Intermediate Macroeconomic Notes

Three Key Macroeconomic concepts

Aggregate output, inflation and unemployment

The national income accounts are used to measure aggregate economic activity, using either GDP or GDI (which are equal by construction). Recall, there are three ways to measure GDP: total value of final goods and services (GDP), total value added (GDP) or total income (wages to workers plus profits) (GDI) i.e. expenditure, output and income. Also, **GDP** is a measure of aggregate economic activity, not related to welfare (i.e. during wartime, GDP's often increase as government expenditure increases) – also doesn't measure black market economic activity.

Nominal GDP is the sum of quantities times current prices where prices are denominated in dollars, **Real GDP** is the sum of quantities times constant prices (choice of prices defines base year, in base year nominal GDP = real GDP).

Inflation is the 'price level' and is measured often using either the GDP deflator or Consumer Price Index (CPI).

- GDP deflator

$$\begin{aligned} \$Y_t &\equiv \text{nominal GDP in period } t \\ Y_t &\equiv \text{real GDP in period } t \\ P_t &\equiv \frac{\$Y_t}{Y_t} \times 100 \end{aligned}$$

- Unemployment rate

$$\begin{aligned} L = N + U &\equiv \text{labor force (number of people)} \\ N &\equiv \text{employed} \\ U &\equiv \text{unemployed} \end{aligned}$$

Unemployment rate in given period: $u \equiv U/L$

- Participation rate in given period: L/civilian (working age) population

- Inflation rate

$$\pi_t \equiv \frac{P_t - P_{t-1}}{P_{t-1}} \times 100\%$$

Composition of U.S. GDP, 2014

		Billions of Dollars	Percent of GDP
	GDP (Y)	17,348	100.0
1	Consumption (C)	11,865	68.3
2	Investment (I)	2,782	16.0
	Nonresidential	2,233	12.9
	Residential	549	3.1
3	Government spending (G)	3,152	18.1
4	Net exports	−530	−3.1
	Exports (X)	2,341	13.5
	Imports (IM)	−2,871	−16.6

GDP Components are **consumption, investment, government** (does not include transfer payments) and **net exports.** $\boldsymbol{Z \equiv C + I + G + (X - M)}$. For simplicity we often assume a closed economy with net exports equal to zero.

- For simple algebra, *linear* consumption function

$$C = C(Y_D) = c_0 + c_1 Y_D, \qquad c_0, c_1 > 0 \quad \text{and} \quad c_1 < 1$$

- Slope parameter c_1 is key

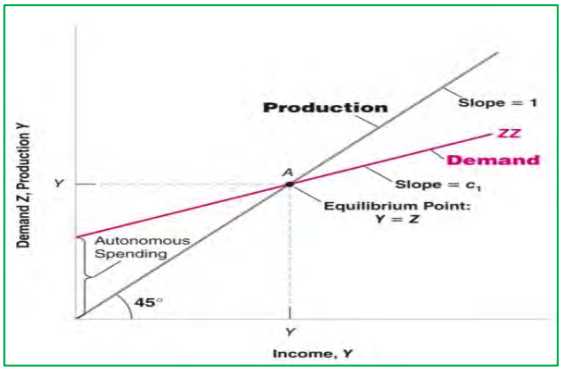
c_1 is the marginal propensity to consume (MPC)

Disposable income is income less taxes, consumption (C) is a simple function of aggregate disposable income. We can treat I, G and T as exogenous variables with G and T describing fiscal policy.

In the **short-run**, we assume that the supply side is 'passive', that is that demand for goods determines output when in equilibrium (Z = Y).

But demand for goods is itself a function of aggregate income Y

$$Z = c_0 + c_1(Y - T) + I + G$$



The solution on the right is the result of setting Z=Y. The multiplier is a key parameter in short-run macroeconomics as it sets the change in consumption resulting from a specific change in income.

Investment/Savings approach – savings are equal to disposable income less consumption. By expressing savings as S = Y – T – C and subbing in the equilibrium condition for Y in a closed economy, we can get the below equation.

- Putting these together we have the new equilibrium condition

$$I = S + T - G$$

- Investment is *private* savings S plus *public* savings $T - G$.

- Solution

$$Y = \frac{1}{1 - c_1}(c_0 - c_1 T + I + G)$$

- Product of two terms
  - *multiplier*

$$\frac{1}{1 - c_1}$$

  - *autonomous spending*

$$c_0 - c_1 T + I + G$$

T > G implies budget surplus, the converse is a deficit. Therefore, we have two ways to state equilibrium in the goods market: output equals demand and savings equal investment. Despite our equation above seemingly showing that G and T are crucial to determining Y, we have seen restrictions in how governments can choose their level of output. Some **problems are** estimating multiples is difficult, expectations, overstimulating may cause inflation as well as impact on government accounts.

- Let investment depend on aggregate income Y and interest rate i

$$I = I(Y, i) = b_0 + b_1 Y - b_2 i, \qquad b_0, b_1, b_2 > 0 \quad \text{and} \quad b_1 < 1$$

I depends positively on Y and negatively on i

- Plugging in for consumption and investment

$$Y = c_0 + c_1(Y - T) + b_0 + b_1 Y - b_2 i + G$$

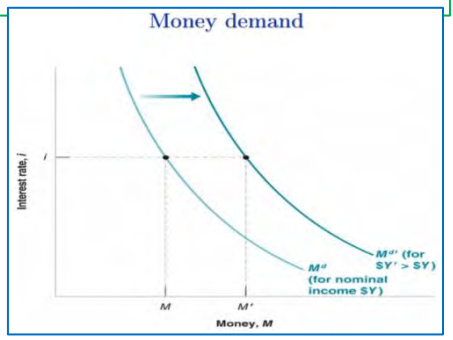
- Solving for income

$$Y = \frac{1}{1 - c_1 - b_1}(c_0 - c_1 T + b_0 - b_2 i + G)$$

(assume $c_1 + b_1 < 1$)

The equation on the right is a key building block of the **IS-LM model.**

Money Demand – money pays no interest but can be used for transactions, thus defined as currency + checkable deposits (checks, eftpos). Conversely, Bond pay interest 'i' and cannot be used for transactions. The mix of M and B in any economy depend on the level of transactions and the interest rate (**liquidity vs return**). We have **two key assumptions** when analysing money markets:
1. Demand is increasing as level of transactions increases (transactions proportional to nominal income).
2. Demand decreasing as interest rates increase (opportunity cost of holding money).
Change in interest rates translates to a movement along the demand curve, change in income causes a shift. As shown on the right, liquidity is negatively related to interest rates, supporting our 2 assumptions.



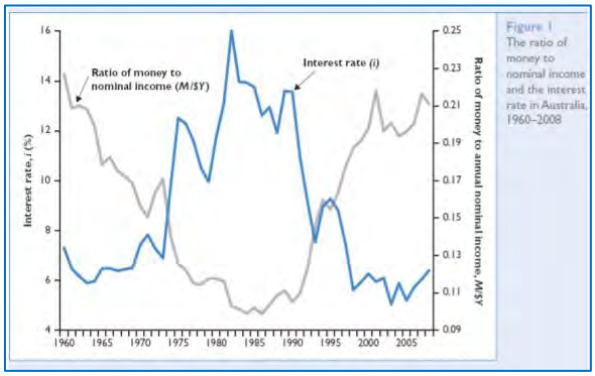


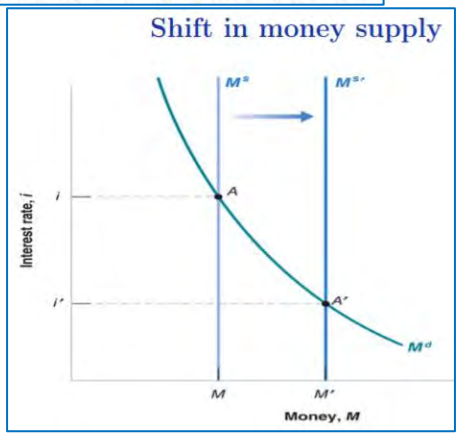
Figure 1 The ratio of money to nominal income and the interest rate in Australia, 1960–2008

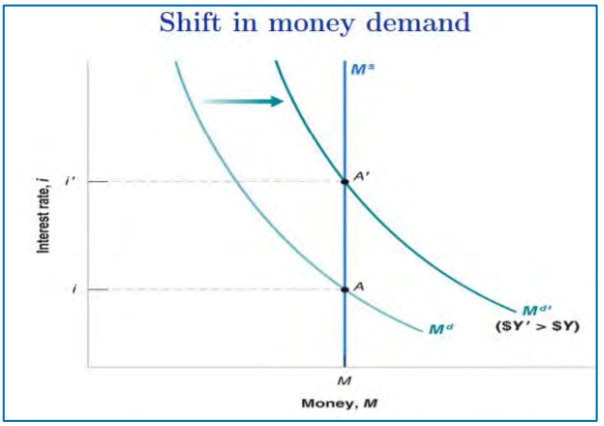
Money Supply – we take as fixed and according to the Reserve Bank's preferences. Equilibrium in money markets implies that M^d=M^s.

$$M = PY \times L(i)$$

Determines the interest rate i for given M and nominal income PY

Gives rise to the LM curve, Liquidity/Money Supply curve. Some example money equilibria and shifts are shown on the right. Note that any central bank can fix the interest rate (common modern monetary policy) and alter supply to meet demand at that set 'i'.





When the **Reserve Bank** buys bonds, demand for bonds increases, P_B rises and 'i' falls. (can be confirmed using PV calculations). The converse holds for when the reserve bank sells bonds. The **balance sheet** of the RBA consists of **assets** (bond holdings) and **liabilities** (money stock issued). **Expansionary** monetary policy refers to RBA buying bonds, **Contractionary** refers to RBA selling bonds.

Balance Sheet	
Assets	**Liabilities**
Bonds	Money (currency)

There is an **interbank market** for bank reserves (held by commercial banks to meet withdrawals, obligations to other banks etc.). In practice, the Reserve Bank can set the interest rate by adjusting the supply of reserves in the interbank market. The interest rate determined in this market is called the **cash rate.**

$$\text{leverage ratio} \equiv \frac{\text{total assets}}{\text{equity}}$$

Global Financial Crisis – typical estimate of lost wealth in US mortgage market meltdown was $300bn, however, this was only 2% of GDP, the big losses came as a result of **leverage** in the financial system. This leverage means that a change in the value of a bank's assets (investments) magnifies the effects the net worth (equity) of individuals and institutions. →

- GOOD YEAR: investments appreciate by $50k
  - return on investment = (550 − 500)/500 = 0.10 or 10%
  - return on shareholder's equity = (150 − 100)/100 = 0.50 or 50%
- BAD YEAR: investments depreciate by $50k
  - return on investment = (450 − 500)/500 = −0.10
  - return on shareholder's equity = (50 − 100)/100 = −0.50

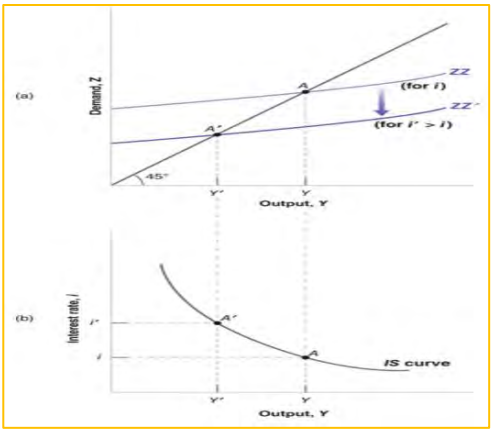
As on the right, a relatively small change (-200) in the value of assets can reduce equity to 0 and put the bank on the brink of insolvency. This can cause a **Classic Bank Run,** where depositors run to the bank to withdraw despite banks not having much cash on hand. To repay depositors, banks may have to **fire-sale** assets at a discount and further reduce their equity. Following the GFC, Australia introduced **Deposit insurance** for any deposit under $250,000 stopping these bank runs and other spill-over effects. In GFC, short-term debt caused much of the issues, since banks were unable to **roll-over this debt** and therefore had to divest assets.

Assets		Liabilities	
Loans	1000	Deposits	1000
Investments	900	Short-term debt	400
Cash and reserves	100	Long-term debt	400
Total assets	2000	*Total liabilities*	1800
		Equity	200

Here, the leverage ratio is $2000/200 = 10$

IS-LM Model

Model that connects our initial consumption and output functions to the interest rate (and therefore financial markets). General form of **IS Curve** is below right. Using the goods market equilibrium diagram (Y=PAE →), we want to see how a change in **interest rates would change equilibrium output**. On the right we have a goods market equilibrium diagram above an IS curve. Changes in G and T will shift the IS left or right while changes in the interest rate will cause movements along the IS curve. Any points above the IS curve represent where there is excess supply in the goods market. Conversely any points below the curve are where there is excess demand in the goods market.



- For given interest rate i demand $Z(Y,i)$ is increasing in output Y

$$Z(Y,i) \equiv C(Y,T) + I(Y,i) + G$$

  - increase in Y increases consumption $C(Y,T)$
  - increase in Y increases investment $I(Y,i)$

The **LM Curve** is given by money supply as discussed previously. $M = P \times Y \times L(i)$ (where L(i) function is decreasing with the interest rate). The LM curve argues that the set interest rate does not change with output, given that the central bank **alters money supply** to keep interest rates constant at the target level. (this flatness of the LM curve is a new phenomenon since banks have only recently started fixing interest rates). The **traditional LM** curve was actually upward sloping since it did not assume the manipulation of money supply/demand in the background. Any point above the LM Curve is excess supply in money markets and any point below the LM Curve is excess demand in money markets. Since it is seen as easier to change interest rates than output, most shifts towards total equilibrium take place along the LM curve.

- Supply of goods equals demand for goods

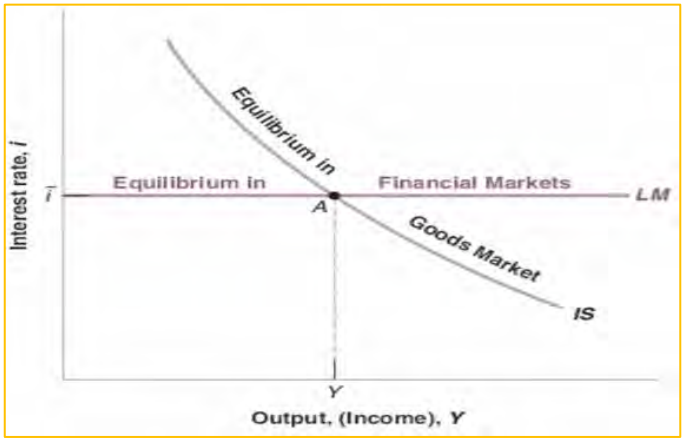
$$Y = C(Y,T) + I(Y,i) + G$$

  - implicitly determines *IS curve*
  - downward sloping relationship between Y and i

- Supply of real money equals demand for real money

$$\frac{M}{P} = YL(i) \qquad \text{[sometimes, } \frac{M}{P} = L(Y,i) \text{ instead]}$$

  - Reserve Bank sets $i = \bar{i}$
  - implicitly determines *LM curve*, a horizontal line



Fiscal Policy – we can either have a **contraction** (decrease in G or increase in T) or an **expansion** (increase in G or decrease in T). In addition, the budget can either be in **deficit** (G > T) or **surplus** (G < T). Fiscal policy affects the position of the IS curve, not the LM curve.