COURSE ORGANISATION

Assessments:

- Tutorial Data Exercise (Weekly) – 10%
  - Weekly, completed during tutorials
  - Can miss one without penalty
- In-Session Quizzes (Week 4 & 8) – 25%
  - Quiz 1: 10th March, 20 minutes, 10% of grade
  - Quiz 2: 6th April, 30 minutes, 15% of grade
- Short Answer Question – 15%
  - Due in Week 10 (21st April 4pm)
- Final Exam – 50%
  - 2 hours, online, MCQs
- Week
  - Read Textbook
  - Lecture Notes
  - Tutorial Questions

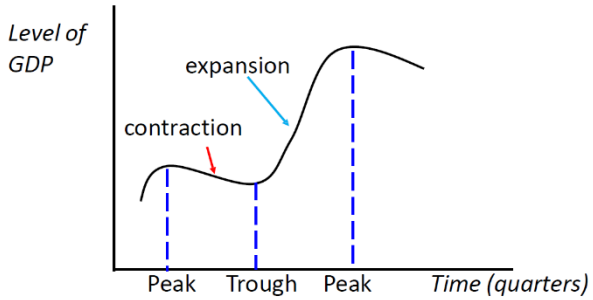
Aggregate Production and Prices

GROSS DOMESTIC PRODUCT (GDP)

- **Informal Definition** – Measure of a country's aggregate output or production
- **Formal Definition** – The monetary value of final goods and services produced in a country during a given period
  - Measured in monetary terms as it is easier to compare monetary amounts
  - Includes only final goods and services that are for final use and are not subject to further processing or manufacturing. Intermediate goods are excluded to avoid double counting.
- GDP excludes non-productive transactions. The two major types of non-productive transactions are:
  - Purely financial transactions (Public transfer payments, private transfer payments, buying or selling of shares)
  - Sale of second hand goods
- For goods and services with no observed market price:
  - Some are excluded from GDP such as unpaid housework (cooking & cleaning)
  - Others such as police services, public hospitals and rental value of owner-occupied dwellings are included
- In order to value unpriced goods for GDP:
  - Publicly provided goods and services such as police & public hospitals – use the cost of providing these goods and services as a measure of their contribution to GDP
  - Rent on owner-occupied dwellings – Imputed by ABS using data from Census on rents and the type and location of owner-occupied dwellings
- In calculating the GDP, it is important that intermediate goods and services are not double counted.
- Hence the concept of **Value Added** – The market value of a firm's production less the cost of inputs purchased from other firms.

- $Value\ Added\ =\ Value\ of\ Sales\ -\ Cost\ of\ intermediate\ inputs$
- GDP measures production within a specified geographic location
    - Excludes goods and services produced in other countries, but consumed in Australia
- GDP Is a flow variable – measured over a period of time
    - Excludes goods and services produced in an earlier period but re-sold in the current period
    - Quarter – denoted by the last month of said quarter (e.g. March = Quarter including Jan, Feb and Mar). The quarters of a year are March, June, September and December.
- Three equivalent ways to measure GDP – Production Method, Expenditure Method & Income Method
- Expenditure Method: Expenditure on goods and services by final users = value of their production
- Main components of expenditure:
    - Consumption (C) – purchases by households
    - Investment (I) – purchases by firms
    - Government (G) – Government purchases
    - Net Exports (NX) – net purchases by foreign section.
      NX = Exports (X) – Imports (M)
- National income accounting identity:
    - GDP ≡ Expenditure
    - Y ≡ C + I + G + X – M
    - Y + M ≡ C + I + G + X
    - I.e. Supply of goods and services ≡ Demand for goods and services
- Income Method: GDP also equals the aggregate incomes paid to Labour (L) and Capital (K) in the production of goods and services (plus indirect taxes)
    - $GDP\ =\ Labour\ Income\ +\ Capital\ Income\ +\ Net\ indirect\ Taxes$
    - $GDP\ =\ (W * L)\ +\ (R * K)\ +\ Net\ Indirect\ Taxes$
    - Net Indirect Taxes = Indirect Taxes – Subsidies
    - W = wages and salaries
    - R = return to capital
    - L = labour
    - K = capital stock
- Nominal GDP – values quantities of goods and services produced at their current year prices
- Real GDP – values quantities of goods and services produced at base year prices. Measure of actual physical volume of production.
- Choice of base year:
    - Using initial prices is known as *Laspeyres index*
    - Using final prices is known as a *Paasche index*
- Chain weighted measure of Real GDP:
    - For any two consecutive years compute the growth rates of real GDP using both the Laspeyres and the Paasche indexes.
    - The chain weighted growth rate is the average of the two growth rates.
    - To compute a change index over a long period, the above approach is applied on a year-by-year basis.

- $Nominal\ GDP\ =\ Price\ Level\ *\ Real\ GDP$
  - If we know any 2 variables we can derive the third.
- $Real\ GDP\ per\ capita\ =\ Real\ GDP/Population$
  - Commonly used as an indicator of economic progress
- There are omissions from GDP that might matter for economic welfare:
  - Leisure time
  - Household production
  - Environmental degradation
  - Quality of life
  - Economic inequality
- GDP is positively correlated with economic welfare in terms of medical care but not in terms of income distribution of the last 20 years
- Alternatives to GDP:
  - Direct measures of happiness (survey based measures)
  - Indexes of variables that might affect welfare
- Business Cycles – economies tend to experience periods of expansion and contraction in the level of economic activity
  - A contraction is a period during which the level of GDP falls
  - An expansion is a period when the level of GDP is rising
- Peaks and troughs – in moving between periods of expansion and contraction the economy will experience peaks and troughs
  - A peak is the beginning of a contraction, the high point of GDP prior to a downturn
  - A trough is the end of a contraction, the low point of economic activity prior to a recovery



- 'Rule of thumb' Definition of a Recession – A recession occurs when there are at least two consecutive quarters of negative economic growth
  - This means the level of GDP has to fall for at least two quarters
  - This has not occurred in Australia since the beginning of the 1990s.

CONSUMER PRICE INDEX

- CPI – For a given period, measures the cost in that period of a given basket of goods and services relative to their cost in a fixed year (called the base year)
- $CPI = \frac{Cost\ of\ base\ year\ basket\ in\ current\ year}{Cost\ of\ base\ year\ basket\ in\ base\ year}$
- Implications:
  - Cost of living is 25% higher in 2015 than it was in 2000
  - Average prices are 25% higher in 2015 than in 2000
- Australian CPI:

    - Published quarterly by the ABS
    - Household expenditure survey used to determine a typical basket (known as weights)
    - (Historically) Base year weights change every 5 years
    - From end-2017 weights are updated on an annual basis
- Inflation (and Deflation) – inflation is measured by the percentage change in the CPI over a given period.
    - $Inflation\ Rate = \frac{CPI - CPI_{-1}}{CPI_{-1}}$
    - Where CPI_{-1} is the CPI in the previous year
- Limitations with CPI –
    - Quality Adjustment and New Goods Bias – quality improvements may show up as higher prices for g/s. New goods are not included until CPI is re-based.
    - Substitution Bias – use of a fixed bias means that no allowance is made for consumers' substitution toward relatively less expensive goods
    - CPI tends to overstate the rate of inflation
- Costs of Inflation – it is important to distinguish between relative price change and a change in the general price level
- Unexpected inflation
    - Unexpected redistributions of wealth (borrowers/lenders, fixed nominal incomes)
    - Distorts tax systems (if not indexed to inflation)
    - Introduces noise into the (relative) price mechanism
- Fully anticipated inflation
    - Shoe-leather costs – inflation reduces the real purchasing power of a given amount of money
    - Menu costs – any real cost associated with changing prices
- Optimal Inflation rate – Policymakers generally wish to avoid high and variable inflation and avoid deflation.
    - A low positive inflation rate is helpful for allowing moderate falls in real wages.
    - Many countries have inflation targets of around 1-3% per annum.

Employment, Unemployment and the Labour Market

LABOUR MARKET DEFINITIONS

- *Employed* – Person worked for at least one hour in the past week for some form of compensation
- *Unemployed* – person did not work during the past week, but:
    - Looked for work in previous month, and
    - Was available to begin work, or
    - Was waiting to start a new job
- *Labour Force* – the total number of people employed and unemployed
    - Labour Force = Employed + Unemployed
    - LF = L + U
- *Not in Labour Force* – does not meet requirements to be employed or unemployed. Examples include unpaid homeworkers, volunteers, unable to work due to disability or illness, voluntarily inactive

- *Working-age population* – Australians who are civilians, usually residents and who are 15 years or older.
- Other categories:
    - Full time vs Part time – Full time is working at least 35 hours per week.
    - Casual worker – absence of paid leave entitlements (holiday or sick leave)
- *Underemployment* – Person is willing to work more than current hours or has skills and experience that are not required in current job.
- *Discouraged worker* – Person has given up active job search, despite being willing to work, because they believe no suitable jobs are available.
- Important Ratios:
    - Unemployment Rate (u):

      $$u(\%) = \left(\frac{U}{LF}\right) \times 100$$
    - Participation rate

      $$Participation\ Rate(\%) = (\frac{LF}{Pop}) \times 100$$
    - Employment rate

      $$Employment - to - Pop(\%) = (\frac{L}{Pop}) \times 100$$
    - *Pop = working age population*

TYPES OF UNEMPLOYMENT

- Frictional or Search Unemployment –
    - Short-term unemployment that is associated with searching for a suitable job
    - Feature of any dynamic economy
    - Beneficial rather than costly to an economy, as it leads to more efficient matching between workers and jobs
- Structural unemployment –
    - Longer-term unemployment that can arise when the distribution of skills of some workers does not match the match the available jobs in the economy.
    - Structural change in the economy may result in a loss of jobs for certain types of specialised workers
    - Workers may have a lack of skills or be subject to discrimination and this prevents them from finding stable long-term employment.
- Cyclical Unemployment –
    - Associated with fluctuations in economic activity.
    - Rises in recessions
    - Falls during booms
- Natural rate of unemployment – Frictional and structural unemployment are less sensitive to business cycles than cyclical unemployment
    - Even if cyclical unemployment is zero, the unemployment rate will still be positive.
    - Natural rate of unemployment is the rate of unemployment that arises, even when cyclical unemployment is zero.
- Measures:
    - $u* = \ natural\ rate\ of\ unemployment = frictional\ unemployment + structural\ unemployment$

- $u = actual\ rate\ of\ unemployment$
- $Cyclical\ unemployment = u - u*$

OKUN'S LAW

- Quantitative model linking cyclical unemployment to changes in economic activity.
- Measures economic activity using the concept of the output gap.
- Potential output – The level of GDP an economy can produce when using its resources or factors of production at normal rates. Symbol – Y*
  - Potential output is not the same as maximum output
  - Potential output increases over time with growth in labour force, capital stocks, growth in technology.
  - Not necessarily the case that Y = Y*
  - Actual output (Y) can expand or contract due to changes in potential output (Y*) and changes in the utilisation rate of labour and capital.
- Output Gap – actual output does not always equal potential output. The difference is called the output gap
  - Output Gap = Y – Y*
  - Positive output gap Y > Y* called expansionary gap
  - Negative output gap Y < Y* called contractionary gap
  - It is convenient to measure the output gap as a %
  - $Output\ Gap(\%) = \frac{(Y-Y*)}{Y*} \times 100$
- Policymakers generally view both contractionary and expansionary gaps as problems.
  - Contractionary gaps are associated with capital and labour not being fully utilised
  - Expansionary gaps are associated with firms operating above normal capacity and can lead them to raise prices (inflationary)
- Okun's Law – The unemployment rate tends to co-move with the output gap in an economy.
  - Contractionary gaps are associated with a high unemployment rate
  - Expansionary gaps are associated with a low unemployment rate
- Quantitative relationship –
  - $\left(\frac{Y-Y*}{Y*}\right) \times 100 = -\beta(u - u*)$
  - An additional percentage point of cyclical unemployment is associated with a β percentage point decline in the output gap.
  - β is Okun's law coefficient, and the size of it can vary across different countries and over time. The current estimate for Australia is $\beta = 2$

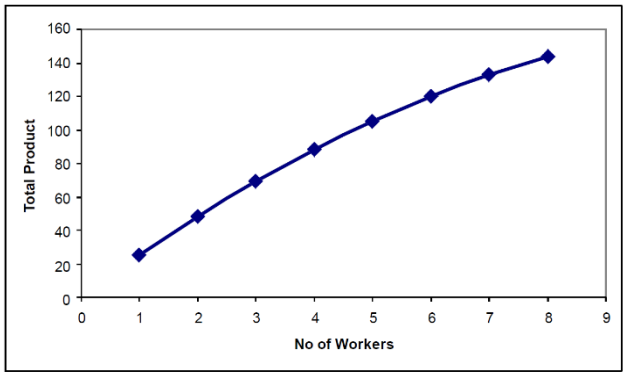
COMPETITIVE LABOUR MARKET MODEL

- Demand for labour (by an individual business) – Can be determined using a concept called the *Marginal product of labour*
    - Suppose a business combines workers with a given amount of capital (machines and building) to produce bikes.
    - As the business employees more labour its output rises, and we want to look at the additional output that is generated by each additional worker.
    - This is the Marginal Product of Labour.
- VMPL – value of marginal product of labour
- $VMPL = p \times MPL$
    - Where p is the price per bike and *MPL* is the marginal product of labour
- Marginal Product Calculations:

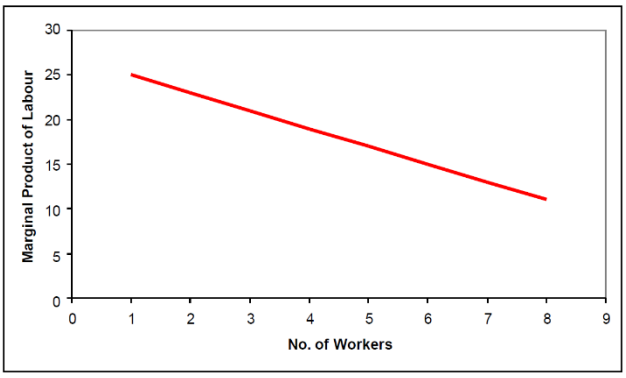
ABC Bike Company

No. of Workers	Output (no. bikes)	Marginal Product	VMPL ($3,000@com)
0	0	-	-
1	25	25	$75,000
2	48	23	69,000
3	69	21	63,000
4	88	19	57,000
5	105	17	51,000
6	120	15	45,000
7	133	13	39,000
8	144	11	33,000

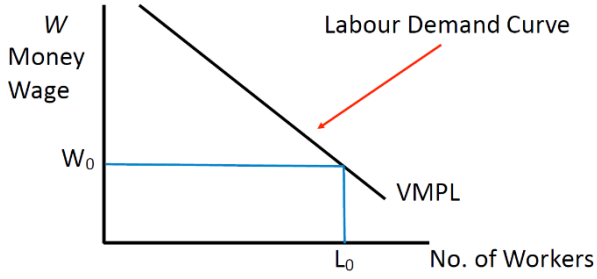
- Production Function:



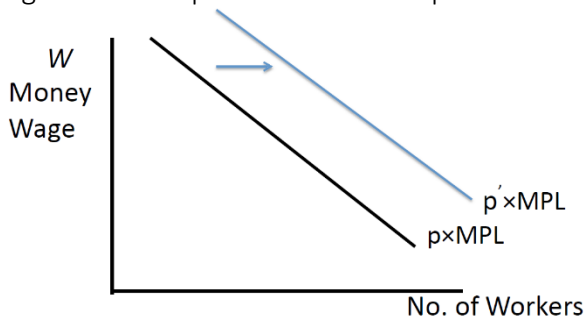
- Marginal Product of Labour:



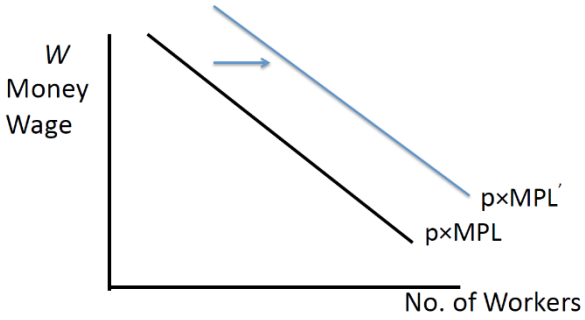
- **Diminishing marginal product** – the nature of the production technology is that each additional worker produces less output than the existing workers.
    - This is a standard assumption in economics
- Business's demand for labour – in deciding the number of workers to employ a business will compare the benefit of an additional worker with the cost of that worker
    - Benefit to the business of employing an additional worker: $VMPL = p \times MPL$
    - Cost to the business for employing an additional worker: $Wage = W$
- We assume that the business operates in a competitive market:
    - It cannot set the wage it pays its workers
    - It cannot set the price is receives for its product
- Therefore, the business will be willing to employ labour until:
    - $VMPL = Money\ Wage$
    - i.e. $p \times MPL = W$
- Demand for labour by an individual business:



Higher relative price for firm's output

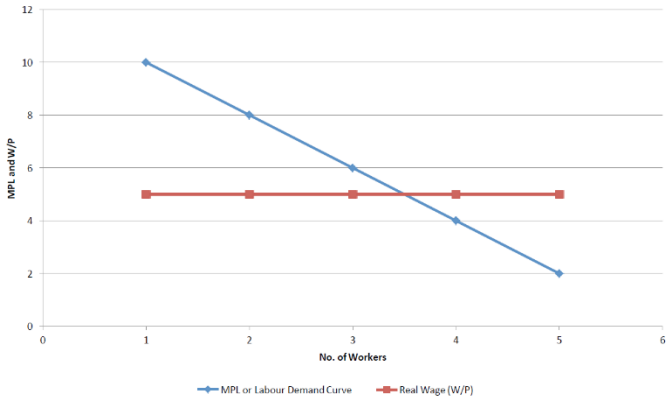


Higher marginal productivity of labour

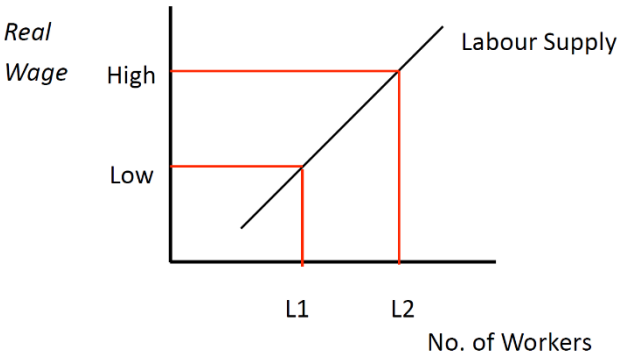


- Aggregate (Economy-Wide) demand for labour – we can apply this model of labour demand to the aggregate economy.
    - $P \times MPL = W$
    - *P* is the aggregate price level and *W* is the aggregate money wage
    - Rearrange as: $MPL = {}^{W}/_{P}$
    - ${}^{W}/_{P}$ is the real wage

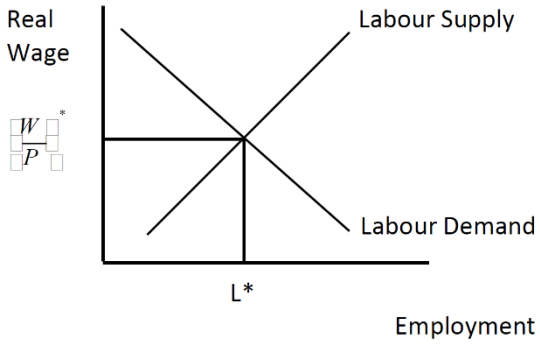
- Aggregate labour demand curve:



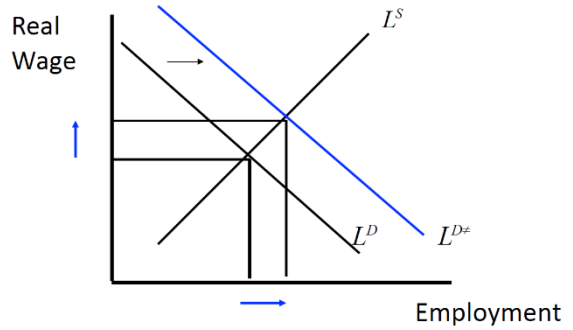
- Supply of Labour –
  - Suppliers of labour are workers and potential workers
  - Labour supply decision – at any given wage people have to decide if they are willing to work.
  - Supply of labour is the total number of people willing to work at each real wage
  - Labour supply is generally assumed to be an increasing function of the real wage.
- Labour supply response to higher real wage:



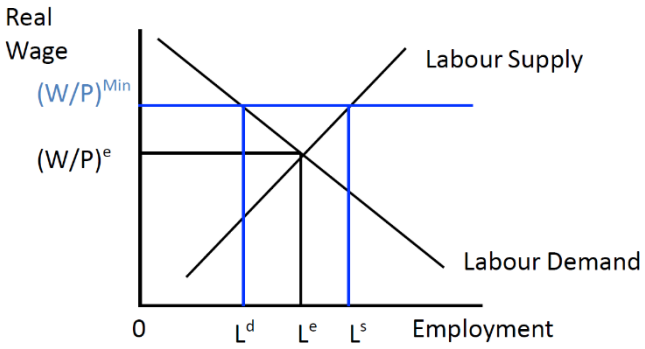
- Factors that shift the labour supply curve:
  - Size of working age population (influenced by birth rate, retirement ages, immigration rates)
  - Participation rate – percentage of working age population who seek employment
- Equilibrium in the aggregate labour market:



- Effect of higher productivity on real wage and employment:



- Frictions in the competitive model – in absence of any friction there is no involuntary unemployment in the competitive model
    - Involuntary unemployment arises where the unemployed would not be willing to accept a job at the current market wage, but are not able to find employment
    - In the competitive model, factors that increase the real wage above the competitive equilibrium are: *Minimum wage laws*, *unions* and *taxes*
- Minimum wage laws – legal minimum hourly wage that business must pay workers.
    - Known as *award wages* in Australia
    - Standard labour demand and supply model predicts that setting the minimum wage too high will produce unemployment.
- Binding minimum wage:



    - The workers (L^d) who are employed at the minimum wage are better-off than at the market clearing wage.
    - The distance (L^s - L^d) indicates people who are willing to work at the minimum real wage but cannot find jobs – i.e. Involuntary unemployment.
- Labour Unions –
    - Workers may negotiate on an individual basis with a firm over wages and conditions
    - Alternatively workers may form labour unions to bargain collectively with a firm
    - Presence of unions tends to produce a wage outcome that is above the market clearing wage.
    - The figure for a minimum wage can be reinterpreted as the outcome for a unionised industry, where: $(W/P)^{min} = W/P^{union}$

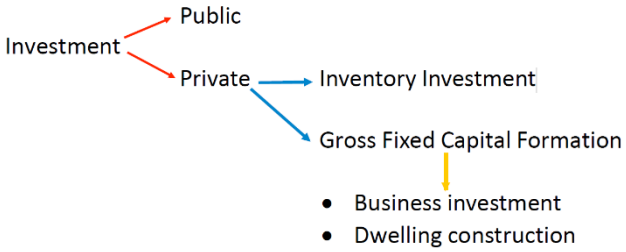
Interest Rates, Investment and Saving

INTEREST RATES

- **Nominal Interest rate** – measures return on a loan in terms of money.
- **Real Interest rate** – measures return on a loan in terms of goods and services.
- Useful approximation –
  - $Real\ Rate \cong Nominal\ Rate - Inflation\ Rate$
  - $r = i - \pi$
- Ex-post and Expected real rate –
  - Ex-post: $r = i - \pi$ (actual inflation)
  - Expected: $r = i - \pi^e$ (expected inflation)
  - Expected is what matters for economic decisions
- Fisher Effect –
  - Assume the real interest rate is a constant
  - $i = \bar{r} + \pi^e$
  - The Fisher effect implies that nominal interest rate will move one-for-one with changes in expected inflation
- Negative nominal interest rates –
  - Nominal interest rates were widely believed (prior to 2008-9) to be subject to a zero lower bound (ZLB)
  - $i \geq 0$
  - Using the expected real interest rate, if $i = 0$ then $(Expected)\ r = -\pi^e$
  - Recent experience in several countries indicates the possibility of negative nominal interest rates.

INVESTMENT

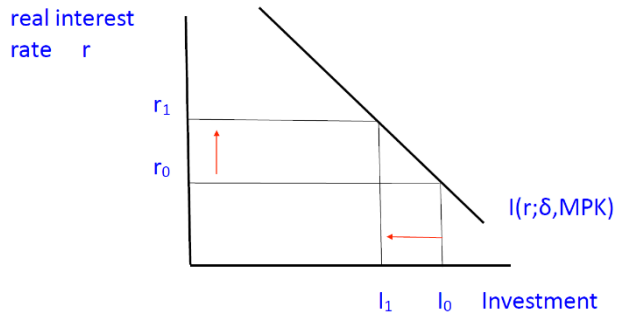
- Investment – the purchase of new capital goods (used in the production of future goods and services)



- Investment is a flow variable
- Accumulation over time gives capital stock
- $K_1 = K_0 + I_1 - \delta \times K_0$
  - K_1 – capital stock at end of period
  - K_0 – capital stock at beginning of period
  - I_1 – gross investment during period
  - $\delta \times K_0$ – depreciation during period
  - δ – depreciation rate
- Economic influences on investment – We compare the marginal product of capital (VMPK) with the user cost of capital (UC)
- Value of marginal product of capital - $VMPK = MPK \times p$

- Other things equal, *marginal product of capital* is the increase in output due to the use of an additional unit of capital, and *p* is the sales price of business's output.

- User cost of capital (UC) – Suppose Tiger Airlines wants to purchase a new plane.
  - Suppose they burrow the funds to buy the new plane at the nominal interest rate = *i*. (Note: even if they used retained earnings there would be an opportunity cost = *i*)
  - The dollar price/cost of the new plane = P_K
  - Physical depreciation rate on plane = δ
  - Over time the price of the plane may rise or fall (capital gain/loss) = ΔP_K
  - The new cost of owning a plane for one year is then:
    $UC = P_K + i \times P_K - (1-\delta) \times [P_K + \Delta P_K]$
  - If we simplify, rearrange and assume that the price of capital goods rises at the general rate of inflation:
  - $UC = P_K[r + \delta]$
  - This model suggests that the two important influences on the investment decision are the price of capital goods (P_K) and the real interest rate (r).
  - I.e. a rise in real interest rate will make the investment less attractive, and a rise in the price of capital goods will make the investment less attractive.
- The benefit of a new plane is the value of the additional output it provides. Cost is given by the user cost of capital, so Tiger Airlines will invest provided:
  - $VMPK \geq UC$
- Investment and the real interest rate – other things equal, an increase in the real interest rate will cause an increase in user cost and this will make less capital investments worthwhile.
  - Implies a negative relationship between investment and the real interest rate.
  - Generally, we can write: $I = I(r; \delta; MPK)$
- Investment demand schedule:



SAVING AND WEALTH

- National saving – in an economy, saving is undertaken by:
  - Households
  - Business
  - Government
- National saving is a measure of aggregate saving in an economy.
- Household saving –
  - $Household\ Saving = Disposable\ Income - Consumption$
  - $S = YD - C$

- YD is the income available to households to spend or save.
    - It is after-tax income
    - Some households get transfer payments
    - Households will get interest payments on any government debt they hold
    - Businesses may choose not to pay all their profits to shareholders, but "retain" some of their profits
- Disposable Income: $YD = Y - TA + TR + INT - RE$
    - Y = GDP
    - TA = Taxes (direct and new indirect)
    - TR = government transfers
    - INT = government interest payments to households
    - RE = business retained earnings
- Two possible measures of household saving:
    - S = YD – C
    - Changes in household wealth
- Wealth is a stock variable, and we use a household balance sheet to measure net wealth.

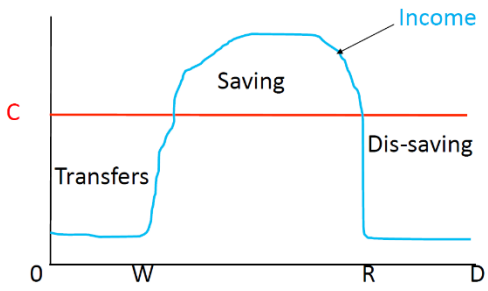
Balance Sheet for Trump Family, 2017

Assets ($)		Liabilities ($)	
House	1,200,000	Mortgage Debt	300,000
Superannuation	2,000,000	Credit Card Debt	35,000
Car	15,000		
Shares	20,000		
Bank Accounts	100,000		
Total	3,335,000	Total	335,000

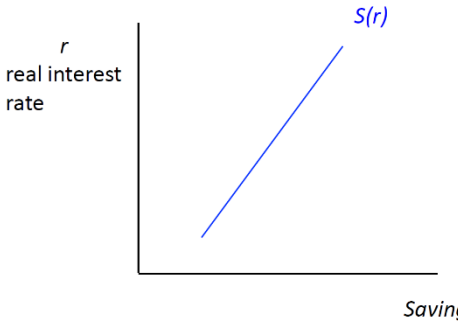
Net wealth = Assets – Liabilities

NB. Use current market prices to value assets/liabilities

- Two things can change net wealth: Saving & Capital gains/losses.
- *Saving* – if saving is positive then assets are being accumulated. If saving is negative then assets are being de-cumulated, or liabilities (debts) accumulated.
- *Capital gains/losses* – Fluctuations in the market value of assets:
    - Change in Wealth = $W - W_{-1} = \Delta W$
    - ΔW = Saving + Capital Gains – Capital Losses
    - $W = W_{-1} + S$ + Net Capital Gains
- Assets, liabilities and wealth are *stock* variables.
- Three standard motives for household saving:
    - *Life-cycle saving* – meeting long term goals:



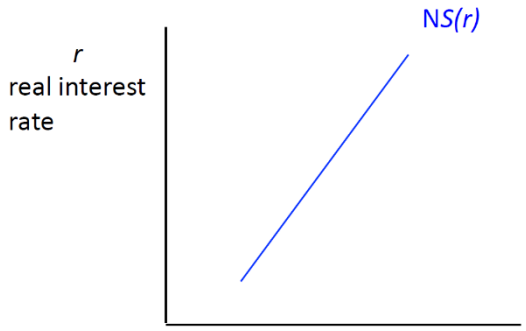
    - *Precautionary Saving* – Savings can be used as a form of insurance against unexpected deadlines in income or unexpected increases in consumption (e.g. temporary unemployment, medical expenses). Increases with level of uncertainty (or variance of income)
    - *Bequest Saving* – People save to leave a bequest or inheritance for their heirs and dependents.
- Household Saving and the real interest rate
    - Saving = Disposable Income – Consumption
    - Saving provides a link between C_{today} and C_{future}
    - Think of the real interest rate as the relative price of consuming today verses consuming in the future.
    - A higher real interest rate makes current consumption relatively more expensive and creates an incentive for people to reduce current consumption (i.e. an increase in saving today)



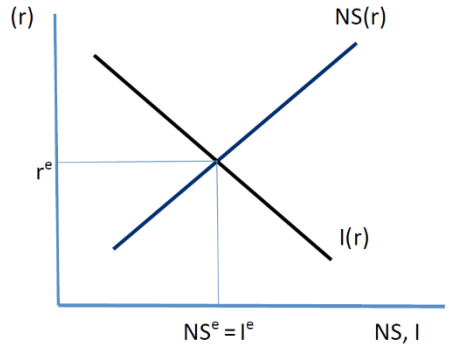
Other things equal, higher r leads to higher saving

- Business Saving –
    - Profits earned by the business sector are typically paid to owners or shareholders as dividends.
    - It is possible for businesses to save by not distributing all their profits.
    - This is known as *retained earnings* (RE)
- Government (Public) Saving – Public saving is measured as:
  $Public\ Saving\ = T - G$
    - Where G is government expenditure, and
      $T = TA - TR - INT$
    - TA = Taxes (Direct and net indirect)
    - TR = government transfers
    - INT = government interest payment to households
- An alternative name for public saving is the government budget balance (BB), which is called a surplus if *positive* and a deficit if *negative*.
- National saving schedule –
    - First definition: *NS = Household Saving + Business Saving + Government Saving*
    - Second definition: *NS = National Income (Y) – Household Consumption (C) – Government Spending (G)*
- Using the second definition, we can decompose NS into its parts:
    - $NS = [(Y - T) - C] + T - G$
    - Where T – G is public saving and [(Y – T) – C] is private saving

- We can further decompose it into:
  - $NS = [(Y - T - RE) - C] + RE + T - G$
  - Where [Y – RE – T – C] is household saving, RE is business saving and T – G is public saving.

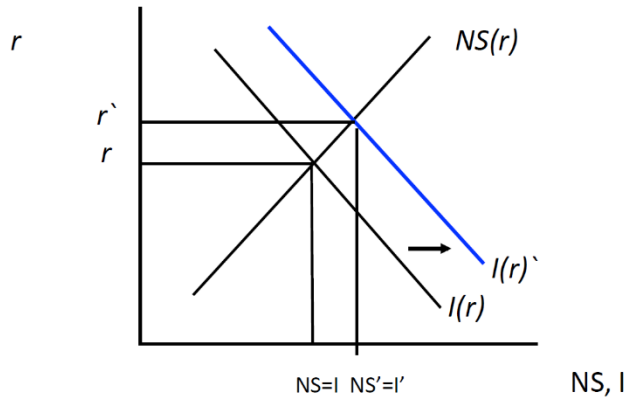


- In an economy with no access to international capital markets:
  - National Saving = Investment
- The supply of saving by households, businesses and government and the demand for saving (for investment) by business are equated by the financial markets.
- Saving is an increasing function of the real interest rate and investment is a decreasing function of the real interest rate. The initial equilibrium is:

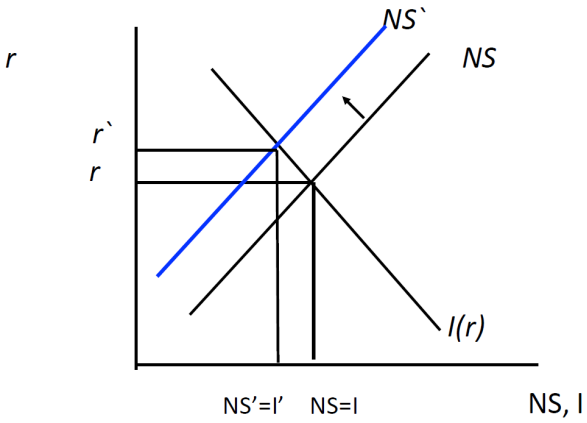


  - If we introduce:

New technology



Increase in budget deficit



- Crowding out –
  - An increase in the government budget deficit will reduce private investment spending.

- In the above model a larger deficit reduces the supply of saving (saving curve shifts inwards) and drives up the real interest rate. The high real interest rate makes investment less attractive and causes a move along the *I* curve.

Income-Expenditure Model of GDP

AGGREGATE EXPENDITURE | ACTUAL AND PLANNED

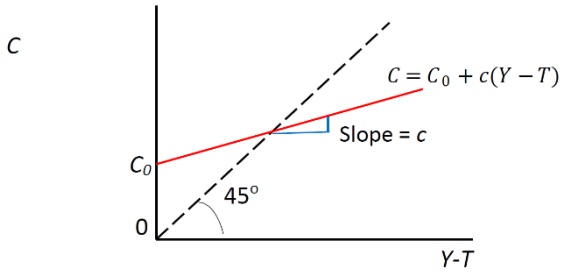
- Key assumption of the Keynesian Model – Prices of goods are fixed (sticky) in the short-run. I.e.
    - Firms do not change prices in response to change in demand for their product
    - Instead they fix their price and then meet the demand by varying their level of production
- In the short run firms will:
    - Accommodate a cut in demand by reducing output and employment, not by reducing prices
    - Accommodate a rise in demand by increasing output and employment, not by increasing prices
- Deeper assumptions:
    - Firms have some ability to set prices
    - Firms face some cost to changing prices – these are called menu costs
- However, in the long-run:
    - Sustained or persistent changes in demand will eventually lead firms to change their prices and cause production to return to normal capacity.
- Frictionless view of the world:
    - Fluctuations in demand will be accommodated by flexible prices and wages without changes in output and employment.
    - There will never be excess production because firms will cut prices to sell it.
    - There will never be persistent unemployment because workers will cut their wages to keep and get jobs.
- The Keynesian assumption is that firms meet demand by changing production. This implies that:
    - Aggregate output (or production) will be determined by the total level of desired (or planned) spending. Thus, we need a measure of planned spending.
- Planned Aggregate Expenditure (PAE) – the total planned spending on domestically produced final goods and services
    - $PAE = C + I^P + G + X - M$
- Aggregate Expenditure
    - $Y = C + I + G + X - M$
- Where:
    - I – actual investment (includes unplanned inventory investment)
    - I^P – planned investment
- Equilibrium condition: $Y = PAE$
    - Which implies that $I = I^P$
    - Then $(unplanned)\Delta Inventories = 0$
    - Equilibrium means there is no tendency for the level of real GDP to change.
- Disequilibrium occurs when:
    - $Y < PAE$ OR $Y > PAE$
    - In both cases there will be some tendency for the level of GDP to change.
- If $Y > PAE$:
    - Businesses will experience an: Unplanned increase in inventory (goods producers) or an excess capacity to meet demand (service producers)

    - This is a signal to businesses to reduce their level of production
    - GDP will fall
- If $Y < PAE$:
    - Businesses will experience an: Unplanned decrease in inventory (goods producers) or an insufficient capacity to meet demand (service producers)
    - This is a signal to businesses to increase their level of production
    - GDP will rise

TWO SECTOR MODEL | HOUSEHOLDS & BUSINESSES

- We make simplifying assumptions:
    - No government sector (G = T = 0)
    - No Foreign sector (X = M = 0)
- Planned Aggregate Expenditure (PAE):
    - $PAE = C + I^P$
- Planned Investment: $I^P = I_0$
    - Assumed to be an autonomous (or exogenous) variable. I.e. it is determined by factors other than GDP (Y).
- Household consumption is decomposed into:
    - Non-durable goods
    - Durable goods
    - Services
- Keynesian consumption function – a simple model in which consumption expenditure is a linear function of disposable income.
- A key influence on consumption spending by households is current disposable income:
    - Disposable Income = Y – T
    - Y = national income of GDP
    - T = Taxes (TA) – Transfers (TR) – Interest on Government Debt (INT)
    - Assume retained earnings (RE) = 0
- Consumption function:
    - $C = C_0 + c(Y - T)$
    - This is a linear relationship.
    - Household consumption depends on a constant C_0 and disposable income $(Y - T)$
- C_0 is exogenous consumption:
    - Factors (other than disposable income) that could affect consumption (e.g. wealth, real interest rates)
    - The value of an exogenous variable is determined outside of the model under construction
- $c(Y - T)$ captures the effect of disposable income on consumption.
    - c is the marginal propensity to consume (parameter)
- Marginal propensity to consume (MPC) – is the change in consumption when disposable income changes by a dollar.
    - $MPC = \frac{\Delta C}{\Delta(Y-T)} = c$
    - A dollar increase in disposable income raises consumption by less than one dollar

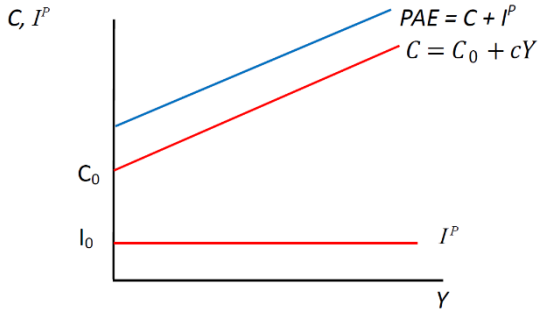
- Consumption function:



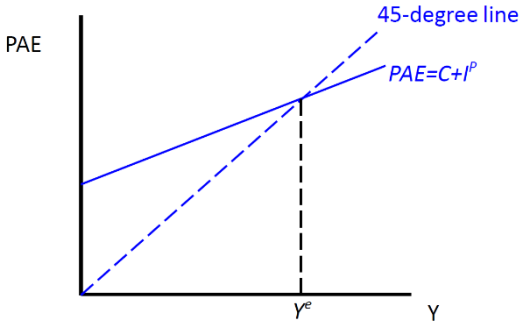
- Average propensity to consume (APC) – proportion of income that is used for consumption:
  - $APC = \frac{C}{Y-T}$
- Relationship between MPC and APC in linear model
  - Divide both sides by (Y – T)

$$APC = \frac{C}{Y-T} = \frac{C_0 + c(Y-T)}{Y-T} = \frac{C_0}{Y-T} + c$$

  - APC > MPC but approaches MPC as Y- T increases
- Now in the **two sector** model:
  - Consumption function: $C = C_0 + cY$
  - Investment: $I^P = I_0$

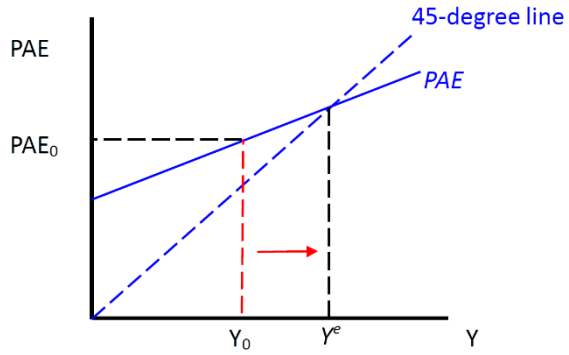


- Equilibrium GDP in the two sector model:

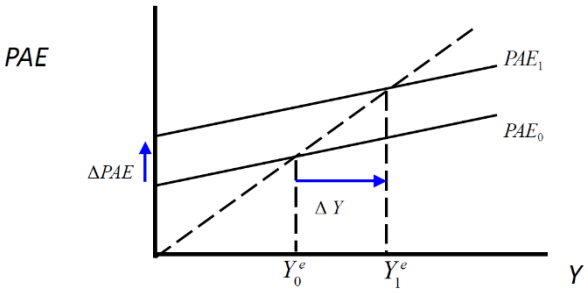


  - We can graphically determine the equilibrium level of GDP.
  - If Y is different to Y^e we are in disequilibrium.
  - When PAE changes, Y^e changes by a multiplier
- Adjustment to equilibrium (PAE > Y):
  - Firms will experience an unplanned decline in their inventories
  - To re-build their inventories firms will increase their level of production

- This will cause GDP to increase, and it will move towards its equilibrium value, where PAE cuts the 45 degree line.
- GDP will increase until PAE = Y.



- Suppose that the level of PAE increases. So does the level of GDP.



- An additional dollar of exogenous PAE generates more than a dollar's worth of GDP:
  - $\frac{\Delta Y}{\Delta PAE} > 1$
- This amount can be calculated as follows:

Definition of *PAE*	$PAE = C + I^{\mathrm{P}}$
Consumption Function	$C = C_0 + cY$
Investment	$I^{\mathrm{P}} = I_0$
Equilibrium Condition	$Y = PAE$

$$PAE = C + I^{\mathrm{P}}$$

$$C = C_0 + cY \qquad (1-c)Y = C_0 + I_0$$

$$I^{\mathrm{P}} = I_0$$

$$Y = PAE \qquad Y^{\mathrm{e}} = \frac{1}{1-c}[C_0 + I_0]$$

$$Y = C_0 + I_0 + cY$$

- We write the model in terms of changes in induced (endogenous) and autonomous (exogenous) variables.

$$\Delta Y^{e} = \frac{1}{1-c}[\Delta C_0 + \Delta I_0]$$

- Autonomous consumption (Set $\Delta I_0 = 0$):

$$\Delta Y^{e} = \frac{1}{1-c}[\Delta C_0]$$

$$\frac{\Delta Y^{e}}{\Delta C_0} = \frac{1}{1-c}$$

- Autonomous investment (Set $\Delta C_0 = 0$):

$$\Delta Y^{e} = \frac{1}{1-c}[\Delta I_0]$$

$$\frac{\Delta Y^{e}}{\Delta I_0} = \frac{1}{1-c}$$

- Therefore, the multipliers are:
  - Autonomous consumption:

$$\frac{\Delta Y^{e}}{\Delta C_0} = \frac{1}{1-c} > 1$$

  - Autonomous planned investment:

$$\frac{\Delta Y^{e}}{\Delta I_0} = \frac{1}{1-c} > 1$$

SAVING AND PLANNED INVESTMENT

- Alternative way to represent the two-sector model:

  Y = PAE

  $$Y = C + I^P$$

  $$Y - C = I^P$$

  $$S = I^P$$

- Deriving the Savings Function:

  Consumption Function

  $$C = C_0 + cY$$

  Definition of Saving

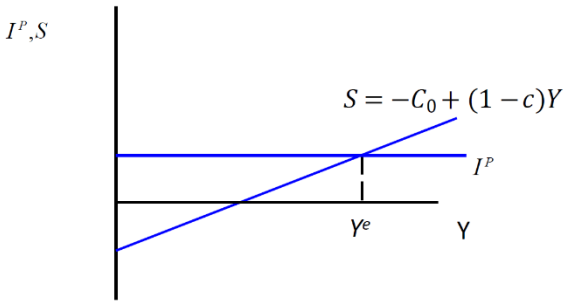
  S = Y – C

  $$S = Y - C_0 - cY$$

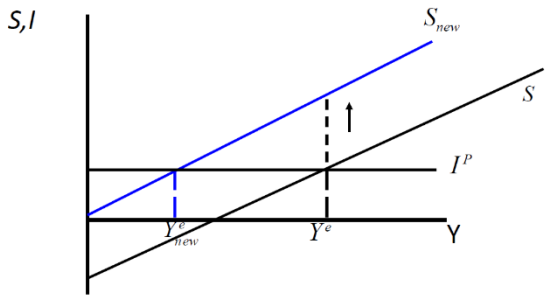
  Saving Function

  $$S = -C_0 + (1 - c)Y$$

- The equilibrium condition is that planned investment equals saving: $I^P = S$



- Paradox of thrift:
  - Suppose there is an exogenous increase in desire to save by households.
  - This can be represented by an upward shift in the saving function.
  - New equilibrium:



  - While any individual household may be able to increase its own level of saving (and wealth), the attempt by all households to increase their saving does not lead to an increase in the aggregate level of saving (and wealth).

OPEN ECONOMY MODEL

- Including international trade in goods and services in the two sector model.
- Definition of PAE:
  - $PAE = C + I^P + X - M$
- Key influences on exports (X):
  - World demand
  - Exchange rate
- Assume exports are exogenous: $X = X_0$
- Key influences on imports (M) is domestic GDP.
  - Simple model: $M = mY$
  - Imports are a linear function of domestic GDP
- m = marginal propensity to import
  - $\frac{\Delta M}{\Delta Y} = m$
- In the open economy model:

$$PAE = C + I^P + X - M$$

$$C = C_0 + cY$$

$$I^P = I_0$$

$$X = X_0$$

$$M = mY$$

$$PAE = C_0 + I_0 + X_0 + (c - m)Y$$

- Thus:

$$PAE = [C_0 + I_0 + X_0] + (c - m)Y$$

  - The first term is independent of output and is called exogenous (or autonomous) expenditure
  - The second term is called induced expenditure since is depends on output
- Short-run Equilibrium output – When firms produce a level of output that just equals planned aggregate expenditure.

$$Y = PAE$$

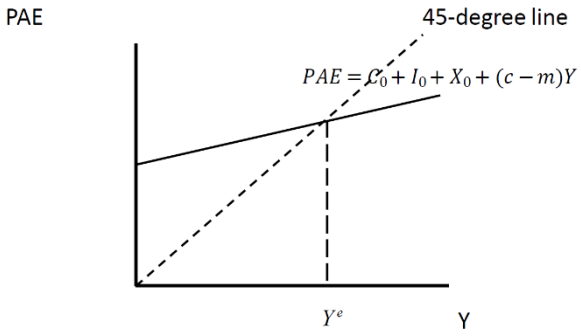
$$PAE = C_0 + I_0 + X_0 + (c - m)Y$$

$$Y = C_0 + I_0 + X_0 + (c - m)Y$$

$$Y^e = \frac{1}{1 - (c - m)}[C_0 + I_0 + X_0]$$

  - Y^e is the short-run equilibrium output.

$$\text{Multiplier} = \frac{1}{1-(c-m)} < \frac{1}{1-c}$$



- PAE and the output gap:
  - Output gap = Actual Output less Potential Output
  - Output gap = Y – Y*
  - We can use the PAE model to explain contractionary and expansionary output gaps.
- The Keynesian model explains fluctuations in GDP with 2 possibilities:

$$Y^e = \frac{1}{1-(c-m)}[C_0 + I_0 + X_0]$$

  - A change in exogenous variables: C_0, I_0, X_0
  - A change in one of the parameters: c, m

Government Sector and Fiscal Policy

FISCAL POLICY AND FISCAL INSTRUMENTS

- Instruments of fiscal policy:
  - Government expenditure: current goods and services, investment and infrastructure (G)
  - Taxes (direct, indirect) – income taxes, consumption taxes (GST) (T)
  - Transfer payments – unemployment benefits, pensions (T)
- Government decisions about G and T can affect the level of output in the economy
- Assume a closed economy (X = M = 0)
  - $PAE = C + I^P + G$
  - There is a direct role for government expenditure G to affect PAE.
  - Taxes play an indirect role via consumption: $C = C_0 + c(Y - T)$
- Tax function: $T = T_0 + tY$
  - Autonomous component to taxes given by T_0
  - Induced component that depends on Y
  - t = marginal tax rate. Gives the change in tax receipts for a change in national income.
  - $\frac{\Delta T}{\Delta Y} = t$
- Consumption function and tax function:

$$C = C_0 + c(Y - T)$$

$$T = T_0 + tY$$

Substitute

$$C = C_0 + c(Y - T_0 - tY)$$

Re-arrange

$$\boxed{C = C_0 - cT_0 + c(1 - t)Y}$$

- Equilibrium in the three sector model:

$$PAE = C + I^p + G$$

$$C = C_0 - cT_0 + c(1 - t)Y$$

$$I^p = I_0$$

$$G = G_0$$

$$PAE = [C_0 - cT_0 + I_0 + G_0] + c(1 - t)Y$$

$$Y = PAE$$

$$Y = [C_0 - cT_0 + I_0 + G_0] + c(1-t)Y$$

$$Y[1 - c(1-t)] = [C_0 - cT_0 + I_0 + G_0]$$

$$Y^e = \frac{1}{[1 - c(1-t)]} \times [C_0 - cT_0 + I_0 + G_0]$$

FISCAL MULTIPLIERS

- Rewrite the equilibrium in changes:

$$\Delta Y^e = \frac{1}{[1 - c(1-t)]} \times [\Delta C_0 - c\Delta T_0 + \Delta I_0 + \Delta G_0]$$

- The multipliers:

Change in G

$$\frac{\Delta Y^e}{\Delta G_0} = \frac{1}{[1 - c(1-t)]} > 0$$

Change in T

$$\frac{\Delta Y^e}{\Delta T_0} = \frac{-c}{[1 - c(1-t)]} < 0$$

  - Note: An increase in government spending has a larger impact than an exogenous tax cut
- Balanced Budget Multiplier: $BB = T - G$
- Suppose a government wanted to undertake a fiscal policy that affected the level of GDP but didn't change the initial value of the budget deficit
- For example:
  - Consider equal changes in G and T that that the initial level of budget surplus is unchanged
    - Increase government spending by 100 (and simultaneously).
    - Increase exogenous taxes by 100.

(Initial) BB = T – G

BB = (T+100) – (G+100)

No change on *initial* value.

Begin with equilibrium Y in 3-sector model

$$Y^e = \frac{1}{[1 - c(1-t)]} \times [C_0 - cT_0 + I_0 + G_0]$$

Re-write in changes:

$$\Delta Y^e = \frac{1}{[1 - c(1-t)]} \times [\Delta C_0 - c\Delta T_0 + \Delta I_0 + \Delta G_0]$$

Now set: $\Delta C_0 = \Delta I_0 = 0$

$$\Delta Y^e = \frac{1}{[1 - c(1-t)]} \times [-c\Delta T_0 + \Delta G_0]$$

But we can set $\Delta T_0 = \Delta G_0$ (Why?)

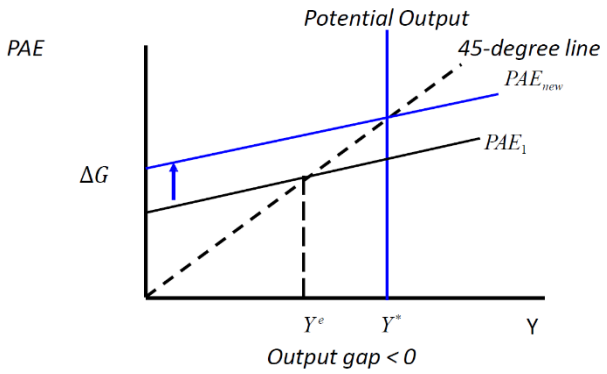
$$\Delta Y^e = \frac{1 - c}{[1 - c(1-t)]} \times \Delta G_0$$

- Even though we matched the increase in G with an equal increase in T, the overall effect is to increase Y.

- The size of fiscal multipliers in practice:
  - Government spending – Plausible range: 0.5 to 0.9
  - Tax/transfer – Plausible range: 0.1 to 0.3
  - Estimates tend to be smaller than what is implied by the Income-Expenditure model

FISCAL POLICY & OUTPUT GAPS

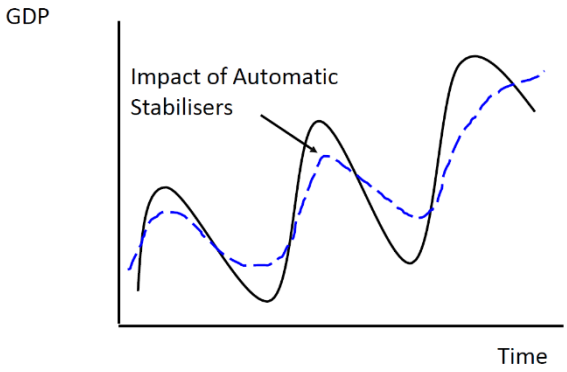
- The income-expenditure model has no automatic mechanism to ensure *Y = Y**.
- However, the model does imply exogenous changes in G and T can be used to close output gaps, i.e. to ensure *Y = Y**.
- Increasing *G* to eliminate a negative output gap:



- The role of fiscal policy in stabilising the economy:
    - Automatic stabilisers – tendency for a system of taxes and transfers which are related to the level of income to automatically reduce the size of GDP fluctuations
    - Discretionary fiscal policy – refers to deliberate changes in the level of government spending, transfer payments or in tax rates (e.g. one-off cash payments)

AUTOMATIC STABILISERS

- Systems of taxes and transfer payments that act as automatic stabilisers for the economy:
    - As GDP declines, the level of taxes paid falls and the level of transfer payments (e.g. unemployment benefits) will increase
    - BB = T – G; so a fall in T, other things equal, implies BB declines
- The process is automatic (without any government action) and makes contractions and expansions in GDP smaller than they would have been otherwise.



DISCRETIONARY FISCAL POLICY

- Prior to 2007-8 GFC, the importance of fiscal policy as a discretionary policy instrument for stabilising the economy had been declining.
- Fiscal policy is seen as less flexible and less timely than monetary policy. This is because of:
    - *Recognition lag* – recognising the need for some form of policy action (by monitoring the state of the economy)
    - *Decision lag* – deciding on an appropriate policy action
    - *Implementation lag* – implementation of fiscal policy generally requires legislation (needs to be approved by parliament)
    - *Effect lag* – time required for policy to have significant effect on economy
- Ideally, macroeconomic policy should be forward-looking, i.e. fiscal policy changes made today should be designed to influence future levels of output
- Differences in the GFC:
    - Falls in GDP were preceded by financial/credit crisis (provided advanced warning for governments)
    - Many countries (not Australia) have had relatively large and persistent falls in GDP

- Concerns about the ability of monetary policy to provide sufficient stimulus to economies. In some countries policy interest rates were at the zero lower bound.
- The GFC provided greater scope for governments to use fiscal policy in a timely manner.

GOVERNMENT BUDGET CONSTRAINT

- Budget balance
  - BB = T – G.
  - Note: T = TA – TR – INT
- Four main components of budget balance:
  - Government purchases of goods and services (G)
  - Tax receipts (TA)
  - Transfer payments (TR)
  - Interest payments on government debt (INT)
- Budget surplus/deficit is a flow variable
- Budget deficits need to be financed in some manner
- A standard source of financing is to borrow from the private sector
- Public Debt – The outstanding stock of government borrowing, and it equals the sum of all past deficits less any surplus: $D_t = D_{t-1} - BB_t$
  - D_t = stock (or level) of public debt at end of period t
  - A budget deficit BB < 0, adds to the stock of public debt
  - A budget surplus BB > 0 reduces the stock of public debt
- Government expenditures (purchases, transfer payments and interest payments) in any period need to be funded by either:
  - Taxes
  - Borrowing (e.g. selling a government security)
  - Printing money (bad reputation – associated with hyperinflation)
- Assume that the government does not use money finance. The means of relating government outlays to their method of financing is via the **government budget constraint**.

Budget Balance

$$BB_t = T_t - G_t$$

Stock of Debt

$$D_t = D_{t-1} - BB_t$$

Substitute and re-arrange

$$-(T_t - G_t) = D_t - D_{t-1}$$

$$-(T_t - G_t) = D_t - D_{t-1}$$

Decompose T

$$T_t = \tilde{T}_t - TR_t - rD_{t-1}$$

$\tilde{T}_t$ = tax receipts

TR_t = transfer payments

rD_{t-1} = real interest payments on public debt

r = real interest rate on debt (assumed constant)

$$T_t = \tilde{T}_t - TR_t - rD_{t-1}$$

Substitute for T

$$-(T_t - G_t) = D_t - D_{t-1}$$

$$G_t + TR_t + rD_{t-1} - \tilde{T}_t = D_t - D_{t-1}$$

and re-arrange

$$G_t + TR_t + rD_{t-1} = \tilde{T}_t + D_t - D_{t-1}$$

- Government budget constraint notation:

$$\underbrace{G_t + TR_t + rD_{t-1}}_{\text{Use of Funds}} = \underbrace{\tilde{T}_t + D_t - D_{t-1}}_{\text{Funding Sources}}$$

G = government purchases
TR = transfer payments
$\tilde{T}$ = taxes
D_{t-1} = stock of government securities (i.e. public debt) at the end of period *(t-1)* *(or beginning of period t)*
rD_{t-1} = real interest payments on public debt

- In any period, a government has a choice for how to pay for their expenditures:
  - One option is to raise just enough revenue through taxes and not borrow. This is equivalent to running a balanced budget.
  - Or the government can fund some of its expenditure by borrowing.
- Trade-off:
  - Raising taxes has economic (and political) costs. Governments to defer some of these costs by borrowing.
  - But higher government debt means relatively higher taxes on future generations.
- There is a temptation for a government to continually defer raising taxes or reducing government expenditures and allow a growing level of public debt.

- One rule for fiscal policy is that governments should seek to *balance their budgets over the business cycle*.
    - During recessions, governments would borrow to finance temporarily larger budget deficits.
    - During periods of expansion, governments would reduce the level of public debt by running budget surpluses.
- An alternative rule for fiscal policy is *the golden rule for public investment*.
    - This rules draws a distinction between government spending for current consumption, and for investment in public capital/infrastructure.
    - The basic principle is that government consumption expenditure only provides benefits to the current generation, so they should be paid for by current taxes.
    - Government investments are long-lived and provide benefits not only for the current generation, but also future generation.
    - Since future generations share in the benefits of government investment, there is a case on equity grounds that they should contribute to the cost of the investment.
    - This will occur if governments borrow to fund their investment spending, as the higher taxes required to repay the debt will fall on future generations.
    - Essentially, under the golden rule, *government investment should be funded by borrowing*.

PUBLIC DEBT

- Public debt emphasises three issues:
    - Consequences of high levels of public debt for economic growth
    - Possible crowding out of private investment due to high real interest rates
    - Intergenerational equity
- Public debt and economic growth:
    - Reinhart and Rogoff (2010) suggested a public debt to GDP ratio greater than 90% is associated with a significant fall in the economic growth rate.
    - Kumar and Woo (2010) estimate that a 10 percentage point increase in a country's initial debt to GDP ratio is associated with a reduction in the annual real growth of about 0.2 percentage points per year.
    - Implication: Other things equal, if a country's debt to GDP ratio were 50% rather than 40%, its annual real growth rate would be 1.8% rather than 2%.
- Crowding out of investment:
    - One mechanism by which public debt might act to reduce economic growth is through crowding out.
    - Closed economy *NS and I* model predicted an increase in the government deficit would tent to increase the real interest rate and reduce the level of private investment
    - Over time a persistently lower level of private investment would result in a lower private capital stock in an economy, and this could lead to a lower level of real economic growth.
- Intergenerational equity:
    - Borrowing because of deficit budgets cannot be sustained forever, and eventually surpluses would be required to reduce debt.

- Intergenerational equity means we should not enjoy the benefits of budget deficits now and pass on the costs of those deficits to future generations
- High levels of public debt that are not matched by high levels of productive public infrastructure tend to be inequitable from an intergenerational perspective.

- Sustainability of public debt:
  - In evaluating sustainability, we use the debt to real GDP ratio: $d = \frac{D}{Y}$
  - A growth in *D* relative to the growth in *Y* will cause *d* to rise.
  - We can derive the following equation to describe the behaviour of the debt to GDP ratio

$$\Delta d_t = \frac{(r-g)d_{t-1}}{1+g} - pbb_t$$

r = real interest rate on public debt.
g = growth rate of real GDP.

$$pbb = \frac{PBB}{Y}$$

PBB = Primary Budget Balance = $[T_t - G_t - TR_t]$

  - Two factors act to increase this ratio: *Primary budget deficits* and if the real interest rate exceeds the growth rate of real GDP ($r > g$)

Financial Assets, Money and Private Banks

ASSET RETURNS AND PRICES

- The yield or return on a financial asset is inversely related to the asset's price.
  - $Return = \frac{Price(tomorrow)+Payoff}{Price(today)} = \frac{P'+I'}{P}$
- Bonds – Legally enforceable promise to re-pay a debt. You can have:
  - Government bonds
  - Corporate bonds
- Four elements of a bonds:
  - Term of bond – length of time before bond has to be repaid (called maturity)
  - Principal – amount that needs to be repaid at maturity
  - Coupon payment – regular dollar payment of interest on the bond
  - Coupon rate – $= \frac{Coupon\ Payment}{Principal}$
- Bonds do not have to be held until maturity. They can be bought and sold on the bond market.
- In order to determine the value of a bond we need to use the present value formula:
  - N-period bond:

$$PV = \frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + \cdots + \frac{C_N + \text{Principal}}{(1+i)^N}$$

  - Perpetuity (No maturity date):

$$PV = \frac{C}{i}$$

DEFINITION OF MONEY

- Fundamental definition of money:
  - Medium of exchange
  - Unit of account
  - Store of value
- *Medium of exchange* – Good or asset whose primary purpose is to purchase other goods
  - Increases efficiency of trade compared to bartering
  - With bartering, both parties need something that the other party wants. When using a medium of exchange, this requirement is removed.
- *Unit of account* – Good that is used to compare the value of all other goods and services
- *Store of value* – Good or asset that serves as a means of holding (or transferring) wealth over time
  - Transfer purchasing power from today into some future period.
  - Many goods and assets can serve as a store of value, but do not possess the medium of exchange or unit of account functions of money.
  - Disadvantage – low (or zero) nominal return compared to other assets
  - Advantages – Perfectly liquid & Nominal price if fixed so no possibility of capital loss (or gain)
- In modern economies money is provided by:
  - Government (currency – notes and coin)

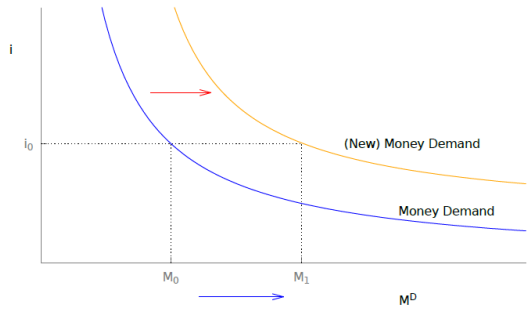
    - Banking system (deposits – accounting)
- Definitions of money measures:
    - Currency = Notes and coins on issue (less what is held by RBA and banks)
    - M1 = Currency + Current deposits at banks
    - M3 = M1 + all other bank deposits of non-bank private sector
    - Broad Money = M3 + borrowings from private sector by non-bank depository corporations (less what these non-banks hold with banks)

DEMAND FOR MONEY

- Money's role as a medium of exchange generates a *transactions* demand for money.
- The factors that are likely to influence the quantity of money demanded for making transactions are:
    - Value of transactions (i.e. volume*price)
    - Opportunity cost of holding money
    - Transactions technology
- Two components:
    - Real GDP (Y) is used as a proxy for volume of transactions. Other things equal, an increase in Y will increase demand for money (M).
    - Aggregate Price Level (P). Other things equal, an increase in P will increase the demand for M.
- Opportunity cost:
    - Money that is held to make transactions pays zero or low interest rate.
    - Holding money incurs an opportunity cost, which is the nominal rate you could have earned by holding a bond.
- Nominal Interest rate (i):
    - Other things equal, an increase in *i* will reduce the demand for M.

      $$M^D = P \times L(Y, i)$$

    - L(.) is some unspecified function of real GDP and nominal interest rate.



- Financial innovation and regulation:
    - Effects on composition of M – Tap and Pay will reduce demand for currency, but we still need bank deposits for transfer or to pay credit card accounts.
    - Effects of demand for M – Bitcoin and other e-currencies (not measured in M). Otherwise there is a very small effect at the present.

SUPPLY OF MONEY

- Main component of money in Australia is bank deposits (value of current deposits is around 4 times the value of currency).
- Private banks provide two basic functions:
  - Financial intermediation
  - Key role in payments system
- $Money\ Supply = Deposits\ held\ by\ banks + Currency\ held\ by\ public$
- Model of a bank:
  - Banks can earn revenue by charging a higher interest rate on its loans than it pays on its deposits
  - Loan rate (i^L) > Deposit rate (i^D)
  - Suppose $500 in deposits are withdrawn from a bank with the following balance sheet:

Assets		*Liabilities*	
Loans	1,000	Deposits	1,000 -500
Reserves	100 -500	Equity	100

  - The bank only has 100 in reserves and will be short 400 to meet withdrawals.
  - Bank could try and make borrowers repay their loans but this is likely to be costly and could case increased withdrawal of deposits.
- The bank then the following options:
  - Attract additional deposits
  - Borrow funds
  - Borrowing reserves from other banks or the central bank.
- A bank's balance sheet includes the following:

Assets	*Liabilities*
Reserves	Deposits
Gov. Securities	Borrowing
Loans	Equity

- Two ratios used to measure riskiness of a bank:
  - Leverage ratio
  - Reserve-deposit ratio (or liquidity coverage ratio)
- Leverage ratio:
  - Assets = Liabilities
  - Loans + Reserves = Debt + Equity
  - Equity = Loans + reserves – Debt
  - $Leverage\ Ratio = \frac{Loans}{Equity}$
  - Equity provides a buffer to banks becoming insolvent or bankrupt in the case of defaults on loans.
- Reserve-Deposit Ratio:
  - Reserves as a proportion of deposit: R/D

    - Historically governments have imposed minimum required reserve-deposit ratio on banks
    - Todays reserve requirements have been abolished in many countries and even where they remain they do not play an important role in the regulation of banks.
- A common feature of bank balance sheets is a mismatch between the maturity of their assets and their liabilities.
    - Banks typically "borrow short" and "lend long"
- The process of maturity transformation by banks makes them susceptible to *bank runs* and *liquidity crises*.
- Bank runs – these arise when depositors seek to withdraw their deposits precisely because they expect other deposit-holders to do the same.
- To meet the sudden and unexpected demand of withdraw deposits, banks will need:
    - To borrow from other sources
    - Try to sell their marketable assets, or
    - Call-in loans
- If banks cannot meet demand for withdrawals they may be forced to suspend the ability of depositors to withdraw their funds.
- Liquidity Crisis – Occurs when a bank is solvent (Assets > Debt Liabilities) but has insufficient liquid assets to meet demand for withdrawals.
- Policy responses:
    - Central bank lending
    - Deposit insurance
- Central bank lending:
    - Suppose banks have insufficient reserves or liquid assets to meet demand to convert bank liabilities into currency
    - Central bank can supply currency/reserves at zero cost, and can lend the banking system necessary liquid assets to meet demand
    - A general rule is that the central bank should lend to banks that are solvent but short of liquid assets.
- Deposit Insurance:
    - Government (or agency) provides insurance to depositors.
    - Since depositors are assured of being able to receive payment in currency regardless of the bank's financial situation, they have less incentive to participate in a bank run
    - In Australia the Federal Government guarantees deposits of up to $250,000 that are held with banks, building societies and credit unions
    - Governments will typically charge banks a fee for deposit insurance.
- Regulation of banks - Banks are susceptible to economic shocks, and consequently banks are subject to various types of regulation:
    - Australia Prudential Regulation Authority (APRA) regulates all domestic financial institutions.
    - Internationally many countries adhere to the Basel Accords
    - *Capital ratios* require banks to maintain a certain ratio of equity capital to a risk weighted measure on their assets

- *Liquidity coverage ratios* require a certain fraction of bank assets are relatively liquid and can be easily used to meet potential deposit outflows and repayment of short-term borrowings.
- *Net stable funding ratios* focus on the sources of bank funding; deposits, borrowing and equity and their relative stability (i.e. the ease with which the type of funding can be withdrawn).
- Restrictions on *loan-to-value ratios* provide limits on the amount that an individual can borrow to purchase an asset

MONEY AND PRICES

- One function of money is the unit of account. I.e. the prices of all other goods and services are measured in terms of money.
- Prices of goods, services and financial assets in Australia are quoted in Australian dollars.
- Velocity – How fast money circulates.
  - $Velocity = \frac{Value\ of\ Transaction}{Money\ Stock} = \frac{Nominal\ GDP}{Money\ Stock}$
  - $V = \frac{P \times Y}{M}$
- Quantity theory –
  - Quantity theory makes two economic assumptions: Velocity is constant & Output is constant
  - Quantity equation: $M \times V = P \times Y$
  - Quantity theory: $M \times V_0 = P \times Y_0$

    Re-write as $P = \frac{V_0}{Y_0} \times M$

    $P = v \times M$

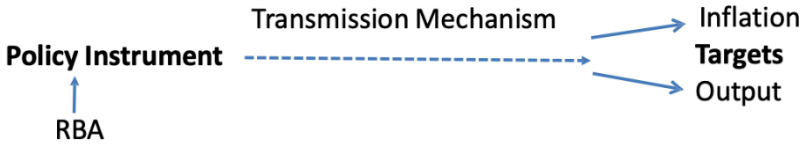
    $v = \frac{V_0}{Y_0}$
  - Price level is proportional to the money stock
  - Quantity theory states that changes in M cause proportional changes in P.
- Inflation and money growth –
  - Re-write levels model: $P = v \times M$
    in terms of growth rates: $\%\Delta P = \%\Delta v + \%\Delta M$
  - Inflation rate = growth rate of money + growth rate of *v*
  - Assume that $\%\Delta v = 0$ (*v* is a ratio of constants)
  - Then $\pi = \%\Delta M$
  - Inflation rate = Growth rate of money

Central Banks and Monetary Policy

RESERVE BANK OF AUSTRALIA

- Central banks make operational decisions about monetary policy.
- They often have a considerable degree of autonomy or independence in implementing monetary policy.
- Australia's central bank is the RBA.
- **Monetary policy** – actions taken by the central bank (CB) to influence short-run macroeconomic outcomes.
- **Targets** – Final variables that CBs seek to influence:
    - Inflation rate
    - Level of resource utilisation
- CBs do not have direct control over ultimate targets.
- **Monetary policy instruments** – Variables which the central bank can directly control that eventually have a predictable effect on policy targets.
- The RBA is NOT required to:
    - Maintain a fixed exchange rate.
    - Maintain an inflation rate between 2-3 percent per annum.
- Main functions of the RBA:
    - Stability and efficiency of financial markets
    - Promoting efficiency of payments systems
    - Responsible for operation of monetary policy
- Headline and core inflation:
    - *Headline inflation* is equal to the measured CPI with no adjustments.
    - *Core/Underlying inflation* – use a procedure to try and remove the volatile, temporary fluctuations in inflation. It measures the longer-term (underlying) trends in inflation rate.
- Two basic approaches to measuring underlying inflation:
    - Remove historically volatile components of headlines inflation such as energy prices.
    - Eliminate a proportion of items with the highest and lowest rates of price change.

MONETARY POLICY FRAMEWORK

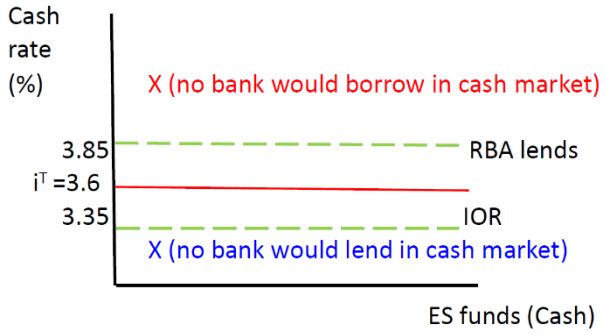


- Statements by RBA indicate it has a 'flexible' inflation target. Takes output into account in setting policy.
- RBA's operating procedures:
    - Announces target value for the Cash rate.
    - Intervenes in cash market to ensure *Actual Cash Rate = Target Cash Rate*
- Monetary policy process:
    - RBA makes 11 monthly decisions on whether to raise, lower, or not change the target cash rate per year
    - Size of change is usually 25 basis points (100 bp = 1%)

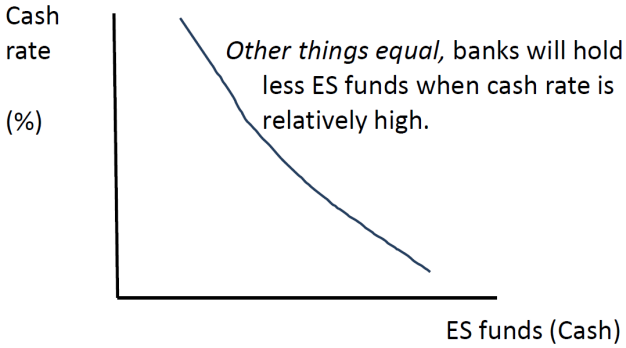
    - Increasing cash rate = Contractionary policy
    - Decreasing cash rate = Expansionary policy
- Definition of Cash – Cash is a colloquial name for Exchange Settlement Funds.
    - *Exchange Settlement Funds* are held in accounts by Australia banks at the RBA. These accounts are called *Exchange Settlement Accounts* (ESAs)
- Role of Exchange Settlement Accounts and Exchange Settlement funds (or cash)
    - Banks hold reserves at RBA in Exchange Settlement Accounts, and they are not allowed to overdraw these accounts.
    - They use ESAs to clear debts (or credits) with other banks.
    - E.g., If ANZ owes $20m to Westpac, then funds are simply transferred between their ESAs. ANZ ESA (-$20m), Westpac ESA (+$20m)
    - Interbank transfers will change the distribution of Cash but will not affect the overall level of Cash in the system.
- Overnight Cash Market –
    - Specialised market where banks can trade Cash.
    - Borrowing and lending for periods up to 24 hours.
    - E.g. ANZ could borrow Cash from some other bank which might find itself with more than it wants to hold.
    - **Interest rate in interbank market = Cash rate**.

CASH RATE AND LONG-TERM INTEREST RATES

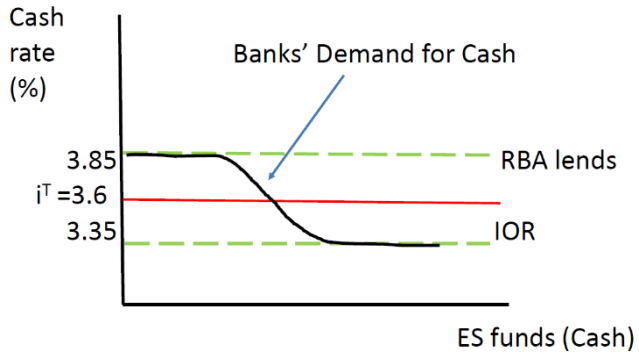
- The RBA sets its cash rate target with two mechanisms:
    - Channel system
    - Open market operations
- A channel for the Cash Rate -
    - RBA provides banks with two automatic facilities for overnight lending and borrowing called **standing facilities**.
    - *Interest on Reserves (IOR)* – They pay interest on funds held in ESAs at rate which is 0.25% below its cash rate target. Since the cash rate is now 3.6%, the IOR = 3.6 – 0.25 = 3.35%. **Lower bound for the actual cash rate**.
    - Re-discount rate – Banks can, at any time, borrow Cash (using bonds as security) from the RBA at a rate that is 0.25% above the target Cash rate. **Upper bound for actual cash rate**.
    - This channel system limits the possible range of cash rate values.



- Banking system demand curve for Cash:

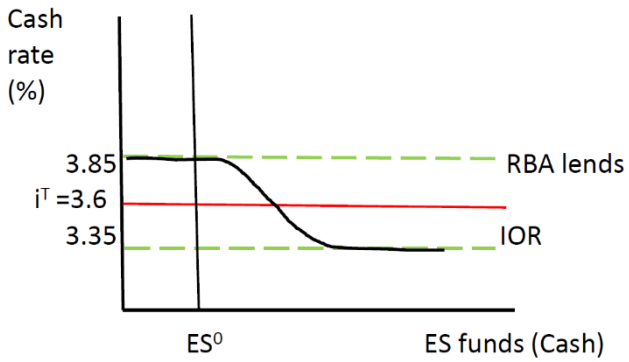


- Banking system demand curve for cash (truncated by channel system):



- Supply of cash (exogenous changes):
  - Banks cannot change the total quantity (supply) of cash available.
  - On any given day the supply of cash is affected by transactions between the private sector and the Federal Government.
  - Private sector payments to the government (taxes) reduce the supply of cash.
  - Government payments to the private sector (transfer payments) increase the supply of cash.
- Supply of cash (OMO):
  - The RBA can change the supply of cash by undertaking **open market operations (OMO)** with the banks.
  - Open market operations are where central banks buy or sell government bonds with the private sector.
  - In practice, the RBA only conducts OMO with banks holding an ESA.
  - If the RBA **buys bonds** from the banks, it will pay for the bonds by crediting their ESAs and, other things, equal, this will *increase the total supply of ES funds* available.
  - If the RBA **sells bonds** to the banks it will receive payment by debiting their ESAs and, other things equal, this will *decrease the total supply of ES funds* available.

- The RBA uses daily OMO to ensure actual = target cash rate:



- Under its current operating procedures, the RBA has little difficulty achieving its target for the Cash rate.
- The cash market is highly specialised, and the cash rate is for very short-term borrowing and lending.
- However, movements in longer-term rates tend to be linked to the cash rate through the **expectations hypothesis**.

EXPECTATIONS HYPOTHESIS

- Suppose you are borrowing $1 for two years. You have 2 options.
  - *Option 1*: Two-year loan at a certain annual interest rate of i_0^2. If this rate is 10% for example, at the end of 2 years you will have to repay:

$$\$1(1+i_0^2)(1+i_0^2) = \$1(1+0.10)^2 = \$1.21$$

  - *Option 2*: Two one-year loans. Interest rate in year 1: i_0^1. Interest rate in year 2: i_1^2 (unknown at beginning of year 1). The expected repayment is:

$$\$1(1+i_0^1)(1+i_1^2)$$

  - To be indifferent between option 1 and 2, the following would need to be the case:

$$\$1(1+i_0^1)(1+i_1^2) = \$1(1+i_0^2)(1+i_0^2)$$

  - Simplifying:

$$(i_0^1 + i_1^2)/2 = i_0^2$$

  - This implies that the interest rate on a two year loan is just the average of the actual and expected rates on the two one-year loans. This can be generalised to:

$$i_0^N = \frac{1}{N}(i_0^1 + i_1^2 + \ldots + i_{N-1}^N)$$

- **Expectations Hypothesis** – Long-term interest rates are averages of current actual and expected future short-term rates.
- Changes in cash rate eventually lead to changes in longer term interest rates.
- In practice: $Market\ Rates = Cash\ Rate + Premium$
  - Premium will tend to reflect risk or liquidity factors.
- The RBA's ability to change long-term interest rates also depends on people's expectations about the future path for the cash rate.

- Note: The RBA has direct control of nominal interest rates but is it the real rate that matters for saving and investment decisions.
- The conventional view among monetary policy makings is that the short-run inflation is fixed (or sticky) and not immediately affected by a change in the nominal rate *i*.
- As such, short-run changes in the nominal rate will tend to influence the real rate *r* in the same direction.

MONETARY POLICY RULES

- Conventional targets for a central bank:
  - Inflation
  - Measure of resource utilisation (e.g. output gap)
- *Monetary policy rules* are simple models of the behaviour of central banks.
- Taylor Rule – A rule that indicates how a central bank will respond to the level of inflation & the output gap.

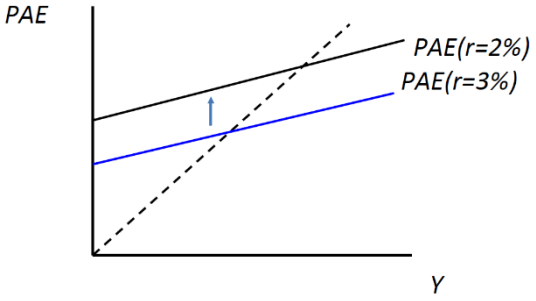
$$i = 1.0 + 1.5\pi + 0.5\tilde{Y}$$

  - It implies that a central bank will increase its policy rate in response to higher inflation and/or an increasing output gap.

Aggregate Demand & Aggregate Supply

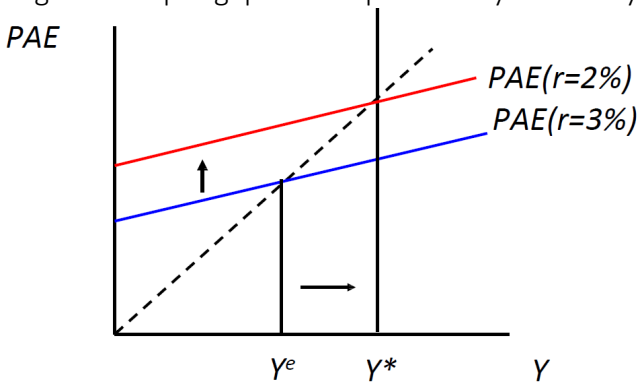
AGGREGATE DEMAND (AD) CURVE

- In the income-expenditure model, planned aggregate expenditure (PAE) depends on the level of real output.
- We want to allow for a role for the real interest rate to influence PAE.
- Two main channels:
  - Higher real interest rates will lead households to increase saving and to defer current consumption.
  - Higher real interest rates will raise the cost of capital and reduce business investment.
- Model for PAE:
  - Consumption:
    $$C = C_0 + c(Y - T) - \alpha r$$
  - Investment:
    $$I^P = I_0 - \beta r$$
  - Both have a negative effect from real interest rate $(\alpha, \beta > 0)$
  - By substituting in the 4-sector income-expenditure model:
    $$PAE = C + I^P + G + X - M$$
  - We get the following:
    $$PAE = [C_0 - cT_0 + I_0 + G_0 + X_0] - (\alpha + \beta)r + (c(1-t) - m)Y$$
- Implications:
  - PAE depends (negatively) on the real interest rate.
  - For any given level of output, PAE will fall with an increase in the real interest rate.
  - If we assume that the RBA can set the real interest rate, then we have a mechanism by which monetary policy can affect PAE and equilibrium output.
- Effect of a decrease in real rate on PAE:



- Consider the equilibrium: $Y = PAE$
  - Then:
    $$Y = [C_0 - cT_0 + I_0 + G_0 + X_0] - (\alpha + \beta)r + (c(1-t) - m)Y$$
  - Solving for Y:
    $$Y^e = \frac{1}{[1 - c(1-t) + m]}\{[C_0 - cT_0 + I_0 + G_0 + X_0] - (\alpha + \beta)r\}$$

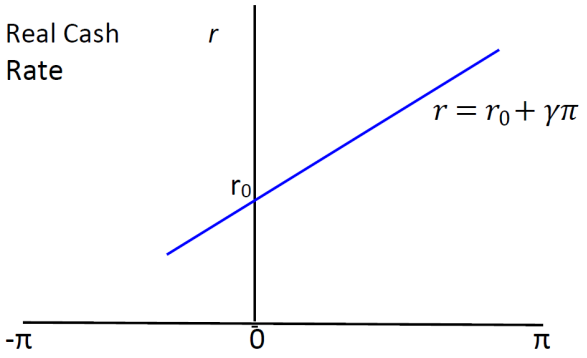
- Negative output gaps and expansionary monetary policy:



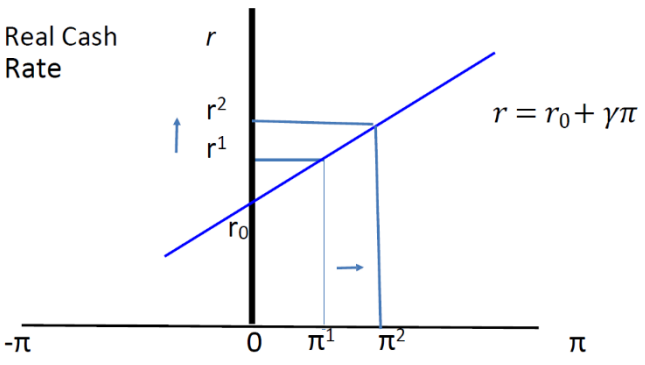
- The RBA reduces the real rate to close negative output gaps.
- **Policy reaction function** – Following is a simplified policy reaction function to describe central bank behavuiour.

$$r = r_0 + \gamma\pi$$

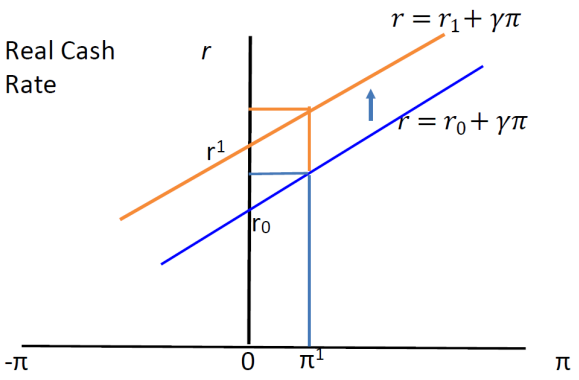
  - r_0 and γ are positive constants chosen by the RBA.
  - γ indicates the sensitivity of the real cash rate to a change in inflation.
  - r_0 indicates the value of the real interest rate when inflation is zero.
- *Assumption*: the RBA automatically responds to changes in inflation by changing the real policy rate (real cash rate).



Endogenous policy response to increase in inflation



Exogenous tightening of monetary policy



- Types of monetary policy:
  - *Endogenous (or induced) policy* – $\gamma > 0$ captures the endogenous response of the RBA to inflation.
  - *Exogenous (or discretionary) policy* – r_0 represents factors (other than the inflation rate) that might influence the real policy rate. Changes in r_0 reflect exogenous changes in monetary policy.
- A simple generalisation of the above policy reaction function would be to allow for a non-zero inflation target.

$$r = r_0 + \gamma(\pi - \pi^T)$$

- In the case of the RBA we might use the mid-point of their target range:

$$r = r_0 + \gamma(\pi - 2.5)$$

- So far we have:
  - A PAE curve that depends on the real interest rate.
  - A policy reaction function for the RBA in which the real interest rate responds to the inflation rate.
- Deriving the AD curve:
  - Use the equilibrium condition for Y:

$$Y = \frac{1}{[1 - c(1-t) + m]}\{[C_0 - cT_0 + I_0 + G_0 + X_0] - (\alpha + \beta)r\}$$

  - Use PFR to replace r:

$$r = r_0 + \gamma\pi$$

  - Substitute, rearrange and let:

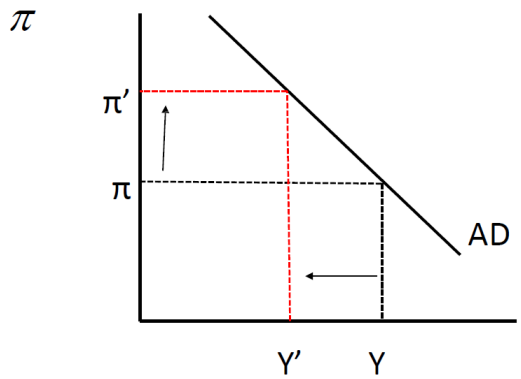
$$k = \frac{1}{[1 - c(1-t) + m]}$$

$$A_0 = k[C_0 - cT_0 + I_0 + G_0 + X_0 - (\alpha + \beta)r_0]$$

- The **AD curve** is then:

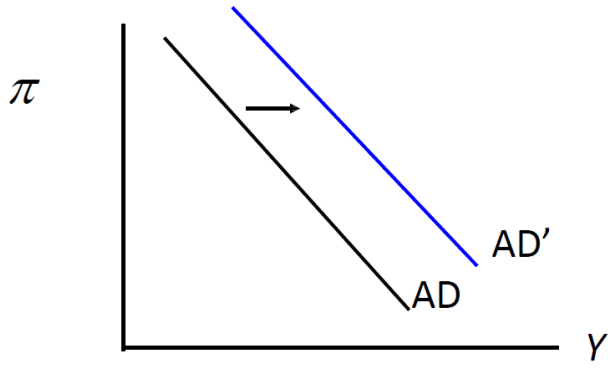
$$Y = A_0 - [k(\alpha + \beta)\gamma]\pi$$

- This model implies a negative relationship between equilibrium output and the rate of inflation.
- Other things equal, an increase in inflation is associated with a fall in equailibrium output.

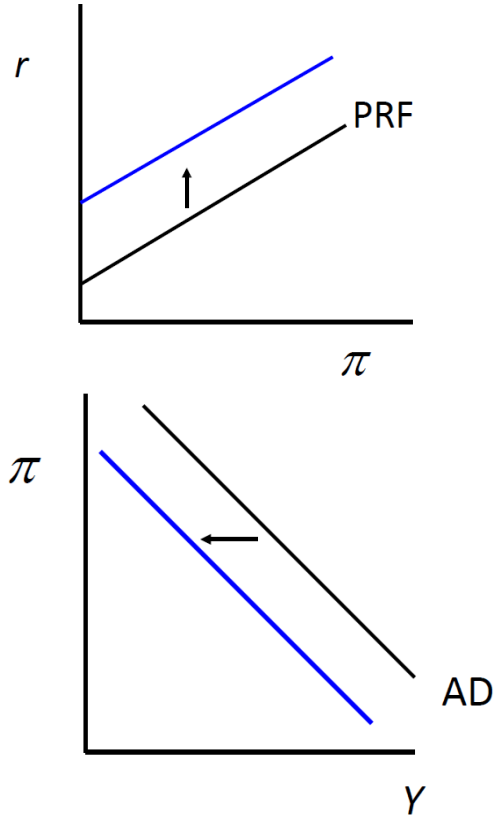


- Notes:
  - The model explains the negative slope as reflecting the behaviour of the central bank
  - When inflation is high the RBA will raise the real interest rate. The increase in *r* reduces consumption and investment (i.e. PAE) and this produces a fall in equilibrium output.
  - Other reasons not explicitly included in the model: wealth, distributional and uncertainty effects.
- Two main factors for shifts in the AD curve:
  - Exogenous changes in spending or taxes (Fiscal policy or private spending)
  - Exogenous change in the RBA's policy reaction function: r_0

Exogenous increase in spending

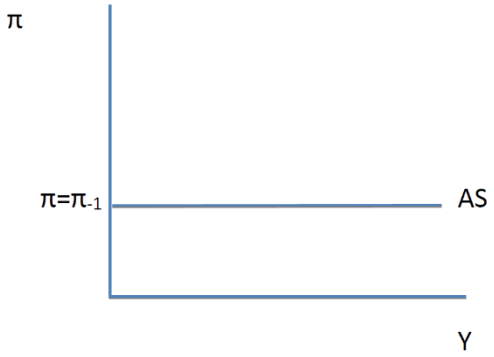


Exogenous shift in policy reaction function



AGGREGATE SUPPLY CURVE

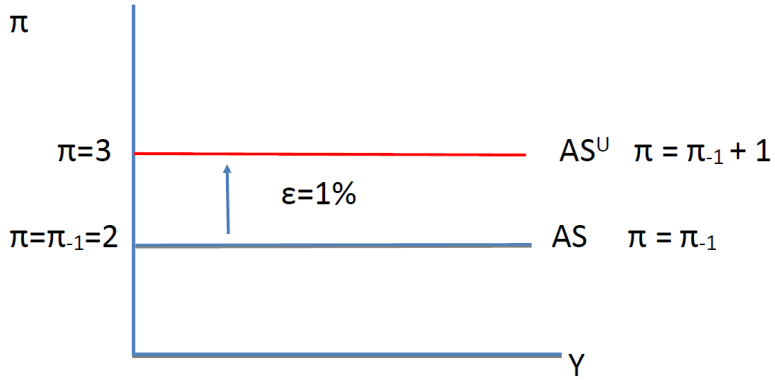
- Three main determinants of inflation:
  - The expected rate of inflation
  - Aggregate shocks to business production costs
  - The size of the output gap in the economy
- Assume expected inflation is sticky or slow in adjusting in the short-run.
  - $\pi^e = \pi_{-1}$
- Aggregate supply curve with constant inflation



- Shocks to inflation – Introduce one-period shocks to inflation rate (e.g. indirect tax changes, changes in energy prices)

$$\pi = \pi_{-1} + \varepsilon$$

  - $\varepsilon > 0$: adverse/unfavourable shock
  - $\varepsilon < 0$: favourable shock
- Shocks cause constant changes in inflation:

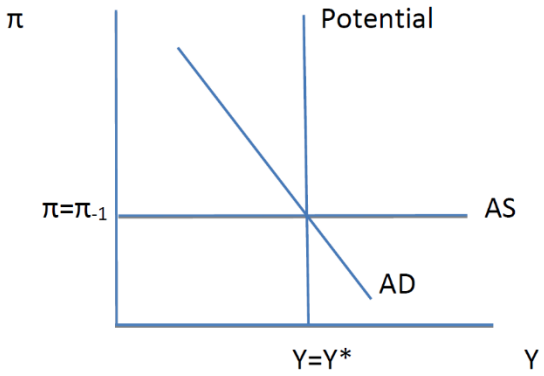


- In the long-term, the output gap in an important influence of inflation.

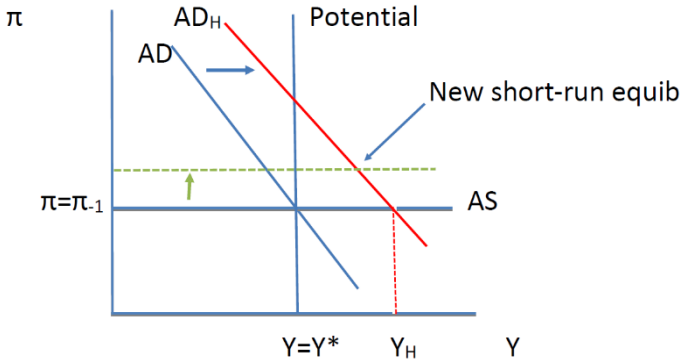
Output Gap	Inflation
Expansionary (Y > Y*)	Rising
Contractionary (Y < Y*)	Falling
Zero (Y = Y*)	Constant

APPLICATIONS OF THE AD AND AS MODEL

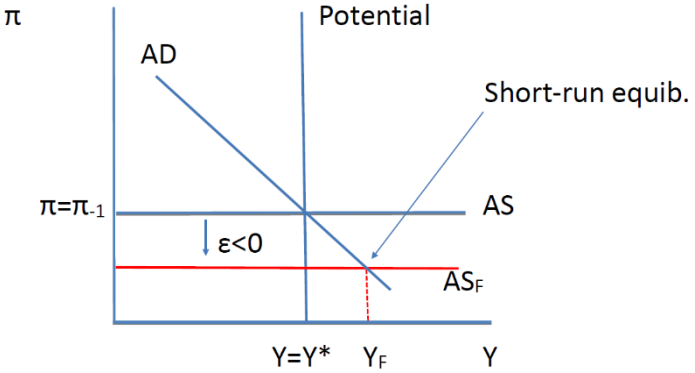
- AD and AS model in long-run equilibrium:



  - Output = Potential
  - Inflation rate is constant over time
- Economic shocks and the business cycle:
  - AD Shocks (permanent) – Exogenous changes in the AD curve
  - AS Shocks (one-period) – General inflation of cost shocks to economy
  - Shocks to potential output (permanent)
- Permanent increase in AD (adjustment):



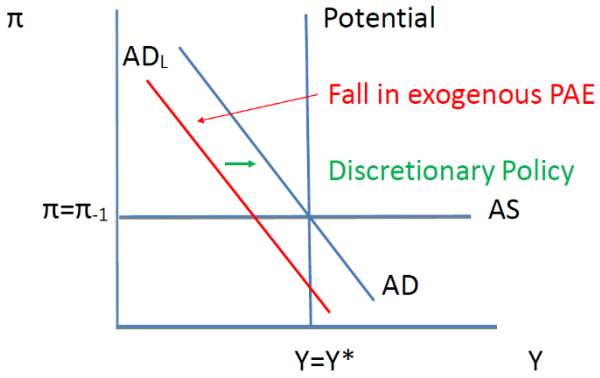
  - Long-run: Y = Y*, but higher inflation rate
- Favourable AS shock (temporary):



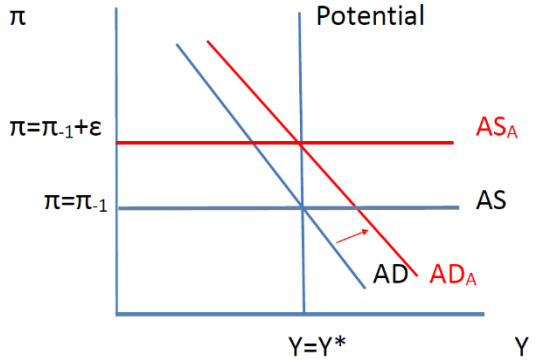
  - Long-run: Y = Y* and inflation returns to initial level
- The self-correcting nature of the economy:
  - AD-AS model implies an economy may experience recessionary and expansionary gaps in the short-run. It will, in the long-run, return to a position where Y = Y*.

- One justification for active stabilisation policy using monetary and fiscal policy instruments – the speed at which the economy returns to the long-run equlibrium is undesirably slow.

- Policy reponse to AD shocks:
  - Use discretionary monetary or fiscal policy
  - In theory policymakers can completely offset the effect of AD shocks.
  - In practice, lags means policymakers need to be forward-looking and base policy on their forecasts.
  - Difficult to achieve complete stabilisation of the economy against AD shocks.
- Unfavourable AD shock:

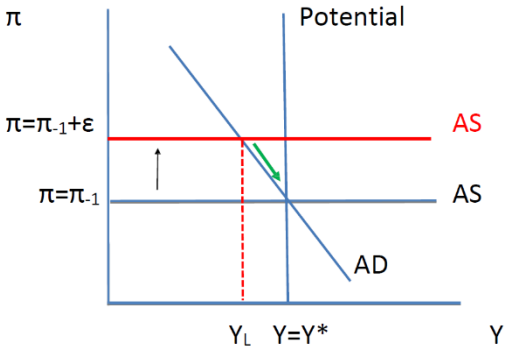


  - Monetary or fiscal policy used to offset AD shock.
- Policy responses to AS shocks:
  - Policymakers face a trade-off when deciding upon their policy response.
  - Can accommodate the AS shock by allowing a long-run change in inflation rate.
  - Can choose to not accommodate the AS shock but accept a non-zero output gap in the short-run.
- Accomodation of inflation shock:



  - Policy elimates negative output gap but increases π.

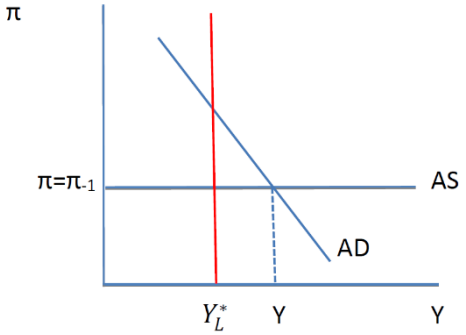
- No accomodation of inflation shock:



  - Negative gap causes π to return to initial value.
- Inflation Targets (IT):

Country	Central Bank	Target (% p.a.)
Australia	RBA	2-3
New Zealand	RBNZ	1-2
Canada	BOC	1-2
Sweden	Riksbank	1-3
United States	Fed	2
Euro Area	ECB	<2

  - Constrain the policy choices and actions of the central bank in how it responds to AD and AS shocks.
  - Central bank with an inflation target could not accommodate an unfavourable AS shock.
  - If private sector expects a central bank to achieve its inflation target we say the target is credible.
  - With credible inflation target regimes, the private sector may use the value of the inflation target as their expectation (or forecast) of future inflation.
  - A possible effect of inflation expectations being anchored to the IT is more rapid return to target following an AS shock.
- Shocks to potential output:
  - The idea of *secular stagnation* in developed economies reflects a concern about a possible long-term fall in the rate of growth of real GDP.
  - While the AD-AS model has no growth, we can approximate the idea by considering a fall in the level of potential output.
- Fall in potential output (short-run):



  - This causes an expansionary gap in the short-run. Higher inflation and lower output in the long-run.

International Macroeconomics & Exchange Rates

BALANCE OF PAYMENTS

- Records of transactions between residents of a country and non-residents.
- **Current account** – Transactions leading to a change in ownership of commodities, services, income flows & transfers.

  Exports of goods and services (X)
  (less)
  Imports of goods and services (M)
  (equals) Balance of Trade or Net Exports (*X – M*)

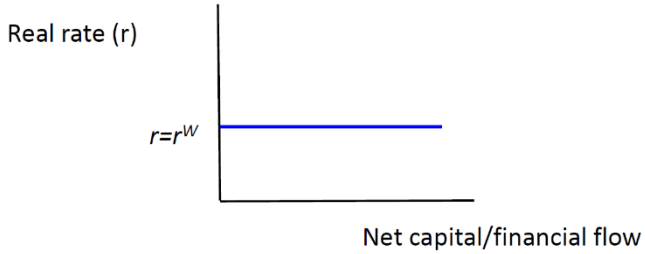
  (plus) Net *Primary Income* (includes net labour and property income payments/receipts)
  (plus) Net *Secondary Income* (Transfer payments, e.g. foreign aid)

  (equals) ***Current Account***

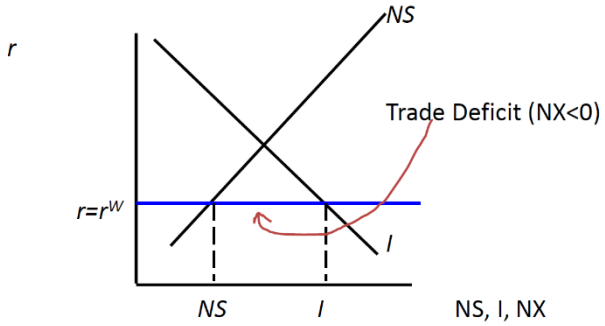
- **Capital Account & Financial Account** – Transactions involving the purchase or sale of assets.
  - *Balance on Capital Account & Financial Account = Balance on Capital Account + Balance on Financial Account*
  - **Balance on capital account** includes Net acquisition/disposal of non-produced, non-financial assets & cancellation of debt to foreign countries
  - **Balance on financial account** measures transactions between residents and non-residents involving assets and liabilities. Asset is a claim by a resident on a non-resident, liability is a claim by a non-resident on a resident.
- Direct investment – investor has sufficient level of ownership to have some control of business
- Portfolio investment – investor has no influence on operation of business.
- Balance of Payments: ***Current Account + Capital and Financial Account = 0***

NATIONAL SAVING AND INVESTMENT IN A SMALL OPEN ECONOMY

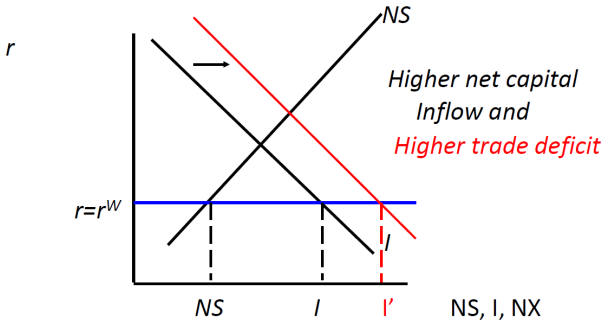
- In an open economy, where international capital and financial flows are possible, savings from other countries can finance investments.
- International capital and financial flows allow countries to invest in more productive investment opportunities than would be possible relying on national savings.
- Residents of a small open economy can borrow and lend in international capital markets at a constant world interest rate r^w.



- In the case where the world real rate is lower than the equilibrium rate in a closed economy $r^w < r^e$:



- If NS < I, Net Exports (NX) will be negative, i.e. a trade deficit.
- Exogenous increase in investment:



NOMINAL AND REAL EXCHANGE RATES

- Nominal exchange rate – Rate at which two currencies can be traded for each other; bilateral exchange rate.
- Cross rates – We can use the exchange rate between different countries to infer the cross rates:

  $US/$A= 0.9456 Euro/$A= 0.7223

  $$\text{Euro/\$US} = \frac{Euro}{\$A}\frac{\$A}{\$US} = 0.7223 \times 1.0575 = 0.7638$$

- Bilateral exchange rates can be quoted in 2 ways:
  - Units of foreign currency per unit of domestic currency
  - Units of domestic currency per unit of foreign currency
- Let *e* denote the nominal exchange rate and define it as:
  - *e* – number of units of foreign currency that one unit of domestic currency will buy (e.g. *e* = $US/$A)
  - A rise in *e* corresponds to an appreciation of $A
  - A fall in *e* corresponds to a depreciation of $A
- Real exchange rate – measures the price of domestic goods relative to the price of foreign goods.

  P = price of domestic goods

  $P^f \times \frac{1}{e}$ = price of foreign goods, in domestic currency

$$\text{Real Exchange Rate} = \frac{e \times P}{P^f}$$

- A rise in real exchange rate implies that domestic goods are becoming more expensive relative to foreign goods.
- Other things equal, this tends to reduce exports and encourage imports, with the overall effect of reducing the level of net exports.

PURCHASING POWER PARITY

- Law of One Price:
  - Allowing for transportation costs and taxes, the price of an internationally traded good must be the same in all locations.
  - If this is not the case, then there will be profitable opportunities to buy the good in the relatively cheaper location and sell it in the more expensive location.
- Purchasing Power Parity (PPP):
  - Suppose the law of one price holds for all goods and services in two countries.
  - If we know the domestic price level P and the foreign price level P^f, then it must be the case that:

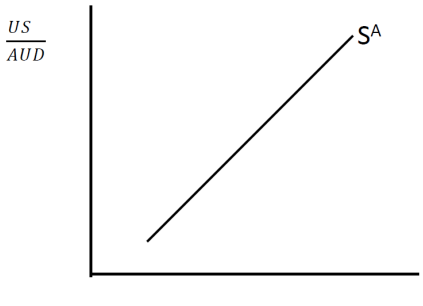
$$\frac{P^f}{P} = e$$

$$\Delta P^f - \Delta P = \Delta e$$

  - I.e. exchange rate adjusts so that price levels in two countries are equal.
- Limitations of PPP:
  - Empirical evidence provides stronger support for PPP in the long-run than in the short run.
  - Non-traded goods. Some types of goods are very costly to trade internationally (e.g. services)
  - Trade barriers such as tariffs and quotas tend to raise costs of transporting goods internationally.

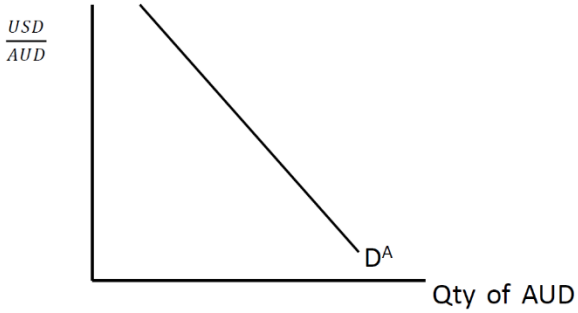
SUPPLY AND DEMAND MODEL OF EXCHANGE RATES

- Who supplies Australian dollars? – Australian households and firms who want to purchase foreign goods, services or financial assets.
  - Such purchases require foreign currency, so households and firms supply AUD for foreign currency.
- Supply of Australian dollars:

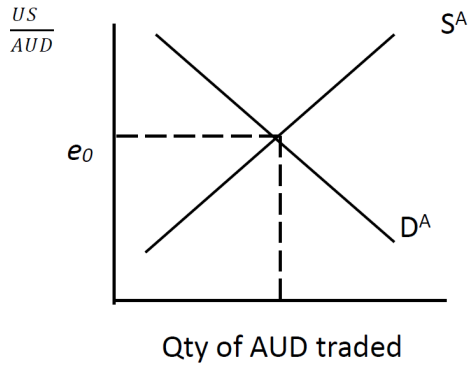


  - An increase in the number of USD offered per AUD makes US goods and assets more attractive.

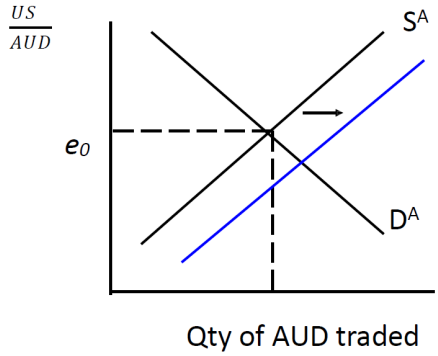
- Who demands Australian dollars? – US households who want to purchase Australian goods, services or financial assets.
- Demand for Australian dollars curve:



  - The more USD that must be offered per AUD, the less attractive Australian goods are.
- Equilibrium:

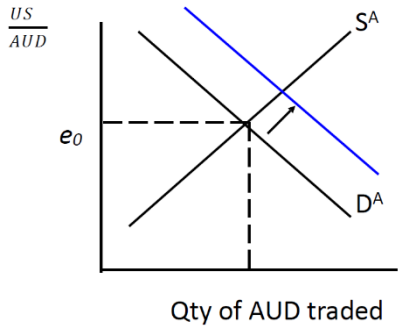


  - e_0 is the fundamental value of the exchange rate.
- Shifts in the supply curve – Exogenous shifts in the desire of Australians to purchase US goods and assets:
  - Increase preference for US goods
  - Increase in Australian GDP (income effect)
  - Expected increase in the real return on US assets.



  - Increase in the supply of AUD will lead to a depreciation of the AUD.
- Shifts in the demand curve – exogenous shifts in the desire of US to purchase Australian goods and assets.
  - Increased preference for Australian goods
  - Increase in US GDP (income effect)

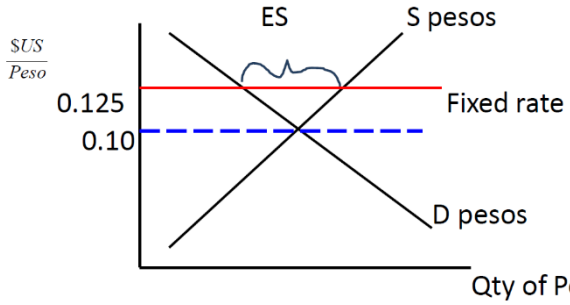
- Expected increase in the real return on Australian assets.



  - Increase in demand for AUD will lead to an appreciation.
- Monetary policy and the exchange rate:
  - In open economies like Australia, the exchange rate provides an additional channel by which monetary policy can influence the level of aggregate demand and GDP.
  - If the RBA tightens monetary policy (by raising the real interest rates), this will increase demand for the dollar and produce an appreciation of the exchange rate.
  - Supply curve may also shift (inwards) as Australians buy less foreign assets.
- A real appreciation and NX:
  - If domestic and foreign prices are sticky in the short-run, then nominal appreciation will lead to an appreciation of the real exchange rate.
  - The higher value of the dollar will tend to reduce the level of net exports, reducing aggregate demand and the level of output.

FIXED EXCHANGE RATES

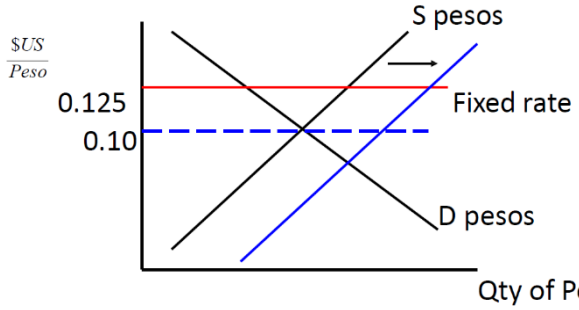
- A country might seek to fix the value of its currency against some other currency
- Under a fixed exchange rate a currency's value can differ from its fundamental value
  - It can be overvalued or undervalued.
- Overvalued currency:



  - At an exchange rate of 0.125, the supply of Pesos exceeds demand. To maintain the fixed exchage rate the central bank must buy the excess supply of pesos.
- International reserves:
  - In order to maintain the fixed value for its exchange rate, a country needs a sufficient level of internaitonal reserves of foreign currency to purchase any excess supply of its domestic currency.
  - *Balance of payments deficit* – net decline in a country's stock of international reserves.

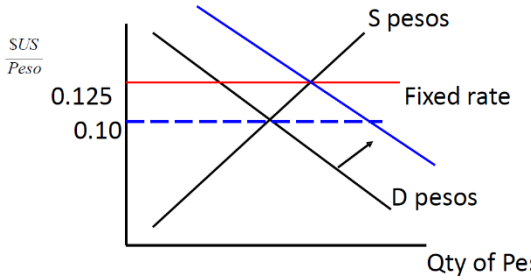
- *Balance of payments surplus* – net increase in a country's stock of international reserves.

- Fixed exchange rates are subject to speculative attacks which are a mass selling of domestic currency assets by financial investors. Possibly driven be a fear of (expected) devaluation.
  - Supply of pesos increases:



  - Fall in the fundamental value peso. Central bank needs to buy a greater value of pesos and this leads to a rapid loss of reserves. Devaluation may eventually be required.

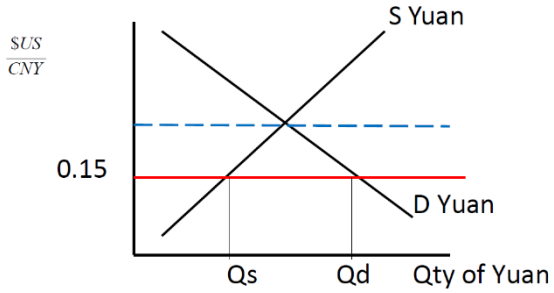
- Use of monetary policy to defend and overvalued exchange rate:



  - Currency is overvalued but central bank tightens monetary policy.
  - Higher real interest rate increases demand for peso-denominated assets; shifts demand curve outwards and raises the fundamental value of the peso.

- Potential conflict for policy makers:
  - Stabilise the currency, vs
  - Stabilise the domestic economy

- While higher real interest rates might stabilise the economy and stop a speculative attack, they can have a contractionary effect on the domestic economy.
- By adopting a fixed exchange rate, a country effectively gives-up the use of monetary policy for domestic stabilisation.
- Example – Excess demand for Yuan:



  - Chinese central bank must supply Yuan in exchange for USD. Holding of USD (assets) will increase.

Economic Growth

ECONOMIC GROWTH

- Economic growth has delivered significant increases in standard of living and general economic conditions over a sustained period of time.
- Real GDP per-capita is the standard indicator of a country's standard of living:

  Real GDP per capita: $y = \frac{Y}{POP} = \frac{GDP}{POP}$

  - Level of real GDP per-capita (y)
  - Growth rate of real GDP per-capita (g_y)

    $$g_y = [\frac{y_t - y_{t-1}}{y_{t-1}}] \times 100$$
- An important cause of cross-country inequality is the fact that countries grow at different rates.
- Small differences in growth rates, maintained over many years, can make large differences in living standards.
- Rule of 69:
  - Approximate formula for number of years for y to double:
  - $Years\ to\ double = \frac{69}{g_y}$
- There is no strong evidence that the cross-country income levels are converging.

AGGREGATE PRODUCTION FUNCTION

- We represent the aggregate output (GDP) by the Cobb-Douglas production function.

  $$Y = AK^{\alpha}L^{1-\alpha}$$
  - Aggregate labour input (L)
  - Aggregate physical capital stock (K)
  - Level of productivity (A)
- There is a constant returns to scale in L and K
  - If you double both, the total output will double.
- Marginal product of Labour:

  $$MPL = \frac{\Delta Y}{\Delta L}$$

  $$MPL = (1-\alpha)\frac{Y}{L}$$
  - Y/L is the average product of labour
- Marginal product of Capital:

  $$MPK = \alpha \frac{Y}{K}$$
  - Y/K is the average product of capital.
- Diminishing marginal product of L and K:
  - MPL falls as L increases, and MPK falls as K increases.
- The marginal product curve gives demand for labour and capital:

- Decomposition of real GDP per-capita:

$$\frac{Y}{POP} = \frac{Y}{L} \times \frac{L}{POP}$$

  - Average labour productivity (Y/L) (output per worker)
  - Share of population in employment (L/POP)
- Main source of economic growth is labour productivity.

PER-WORKER PRODUCTION FUNCTION

- Cobb-Douglas function:

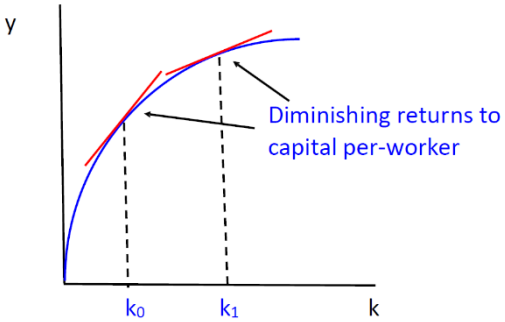
$$Y = AK^{\alpha}L^{1-\alpha}$$

Divide both sides by L

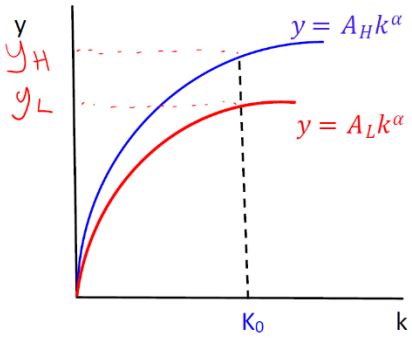
$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha}$$

$$y = Ak^{\alpha}$$

  - y = Y/L (GDP per worker, or labour productivity)
  - k = K/L (Capital per worker)
- Increasing physical capital per-worker will increase labour productivity.
- Physical capital includes the stock of machines, tools, plant and equipment, buildings and structures.
- Since $\alpha < 1$, for a given level of A, increasing capital per-worker runs into diminishing marginal returns
- Suggests that simply increasing physical capital per-worker will not be able to general permanent growth in *y*.



- Forms of capital:
    - Private capital
    - Public capital (infrastructure)
    - Human capital (quality of workers)
- Increase in the level of productivity (A) will, other things equal, lead to an equal increase in output per-worker.



- Influences on productivity:
    - Technology (ideas and knowledge, R&D)
    - Managerial skills
    - Property rights (rule of law)
    - Cultural capital (cultural and social values, trust)
    - Natural capital
- Policies to promote economic growth:
    - Support for basic human capital accumulation
    - Encourage saving and investment
    - Support for research and development
    - Secure system of legal and property rights

ACCOUNTING FOR GROWTH

- Convert production function to growth rates:

$$\Delta Y = \Delta A + \alpha \Delta K + (1 - \alpha)\Delta L$$

- In any period output growth is due to:
    - Growth in productivity
    - Growth in capital (weighted by α)
    - Growth in labour (weighted by 1 – α)
- We have direct measures of output, labour and capital, but not for productivity. Thus we write:

$$\Delta A = \Delta Y - \alpha \Delta K - (1 - \alpha)\Delta L$$

    - We can estimate the growth rate of productivity (called TFP = Total factor productivity or MFP = Multi-factor productivity)
- Estimating $1 - \alpha$:

$$MPL = w$$

$$\frac{w \times L}{Y} = 1 - \alpha$$

- The left-hand side is labour's share of total output, and we can use this figure as an estimate for $1 - \alpha$.