between its *instruments* – such as OMO – and its *goals* of a) price stability, and b) stable economic growth. At each level, there needs to be a stable relationship between:

a) The operating instrument and the intermediate target; and
b) The intermediate target and final target.

'Intermediate targets' are variables that:

- The Central Bank **cannot directly control** but can *influence predictably*; and
- Are related to the Central Bank's **ultimate targets** of price stability and stable economic growth.

Since the late 1970s, 2 intermediate targets were used by the RBA:

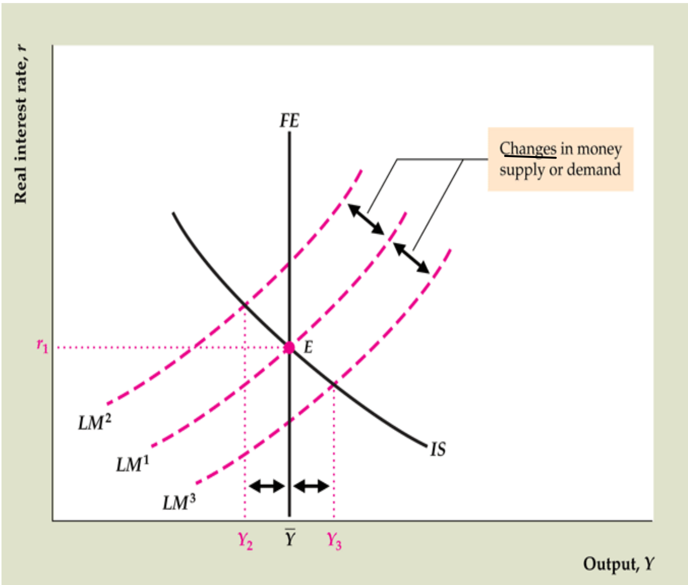
I. **Money Aggregates** – where the RBA targeted the *money supply*. However, this was formally abandoned in 1985 in favour of –
II. **The Short-Term Interest Rate** – otherwise known as the *cash rate*. This was the beginning of interest rate targeting.

The reason the RBA moved to interest rate targeting is because the *money aggregates were unstable*. This instability was largely due to the instability in money demand. Financial innovations – such as credit cards – had begun to cause money demand to *shift unpredictably*.

Additionally, the RBA was unable to *target both the money supply and interest rate simultaneously*:

- **Controlling Money Supply** – through expansionary/contractionary policy, the interest rates will be determined by the market.
- **Controlling Interest Rates** – through expansionary/contractionary policy, the money supply will be determined by the market.

Take the following graph as an example –



Targeting Money Supply v. Targeting Interest Rate

This graph assumes that the *nominal interest rate = real interest rate*, with *inflation = 0*.

Initially: Equilibrium exists where IS = LM(1). However, changes in money demand can have the following effect –

LM(2) = IS – with *increased money demand*, the LM curve shifts up and *interest rates increase*.

LM(3) = IS – with *decreased money demand,* the LM curve shifts down and *interest rates decrease*.

Thus, if the Central Bank **targets Money Supply** and sticks to a given target, *interest rates fluctuate*, with output shifting between Y(2) and Y(3). This wild swinging leads to unpredictable output and production, and thus unpredictable growth. However, if the central bank **targets the Interest Rate**, fixing it at r(1), it can *offset shifts in money demand*, reversing the LM shift.

Thus, targeting interest rate can stabilise output, the interest rate, and price level, and offset shocks to LM.

Understanding the Money Demand (M(d)) – Money Supply (M(s)) Relation with Interest Rate Targeting

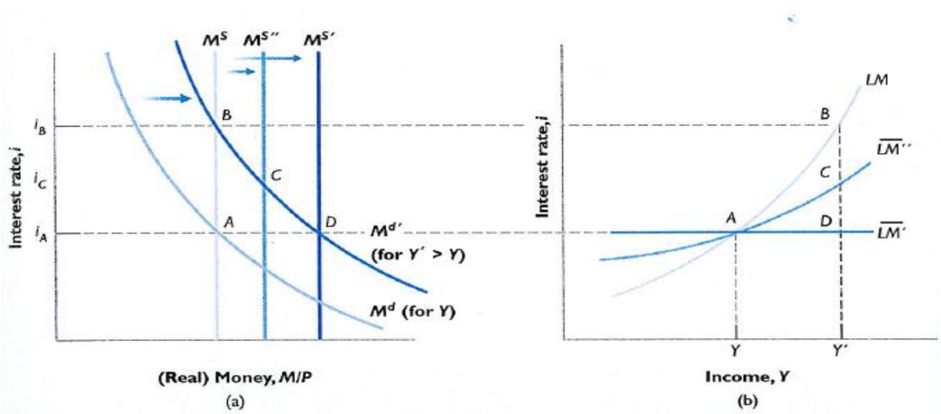
With each given **interest rate** (I) – and given the parameters and behavioural equations – there is a level of **output** (Y). With each shift in the *interest rate* and *output*, there is an associated *shift in Money Demand*.

If the IS shifts, output will shift and money demand will shift. But instead of allowing the interest rate to shift to equilibrium, the RBA holds its interest rate target, and allows the *Money Supply to adjust through OMO* – whether it is **expansionary or contractionary** – *to equate with Money Demand*. Thus, in effect, **money demand drives money supply**.

The RBA now 'accommodates' Money Demand with the required Money Supply. This means that –

- **With Interest Rate Targeting** – there is an endogenous money supply. That is, the money supply is being driven by money demand and the level of economic activity. **Money Supply and Demand and then *inter-dependent*.**
- **With Money Supply Targeting** – the money supply is governed by the RBA and there is an exogenous money supply. As a result, **Money Supply and Demand are *independent***.

LM Curve with Interest Rate Target



- **Initially:** M(d), M(s), i(A), A.
- **Increased in Aggregate Demand: M(d)', Y'** – output increases to Y' with a shift in money demand from M(d) to M(d)'.

With the advent of increased aggregate demand, there are 3 possibilities for the Central Bank:

1) **Targeting and holding Money Supply** – if the central bank targets and holds money supply, it can increase interest rates to i(B). This corresponds with the LM curve on panel (b). Equilibrium will then be at point B and Y' – **smaller Y, higher i.** This is the case of the *exogenous money supply*.
2) **Targeting and holding an Interest Rate** – if the central bank targets and holds interest rate 'i(A)', the money supply will increase to MS'. This corresponds with the LM' on panel (b). Equilibrium will then be at point D and Y' – **larger Y, maintained i.** This is the case of the *endogenous money supply*.
3) **Targeting an Interest Rate by changing Interest Rate –** if the central bank targets interest rate 'i(A)', but decides to increase the interest rate target as output increases (although the target is *less than 'i(B)'*), money supply will increase to MS". This corresponds with LM" on panel (b). Equilibrium will then be at point C and Y' – **larger Y, larger i.** This is also the case of the *endogenous money supply*, although monetary policy is less accommodating.

But why does the LM" curve have a higher 'i' than the LM curve at any point to the ***left of Y*** *on panel (b), considering it is an accommodating monetary policy?*

Because, for LM", the RBA may be aiming for a **'mid-point'** between policies 1 and 3. As a result, to the **right of Y**, the increase in 'i' is a **midpoint as Y increases**. By extension, if **Y falls** to the left of initial Y, the central bank follows a policy *midway between the exogenous money supply* (LM) and the *endogenous money supply where it does not change* (LM'). So LM" is the mid-point result where the money supply is endogenous.

Most economies are assumed to be like LM" (previous page). This is because central banks think economies can grow at a particular rate of output (Y) *without the inflation rate changing*; that is, a **trend growth in Y**. There will be a particular interest rate target which corresponds to that output rate. The bank will then vary the interest depending on **whether it is greater or less than initial Y:**

- **Greater than initial Y = Boom** – central bank can *raise* the target rate and lower the economy into a recession.
- **Less than initial Y = Recession** – central bank can *lower* the target rate and raise the economy into an expansion.

Monetary Policy is now being defined in terms of the central bank's intermediate target rate at the trend position. This is consistent with a monetary policy of *interest rate targeting*.

NOTE: A cyclical change in target interest rates *does not indicate a change in monetary policy*.