ECON1102 Notes

Chapter 1: Aggregate Production and Prices

- Key aggregate variables include: total production of goods and services, the general level of prices, the level of employment and the unemployment rate

1.1 Gross Domestic Product

- GDP is **the monetary value of final goods and services produced in a country**
- GDP only measures the value of a subset of the entire production activities and transactions occurring in an economy over some period
- Generally non-market production activities are excluded from GDP

1.1.1 Monetary Value

- Quantity of good x price = value of the good
- Value of goods produced in an economy added together = GDP
- In measuring aggregate production for our simple economy it is not reasonable to simply add-up the physical number of bikes and burgers produced (example)
- Role played by market prices is to weigh the quantities of goods produced and transform them into common unit dollars
- The fact that market prices are used in the calculation of GDP means that the contribution particular goods and services make to GDP is influenced by market values

1.1.2 Goods and Services without market prices

- Some goods and services do not have market prices, sizeable share of an economy's production of final goods and services (e.g. police) do not have an explicit market price
- One strategy is to estimate a market value for the G/S
- Second approach (used for gov. services) is to **use the cost of providing the good or service** in place of its unknown market value

1.1.3 Intermediate Goods and Value added

- GDP refers to final G/S, doesn't include intermediate goods
- Intermediate goods: good that is used in the production of another good or service
- In calculating GDP, it is important to count the value of each good only once, avoid double counting intermediate goods = value added concept
- **Value added**: the market value of a firms production less the cost of inputs purchased from other firms
- Two ways to calculate the contribution of the production of a good to GDP
    - One method is to measure the market price of the good when it
    - The second method is to add-up the value added of each producer who contributes to the final product
- Production approach: to calculating GDP is the summation of value added for all businesses operating in an economy
- The definition of GDP refers to the production within a country
- The final element of the definition of GDP refers to it being measured over some period of time, typically 3 months/1 quarter – excludes G/S produced in an earlier period, but re sold in the current period

1.1.4 Expenditure Approach to GDP

- Expenditure approach: to calculating GDP entails the summation of expenditures on domestically produced final goods and services by households, businesses, governments and by the rest of the world
- Expenditure on goods and services by final uses = value of their production
    - Household expenditure = consumption spending C
    - Business expenditure = private investment spending I
    - Government spending G
    - Domestically produced gods and services that are purchased by the rest of the world = exports X
    - Foreign produced that are purchased from the world = imports M
    - Net exports **NX= X-M**
- Decomposition of **GDP Y = (triple equal sign) C + I + G + X – M**
- **Supply of G & S = Demand for G & S**
    - The triple equal sign indicates this is an accounting identity
    - The value of production of final goods and services must be equal to the value of expenditure on final goods and services

1.1.5 Statistical Discrepancy

- The three approaches to measuring GDP can result in errors and differences in result
- The ABS averages these three measures
- Private Investment – Inventories
    - Inventories are currently unsold stocks of goods held by businesses, calculated by inventory level (end of period) – inventory level (beginning period)

1.1.6 Second Hand Goods

- A fraction of expenditure will involve the purchase of second-hand or used goods
- E.g. include the purchase of a used car or a second-hand textbook
- The value of such sales are not included in the calculation of current GDP

1.1.7 Income Approach to GDP

- Income approach to measuring GDP is obtained as the sum of payments to **labour L** and **capital K** plus any net indirect taxes
- In order to produce goods and services, businesses use labour and capital (factors of production)
- Payment must be made by business to the owners of the factors of production representing income in an economy
- The total value added received by businesses in an economy must be either paid to labour in the form of wages and salaries or paid to capital in some form (rent, interest, profit)
- Sum of payments to labour and capital = GDP at factor cost
- To obtain GDP we need to account for any indirect taxes that are levied on goods and services or any subsidies that are paid
- GDP is the sum of GDP at factor cost plus net indirect taxes
    - **Y = labour income + capital income + (indirect taxes – subsidies)**
      Y = (WxL) + (RxK) + net indirect taxes
    - L = labour, K = capital, W = wage per unit of labour, R = rate of return to a unit of capital, net indirect taxes = indirect taxes – subsidies

1.1.8 Gross National Income (GNI)

- GNI: equals the income measure of GDP plus any net factor income receivable from non-residents
- Based on the country of origin of the factors of production
- Some of the income from GDP will accrue to foreign nationals
- **GNI = GDP + net primary (or factor) income from non-residents**

1.1.9 Nominal and Real GDP

- Variations in nominal GDP over time reflect a combination of the effects of changes in the quantity or volume of goods and services produced and their current prices
- **Value of nominal GDP**: values quantities of goods and services produced at their current year (or year of production prices)
- **Real GDP** uses final goods and services prices for a common base year to value the quantities produced in other years

1.1.10 Nominal, Real GDO and the GDP price index

- Nominal GDP = real GDP x GDP price index
- Can be used to compute a price index or deflator for GDP, if we have values for nominal and real GDP we can use those to compute a price index for GDP as:

$$\boldsymbol{GDP\ price\ index = \frac{nominal\ GDP}{real\ GDP}}$$

1.1.11 Growth in Real GDP

- Commonly used as an indicator of economic progress

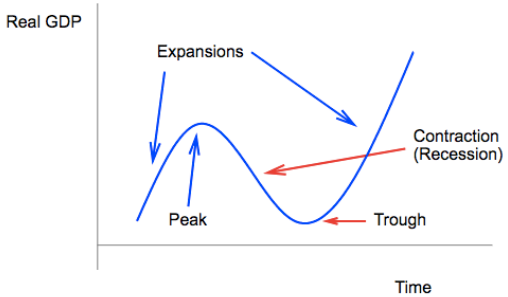
$$\boldsymbol{real\ GDP\ per\ capita = \frac{real\ \ GDP}{population}}$$

1.1.12 GDP and Economic Welfare

- GDP is an incomplete measure of the general concept of economic welfare
- There are many factors that can affect people's economic welfare which aren't measure by GDP, GDP omits many non-market activities
- Economic welfare depends on distribution of income and degree of income inequality
- One approach to adjust this is to adjust the GDP to try and capture more of the depreciation costs
- Second approach involves arguments GDP with a variety of other economic and social indicators

1.1.14 Business Cycles

- The business cycle is used to describe general or widespread variations in the rate utilisation of resources in an economy
- A recession occurs when there are at least two consecutive quarters of negative economic growth, has to fall for at least quarters



- Contraction: period of level of GDP falls
- Expansion: period of level of GDP rises
- Peak: beginning of contraction, high point of GDP prior to a downturn
- Trough: end of contraction, low point of GDP prior to an uptown

1.1.15 Technical Recession

- Much simpler method for defining and identifying a recession is a technical recession
- Technical recession: defined by the simple rule of at least two consecutive quarters of negative growth in real GDP

1.2 Consumer Price Index (CPI)

- The calculation of nominal and real GDP also allows for the calculation of an (index) measure of the aggregate price level for an economy
- The GDP deflator (price index) provides a very broad measure of the average changes in prices across all sectors
- CPI: is a measure of the change, over time, in the cost of purchasing a fixed basket of goods and services
    - Measure of change in the cost of living and in the level of prices faced by an average consumer
    - Is based on the use of a fixed basket of goods and services – basket reflects the average consumption pattern for various households in a period
    - CPI provides how this changes compared to the previous years

$$\boldsymbol{CPI = \frac{cost\ in\ current\ year}{cost\ in\ base\ year}}$$

- we can use the CPI to calculate a measure of the rate of inflation for this simple economy, using the symbol π

$$\boldsymbol{\pi = \frac{CPI - CPI\ (of\ previous\ period)}{CPI\ (of\ previous\ period)}}$$

- inflation is a situation in which the general price level in an economy is rising, while deflation (or negative inflation) represents a situation in where the general price level is falling
- inflation is measured by the percentage change in the CPI over a given period
    - inflation rate = 0 implies prices are constant
    - inflation rate > 0 implies prices are rising
    - inflation rate <0 implies prices are falling

1.2.1 Biases in the CPI

- One source of bias arises due to quality improvements, when improvements in quality are widespread and not taken into account the CPI suffers from quality adjustment bias and will tend to over-estimate the increase in prices (or the cost of living)
- Second type of bias in the CPI arises because the consumption basket is held fixed at its abse year level, it doesn't take into account substitute goods, which will tend to overstate what the consumer actually spends on buying their combination of goods
- The CPI will thus tend to overstate the consumers true cost of living

1.2.3 Costs of Inflation

- Important to distinguish between relative price change and a change in the general price level
- When inflation is unanticipated, it can produce undesirable redistributions of income or resources among different groups in the economy
- Unexpected inflation tends to transfer resources away from people with fixed incomes or with incomes that are not fully indexed to the actual inflation rate
    - Redistributions of wealth, transfer from lenders to borrowers
    - Increase will decrease saving
    - Distorts tax systems if not indexed to inflation

- Typically, a change in relative prices provides a signal to businesses to change their production, while a change in the inflation rate does not
- One policy for minimizing the costs of inflation is to index all prices and wages in the economy to the actual inflation rate
- Two postivie costs associated with (positive) inflation
    - Menu costs: refer to any real (resource) costs associated with changing prices due to inflation
    - Shoe-leather cost refers to the idea that people will need to make more frequent trips to the bank and in doing so will wear out their shoes more quickly

1.2.4 Optimal Rate of Inflation

- 1-3% of inflation

Chapter 2: Employment, Unemployment and the Labour market

2.1 Labour Market Definitions and Data

- a country's economically active population includes all people involved in the production of goods and services

2.1.1 Definitions

- **working age population**: consists of members of the Australian population who are civilian, usually resident and 15 years or older
- **labour force**: comprised of members of the Australian population who are employed or unemployed
- **employed person**: worked for at least one hour during the previous week for some form of compensation or who had a usual job or business but were not at work in the previous week for some reason (type of leave)
- **unemployed person**: not employed in the previous week but had either looked for work in the previous month and was available to begin work or was waiting to start a new job within the next moth and could start if job was available
- a person not in the labour force does not meet the requirements to be either employed or unemployed and includes retirees, unpaid home-workers or volunteers, permanently unable to work, voluntary inactive in labour market and people in institutions
- **LF = L + U** – where **LF is the labour force, L are those employed and U are those unemployed**
- **Full time employment**: corresponds to working at least 35 hours per week. Individuals who work less than 35 hours per week are classified as being in part time employment
- **Casual employment** is the absence of any paid leave entitlements
- **Underemployment**: a work has less paid hours or work than they are willing and able to work, or a worker's current positions does not make full or suitable use of their level of skills
- **Discouraged job seeker**: has given-up active job search, despite being willing to work, because they believe they have very little chance of finding a suitable job

2.1.2 Labour Market Data

- Unemployment rate is the number of unemployed persons expressed as a percentage of the labour force
    - Calculated as:

$$u = \left(\frac{U}{LF}\right) \times 100$$

- Participation rate is the number of people in the labour force expressed as a percentage of the working-age population
    - Provides a measure of the percent of the working age population that is actively participating in the labour market
    - Calculated as:

$$\text{Participation rate} = \left(\frac{LF}{POP}\right) \times 100$$

    - Influenced by longer term demographic and social factors, and by current and expected state of the economy
- Employment to population rate is the number of people in employment expressed as a percentage of the working age population
    - Calculated as:

$$\text{Employment to population rate} = \left(\frac{E}{POP}\right) \times 100$$

2.2.1 Frictional or Search unemployment

- **Frictional or search unemployment** refers to a situation where a person is unemployed (usually for a short period of time) because they are in transition between different jobs or between full time education and a job
- Can use a simple model to think about what factors will determine the equilibrium level of frictional unemployment
    - Assume all unemployment is frictional
    - Labour force can change over a period because people find jobs/others leave, s=the job separation rate and f=job finding rate, can write the change in level of unemployment:

$$\mathbf{\Delta U = sL - fU}$$

    - Where sL is the number of people who move from being employed to unemployed during a month and fU is the number of people who move from being unemployed to employed during a month
    - Use the previous labour force to substitute for L to get:

$$\mathbf{\Delta U = sLF - (s + f)U}$$

    - Suppose we define the long run as a situation when the level of unemployment is constant so that $\Delta U = 0$, we have

$$\mathbf{\Delta U = 0 \text{ so } sLF = (s + f)U}$$

    - or rearranging

$$\boldsymbol{u = \frac{U}{LF} = \frac{s}{s + f}}$$

    - can now right the long run rate of frictional unemployment (%) as:

$$\boldsymbol{u = \left(\frac{s}{s + f}\right) x\ 100}$$

    - rate of frictional unemployment in the long run is determined by the job separation and the job finding rates
    - this implies that policies designed to reduce the level of frictional unemployment in an economy would need to reduce the job separation rate s, and/or increase the job finding rate f

2.2.2 Structural unemployment

- unemployment due to structural change in an economy, over time some industries or sectors grow while others decline – when the skills of workers don't match the needs
- e.g. variations in peoples tastes or preferences, or changes in technology or in government regulation
- people who have industry specific skills or who live in a region due to some industry may become unemployed if that industry declines
- policies to reduce structural unemployment may involve re-training programs for workers or other specific forms of assistance to find new jobs

2.2.3 Cyclical unemployment

- associated with fluctuations in the level of aggregate production
- if real GDP declines or slows down the unemployment rate tends to rise and vice versa

2.2.4 Natural Rate of unemployment

- is measured as the sum of the frictional unemployment and the structural unemployment rate – not sensitive to short run changes in the level of real GDP

- u* = frictional rate + structural rate
- can measure the rate of cyclical unemployment as the difference between the total unemployment rate u and the natural unemployment rate u*
- **cyclical unemployment rate = u – u***

2.2.5 Okun's law

- **Okun's law** is a quantitative model linking cyclical variations in real GDP and in the rate of unemployment – we will focus on the output gap
- The output gap for an economy is equal to the actual (or measured) level of real GDP less a measure of potential output
- Rate at which its workers and machines are used by a business is known as the utilisation rate
    - A normal utilisation rate would be a rate that can to be sustained by a business in the long run without any excessive or undue costs
    - If all businesses in an economy are utilising labour and capital at their normal rates, we refer to the level of GDP being produced as potential GDP
- To distinguish actual GDP and potential GDP we will use the following notation
    - **Y = real (actual) GDP**
    - **Y* = real potential GDP**
- In any period of time it is possible for actual and potential GDP to differ, actual GDP is determined by actual utilisation rate, while **potential GDP** is the level of GDP an economy can produce when using its resources or factors of production (labour and capital) at normal rates
- Potential output is not the same as maximum output
- Difference between the two is known as output gap
    - **Output gap = Y – Y***
    - Positive output gap Y>Y*: called expansionary gap
    - Negative output gap Y < Y*: called contractionary gap
- Output gap will be negative during a recession, be positive during an economic boom
- One way to measure output gap

$$\boldsymbol{output\ gap}\ (\%) = \left(\frac{\boldsymbol{Y - Y^*}}{\boldsymbol{Y^*}}\right)\boldsymbol{X\ 100}$$

- our version of Okun's law is a quantitative relationship between the output gap and the cyclical unemployment rate

$$\left(\frac{\boldsymbol{Y-Y^*}}{\boldsymbol{Y^*}}\right)\boldsymbol{X\ 100} = \ -\boldsymbol{\beta}(\boldsymbol{u - u^*})$$

    - left hand side is the output gap as a percentage of potential out put
    - according to okun's law the output gap is negatively related – via the coefficient β to the rate of cyclical unemployment
    - negative cyclical unemployment corresponds to a situation where the measured rate of unemployment is ess than the natural rate of unemployment
- contractionary gaps are associated with capital and labour not being fully utilised (cost in terms of forgone output) and high unemployment rate
- expansionary gaps are associated with firms operating above normal capacity and can lead them to raise prices with a low unemployment rate

2.3 Competitive model of the labour market

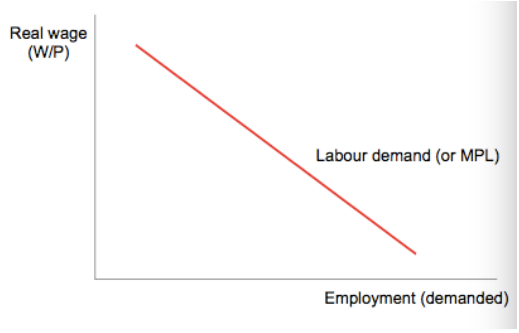
2.3.1 Demand for labour by a business

- we assume that by increasing the quantity of labour used, the business is able to increase its volume of output
- thus the level of output increases with the quantity of labour employed

- **marginal product of labour (MPL**) is the addition to ouput from increasing the labour input by one unit, with all other factors of production held fixed e.g. calculate the additional cups of coffee produced by adding each extra worker
- value of marginal product of labour is marginal product of labour times the price of the business's output
    - VMPL = MPL x p
    - Where MPL is the marginal (physical) product of labour and p is the price of a cup of coffee
- The money or nominal wage is simply the wage received by a worker measured in units of currency
- The real wage is the money or nominal wage divided by some measure of the price of goods and services. It measures a wage in terms of its ability to buy real goods and services
- to determine whether to hire another worker, business will look at whether the VMPL from employing the worker is at least as large as wage paid – VMPL > W (where W is the hourly wage)
- To derive the labour demand curve, must compare marginal cost vs marginal benefit
    - Repeat the calculation for different values of the money wage and by doing so would be able to dervive demand for labour curve
    - All other things held constant, an increase(decrease) in the money wage will cause a fall (rise) in the number of workers employed
- Condition for our determing the level of employment as equality: VMPL = W or as p X MPL = W
    - Two things can affect the VMPL, the price of the business's product (P) and the MPL
    - An increase in p will cause the VMPL(labour demand curve) to shift to the right
    - Implies that an increase in the relative price of a product will increase demand for labour
    - Changes in a businesses capital or technology will affect the MPL, increases will increase the MPL and would shift the VMPL to the right

2.3.2 Labour Demand in an economy

- P x MPL = W
    - This condition states that labour will be employed in an economy up to the point where the value of its marginal product is just equal to the economy – wide money wage
    - P is now an index of the general level of prices (CPI or GDP price index), MPL is the aggregate marginal product of labour and W is index of the general level of wages in the economy
    - At the aggregate level it is common to divide both sides of the above equation by P
    - $MPL = \frac{W}{P}$
    - such that the aggregate level of employment is determined by the equality between the marginal product of labour and the real wage

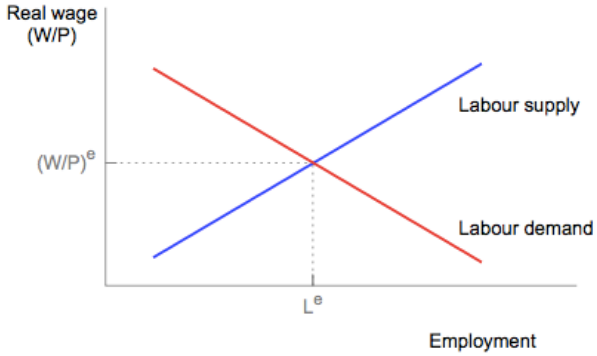


- other things held constant, changes in the real wage will result in changes in the amount of labour demanded in an economy
- predicts that increases in the real wage will be associated with a reducded quantity of labour being demanded
- shifts in the aggregate labour demand curve will occur if the economy wide marginal productivity of labour changes

2.3.3 Labour Supply for an economy

- we assume that the supply of labour is increasing with the level of the real wage
- other factors held constant, increases in the real wage lead to an increase in the quantity of labour that people are willing to suuply
- shifts in the labour supply curve arise from changes in demographic factors such as migration rates, change in retirement age

2.3.4 Equilibrium in a competitive labour market

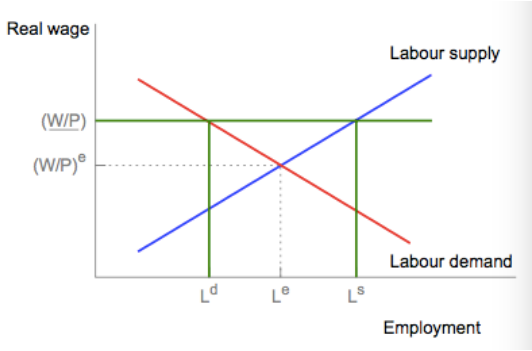


- if effect on innovation results in a general increase in the marginal productivity of workers, will shift the labour demand curve outwards (to the right)
  - will increase the real wage and the level of employment
- various types of changes or shocks may shift the economy's aggregate labour supply curve
  - demographic changes such as changing birth or immigration rates can produce shifts in labour supply
  - changes in peoples preferences for work versus leisure can also shift the labour supply curve

2.3.5 Frictions in the competitive labour market

- feature of the competitive model of the aggregate labour market is that without the addition of some additional frictions it does not result in any reasonable concept of involuntary unemployment
- in the competitive labour market, the level of employment is L^e
  - if L^e is less than the aggregate labour force in the economy (LF) there will be some level of unemployment ($U = LF - L^e$) this will be an entirely voluntary choice by individuals

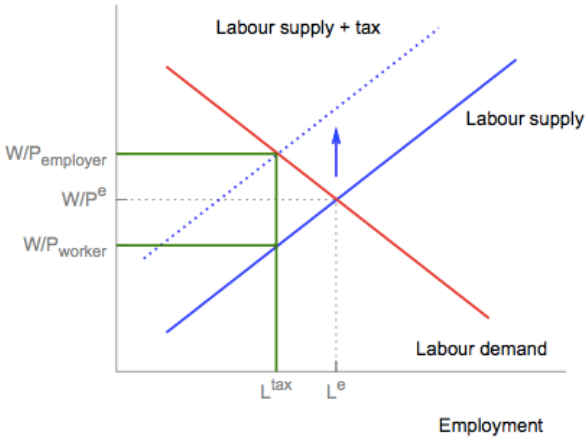
- involuntary unemployment is commonly interpreted as a situation where an unemployed individual would be willing to accept a job but is prevented from participating in the labour market
- one way to introduce unemployment into the competitive model of labour market is by assuming that some mechanism or institution causes the aggregate real wage in the economy to be fixed at level that is greater than the competitive level
- such a wage floor will produce divergence between the quantity of labour demanded and quantity of labour supplied



- the real wage W/P exceeds the equilibrium wage level $(W/P)^e$
- this causes a decline in the quantity of labour demanded L^d and an increase in the quantity of labour supplied L^s
- the difference $L^s - L^d$ represents people who are willing to work at the going real wage rate, but who are unable to find employment
- factors that might lead to real wages being above equilibrium include minimum wage laws or other forms of wage regulation and labour unions

2.3.6 Taxes

- the introduction of the tax causes an upward (inward) shift of the initial labour supply curve, by the amount of tax per worker
- the new labour supply curve (labour supply + tax) intersects the intial labour demand curve at a higher real wage $W/P_{employer}$ and at a lower level of employment L^{tax}
- one effect of the tax is to reduce the level of employment from L^e to L^{tax}
- tax also causes the real wage paid by the employer $W/P_{employer}$ to increase above the intial real wage of W/P^e and for the real wage received by the worker W/P_{worker} to fall below W/P^e



Chapter 3: Interest Rates, Investment and Saving

- Financial markets are where the borrowing and lending desires of economic agents are organised
- Main financial market in an economy is the bond market, stock market and FOREX market

3.1 Interest Rates

3.1.1 Nominal Rate

- The return paid (or earned) on a loan is known as an interest rate
- To derived a net interest rate – divide the dollar value of the interest paid by the dollar value of the initial loan
- Alternative formulation is the gross interest rate e.g.:

$$1 + i = \frac{\$110}{\$100}$$

$$1 + i = 1.10$$

- Gross interest rate is useful in calculating the dollar amount that needs to be repaid on the loan at the end of the year
- This example applies a nominal interest rate
    - Nominal interest rate is the return on a loan measured in monetary terms
    - Refers to the fact that the interest rate on the loan is measured purely in terms of the quantity or number of dollars that are paid on the loan
    - However, if there is a change in the aggregate price level over the period of the loan, purchasing power will differ – account for the effects of changes in the aggregate price level by calculating a real interest rate

3.1.2 Real Rate

- Consider example that Lisa offers Homer $100
    - Suppose consumer price index was $CPI_0 = 100$ at the beginning of the year and was $CPI_1 = 105$ at the end of the year
    - The real interest rate (r) can be calculated as follows:

$$r = \frac{\frac{\$110}{105} - \frac{\$100}{100}}{\frac{\$100}{100}}$$

$$r = \frac{1.0476 - 1.0}{1.0}$$

$$r = 0.048$$

    - 4.8% real interest rate compared to 10% of nominal rate
- **the real interest rate** measures the return on the loan in terms of the ability to purchase real goods and services
- since the general level of prices rises by 5% over the period of the loan, $1 at the end of the loan is worth less in terms of its ability to purchase goods and services than was $1 at the beginning of the loan
- we can think of r as the net real interest rate and 1+r as the gross real rate
- using the values for the CPI we can calculate the annual rate of inflation π as:

$$\pi = (\frac{CPI_1 - CPI_0}{CPI_0}) \times 100$$

$$\pi = (\frac{105 - 100}{100}) \times 100 = 5$$

- the approximate value for the real interest rate is given by

$$r \approx i - \pi$$

$$r = 10 - 5 = 5$$

- similar to the exact calculation of 4.8%

3.1.3 Ex-post and expected real rate

- if we are using past or historical data then we can calculate the actual or ex-post real interest rate
- the two measures of the real interest rate

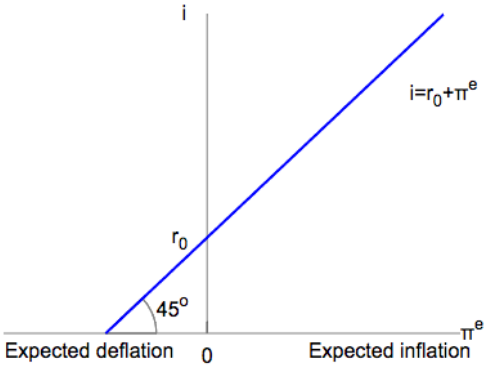
$$(\text{ex-post})\ r = i - \pi$$

$$(\text{expected})\ r = i - \pi^e$$

  - pie is equals actual inflation and pie to the e equals expected inflation
- to compute the ex post real rate we need to know the actual rate of inflation over period of the loan
- for the expected real interest rate we have to use the expected rate of inflation π^e over the period of the loan
- from perspective of economic decision making it is the expected real interest rate that is relevant to economic agents

3.1.4 fisher effect

- fisher effect implies that nominal interest rate will move one for one with changes in expected inflation
- **$i = r_0 + \pi^e$**
  - for a given real rate r_0 the nominal interest rate will move one for one with changes in the expected rate of inflation
- demonstrates the fisher effect
  - nominal interest rates on the vertical axis and expected inflation on the horizontal axis
  - if $\pi^e < 0$ we have expected deflation and $\pi^e = 0$ the nominal interest rate is equal to the real interest rate
  - as inflation rises so does the nominal interest rate



3.1.5 Negative interest rates

- zero lower bound (ZLB) = i > 0
- once expected deflation exceeds 2%, the nominal interest rate cannot fall any further, any further increase in the rate of deflation is associated with an increase in the real interest rate
- use the expected real interest rate
  - **(expected) r = i $- \pi^e$**
  - **if i=0 (expected) r = $-\pi^e$**
- to see this, use the fisher effect without assuming a constant real interest rate
  - **i = r + π^e** and assuming i = 0 we get **r = $-\pi^e$**

- as deflation increases the real interest rate will also rise

3.2 Investment

- investment: expenditures that are concerned with the production of future goods and services

3.2.1 Private investment

- undertaken by businesses and households
- major categories of private investment: purchases of new machines and equipment, investment in non-residential buildings, investment in intellectual property
- for the household sector purchases of new housing are included in investment expenditure as dwelling construction
- combining private business investment and dwelling construction gives private gross fixed investment

3.2.2 Public Investment and 3.2.3 Inventory Investment

- government or public sector also undertakes investment at local, state and federal levels and also through publicly owned corporations
- inventory investment (equal to the change in the level of inventory holdings) as a share of nominal GDP

3.2.4 – Investment and Capital Stock

- investment expenditure is a flow variable and consequently is measured over some period of time
- investment flows can accumulate over time and affect the level of stock of capital in an economy
- at any point of time an economy will have some particular level of capital stock
- standard formula for the accumulation of capital is given by:
    - $\mathbf{K_1 = K_0 + I_1 - \delta K_0}$
    - Where K_0 is the stock of capital at the beginning of the period, I_1 is gross investment over the period, δK_0 is physical depreciation on the existing capital stock (δ *is the deprecation rate*) and K_1 is the stock of capital at the end of the period
- Gross investment is what is included in the expenditure approach to calculating GDP
- Can define net investment as gross investment less depreciation
    - **Net investment = I - δK**

3.2.5 Economic influences on investment

- the marginal product of capital is the addition to output from increasing the capital input by one unit, with all other factors of production held fixed
- can assume that the marginal product of capital is positive, but declines with each additional unit of capital that is added
- to obtain the value of the marginal product of capital (VMPK) we simply multiply the marginal product of capital by the sales price of the business's output (p)
    - VMPK = MPK x p
    - Provides a measure of the marginal benefit to the business from investing in new capital

3.2.6 – User cost of capital

- The durable nature of capital goods means the cost to a business investing in a new capital good is not simply the purchase price of that good
- Example of buying a plane
    - Interest cost of the new plane over one year will be i x P_k
    - Depreciation rate of the plane is equal to δ
    - The amount of the plane that remains at the end of year is (1-δ)
    - Assume at the end of the year market price for the plan will equal $P_K + \Delta P_K$ where ΔP_K measures any change in the price of planes over the year
- **User cost = purchase price + interest payments – market price of depreciated plane (at year end)**
- **UC = P_K + i x P_K – (1- δ) [P_K + ΔP_K]**
    - Above formula can be used to calculate the exact dollar value of the annual user cost of the plane
    - Could compare the UC to the expected value of the marginal product of the plane over the next year and would decide to undertake the investment in the new plane, provided VMPK > UC

3.2.7 – an approximation

- **UC = P_K [i + δ – (ΔP_K / P_K)]**
    - Simply the nominal interest rate plus the physical depreciation rate minus the annual rate of price change on capital goods
- We can make one final simplifying assumption to the user cost by assuming that capital goods prices increase at the general rate of inflation
    - We can replace (ΔP_K / P_K) with the inflation rate π
- **UC = P_K [i + δ – π]**
    - Or noting that the real interest rate is r=i- π
- **UC = P_K [r + δ]**
    - So that UC depends on the price of the capital good, the physical depreciation rate and the real rate of interest
- The rate of the user cost is just equal to the real interest rate and the rate of depreciation

Approximate Formula for the User Cost of Capital

User cost formula

$$UC = P_K + i \times P_K - (1-\delta)[P_K + \Delta P_K] \quad (3.$$

Expand final term in formula

$$UC = \begin{array}{l} P_K + i \times P_K \\ -[P_K + \Delta P_K - \delta \times P_K - \delta \times \Delta P_K] \end{array} \quad (3.$$

Cancel the plus and minus P_K

$$UC = i \times P_K + \delta \times P_K - [\Delta P_K - \delta \times \Delta P_K] \quad (3.$$

Now multiply and divide the last term in [.] by P_K

$$UC = \begin{array}{l} i \times P_K + \delta \times P_K \\ -[(\Delta P_K / P_K) - \delta \times (\Delta P_K / P_K)] \times P_K \end{array} \quad (3.$$

Focusing on the $\delta \times (\Delta P_K / P_K)$ term we note that it is likely to be "small", as the two elements being multiplied δ and $(\Delta P_K / P_K)$ are decimals and their multiple will be a smaller decimal. For example let $\delta = 0.1$ and $\Delta P_K / P_K = 0.05$, the $\delta \times (\Delta P_K / P_K) = 0.005$. Treating $\delta \times (\Delta P_K / P_K)$ as approximately zero gives;

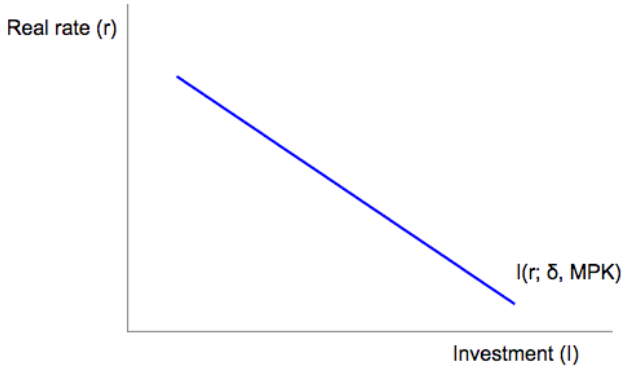
$$UC \approx i \times P_K + \delta \times P_K - [(\Delta P_K / P_K)] \times P_K \quad (3.$$

Finally collecting all the terms in PK gives;

$$UC \approx P_K[i + \delta - (\Delta P_K / P_K)] \quad (3.$$

3.2.8 – investment demand curve

- An increase in the real interest rate will increase the user cost of capital and hence make it less likely that the value of the marginal product of a new investment will exceed its user cost
- A rise in the real interest rate will make investment less attractive



3.3 National Savings

- Defined as an economic agent's income minus current consumption

3.3.1 – Household saving

- In the national accounts, household saving is measured as household disposable income less consumption expenditure
- **income measure of GDP → Y = labour income + capital income + (indirect taxes – subsidies)**

    - To obtain household disposable income from national income Y, it is necessary to subtract all forms of taxes (indirect and direct) but to add government transfer payments and government interest payments to households
    - Transfer payments: by the government are payments made to households (pension, unemployment benefit) for which households provide no goods or services in exchanges
    - Government interest payments are paid to households on their holding of government bonds
    - Most capital income is paid to households as rent, interest or dividends businesses may keep ome profits in the form of retrained earnings
    - Retained earnings: represent business profits that are not paid out to sharehodlers in the form of dividends
- **YD = Y – TA + TR + INT – RE (disposable income)**
    - Y = GDP
    - TA = taxes
    - TR = government transfers
    - INT = government interest payments to household
    - RE = business retained earnings
- **S = YD – C**
    - S is gross household savings, since it includes saving to offset depreciation and is measured as household disposable income minus household consumption expenditure
    - C is depreciation

3.3.2 Savings and Wealth

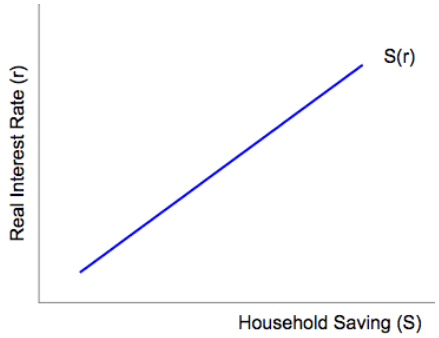
- In the national accounts household saving Is measured as the difference between disposable income and consumption expenditure
- Two possible measures of household saving, S = YD – C or changes in household wealth
- **Net wealth = assets – liabilities**
    - Can write the current stock of net wealth W_1 as:
    - **$W_1 = W_0 + S$ +(net) capital gains**
    - Assets, liabilities and wealth are stock variables
    - W_0 is ent household wealth at the beginning of the period, S is household saving over the period and net capital gains reflects the overall effect of changes in market prices

$$\boldsymbol{W_1 - W_0 \equiv \Delta W = S + (net)\ capital\ gains}$$

    - changes in net wealth is equal to household saving plus any net capital gains on existing assets
- Household wealth can be affected by changes in the price of assets
- Households save – life cycle saving (meet long term goals), precautionary saving and bequest saving

3.3.5 Role of the real interest rate

- **Saving = disposable income - consumption**
- Saving and dis saving allows households to move resources over time
- When households are making decisions about consumption and saving decisions the real interest rate (r) plays the role of a relative price



- If the real interest rate is relatively low, then the opportunity cost of consuming more today is relatively low
- By forgoing $1 of consumption today you are able to consume $1 (1+r) tomorrow
- Assume r is relatively high, then if you consumer $1 today, you are forgoing more additional consumption tomorrow
- Higher r leads to higher saving
- An increase in the real interest rate will create an incentive to reduce current consumption as it has become more expensive and increase saving out of current income

3.3.7 government saving

- The sum of household saving and business saving will give us aggregate saving by the private sector in an economy
- **Public saving is measured as: BB = public saving = T – G**
  - **G is government expenditure**
- **T = TA – TR – INT**
  - **TA = taxes**
  - **TR = government transfers**
  - **INT = government**
- An alternative name for public saving is the government budget balance (BB)

3.3.8 national saving schedule

- **National savings = household saving + business saving + government spending**
- **National saving = private saving + public saving**
- **NS = Y – C – G**
  - **Y = national income**
  - **C = household consumption**
  - **G = government spending**
  - **Excludes I because by definition it is spending that provides for future needs not current ones, we are assuming that all government spending is on current consumption (no investment)**
  - **Since closed economy NS = I**
- Can add and subtract T, then we decompose NS into private and public saving

$$\boldsymbol{NS \equiv Y - C - G + T - T}$$
$$\boldsymbol{NS \equiv [(Y - T) - C] + T - G}$$

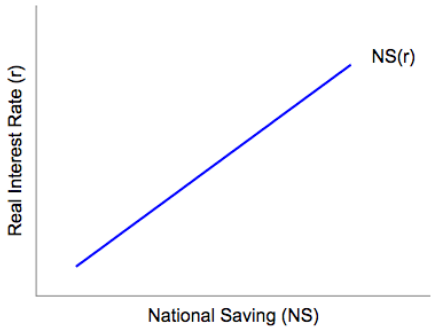
  - T-G is public saving
  - [(Y-T)-C] is private saving
- can further decompose of NS by adding and subtracting RE to both sides

$$NS \equiv [(Y - T) - C] + T - G + RE - RE$$

$$NS \equiv [(Y - T - RE) - C] + RE + T - G$$

  - **where Y – RE – T – C is household saving and T-G is public saving**

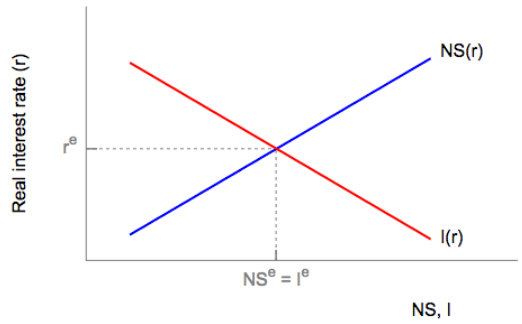
- a rise in the real interest rate will result in an increase in the amount of nationa saving as we assume that a rise in r leads to an increase in household saving



3.3.9 national saving and investment in equilibrium

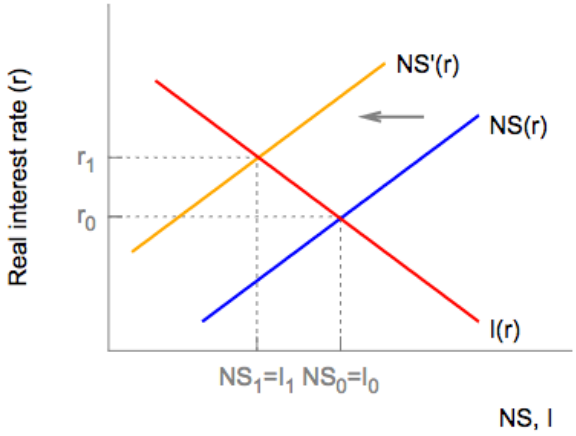
- national saving = investment

- real interest rate wo;; adjust to ensure that this equality holds, saving is an increasing function of the real interest rate and investment is a decreasing function of the real interest rate



3.3.10 – crowding out

- crowding out means that an increase in the governments budget deficit can cause a fall in the level of private investment
- a larger deficit reduces the supply of saving (savings curve shifts inwards) and drives up the real interest rate. The higher the real interest rate makes investment less attractive and causes a move along the I curve
- the increase in the budget deficit will shift the NS curve to the left, but does not produce any change in the investment curve
- the fall in the national saving curve results in an increase in the real interest rate and caushing a shift along the I(r) curve and hence a lower level of investment



3.3.11 – investment slumps

- the fall in business confidence causes the investment schedule to shift inwards
- graph demonstrates a decline in the real interest rate and a fall in both investment and national saving

chapter four – income expenditure model of GDP

Keynesian Model

- prices of goods are fixed (common to say sticky) in the short run
    - firms do not change prices in response to a change in demand for their product
    - instead they fix their price and then meet the demand by varying 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 (not perfectly competitive world) and firms face some cost to changing prices – these are called menu costs
- 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

4.1 aggregate expenditure: actual and planned

- planned aggregate expenditure (PAE) reflects the desired level of spending on domestically produced final goods and services by all sectors of an economy
    - PAE in the four-sector economy is given by: **$PAE = C + I^p + G + X – M$**
    - Where PAE differs from actual aggregate expenditure by its inclusion of planned investment I^p as opposed to actual investment (I)
    - **Unplanned changes in inventories will arise when desired purchases of a firms output differ from its production level plus any planned change in inventories – why actual expenditure is not always equal to planned expenditure**
    - Can write**: $I = I^p + \Delta Inv^u$**
        - Which states that measured investment equals planned investment plus any unplanned change in inventories
    - Aggregate output or production will be determined by the total level of desired (or planned) spending

4.1.1 – equilibrium and disequilibrium

- Equilibrium in the income-expenditure model is a situation where GDP is just equal to the level of planned expenditure
    - Aggregate production is just equal to planned aggregate expenditure
    - **$Y = PAE$ or $Y = C + I^p + G + X – M$**
- At equilibrium GDP, it must also be true that there are no unplanned changes in inventories **$\Delta Inv^u = 0$ and $I = I^p$**
- **Dis-equilibrium: in the income-expenditure model is a situation where aggregate production is greater than or less than the level of planned aggregate expenditure**
    - **$Y < PAE$ or $Y > PAE$**
- When Y>PAE
    - Businesses producing goods will experience an unanticipated increase in unsold inventories, excess capacity to meet demand
    - Service producers will have more workers employed than needed

    - In response businesses will decrease level of production
    - This will cause Y (GDP) to fall
- When Y <PAE
    - Business sector in aggregate will find they have to run down their levels of inventories of goods in order to meet demand
    - Businesses that produce services will find that demand for their services will exceed their existing capacity to meet and will have customers they cant supply
    - Then will occur an unanticipated decline their inventories and in the model will respond by increasing production
    - Will cause Y to increase

4.2 – Two Sector Model: households and businesses

- **In the two-sector model PAE is comprised of household consumption and planned business investment → PAE = C + I^P, no government and foreign sector**

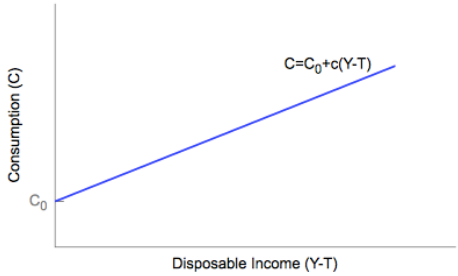
4.2.1 – Planned investment

- In the case of planned investment we make the simplifying assumption that I^P is an autonomous or exogenous variable → determined by factors other than the level fo real GDP
- In terms of the income-expenditure model this amounts to assuming that planned investment equals some given value (number) and does not depend upon the level of Y
- **Notation for exogenous/autonomous variable: $I^P = I^0$**

4.2.2 – Household consumption

- It is considerably less volatile than business investment
- Sometimes used to classify consumption expenditure into three basic types; non durable consumption (goods that are for immediate consumption), durable consumption (flows over a relatively long period of time) and consumption of services (movies, education)

4.2.3 – a model of consumption



- Keynesian consumption function assumes aggregate household consumption depends upon current household disposable income
- **$C = C_0 + c(Y-T)$ → linear relationship**
    - **C is real consumption expenditure**
    - **C_0 is exogenous (autonomous) consumption**
    - **Disposable income = (Y-T)**
    - **Y is real national income or GDP and T equals total taxes (TA) less transfer payments (TR) less interest payments on public debt (INT)**
    - **Assume retained earnings (RE = 0)**
    - **C(Y-T) captures the effect of disposable income on consumption (sometimes called induced consumption)**
    - There are two parameters in the model,
        - C_0 is a constant term that indicates what aggregate consumption will be if aggregate disposable income is zero
        - Conventional to assume $C_0 > 0$ which suggests there are factors other than disposable income that influence consumption
        - Other parameter is c, which is known as the marginal propensity to consume
- Marginal propensity to consumer
    - Is the change in consumption when disposable income changes by a dollar
        - $\Delta C = c\Delta(Y - T)$ **(assume $\Delta C_0 = 0$)**
        - $MPC = \frac{\Delta C}{\Delta(Y-T)} = c$

- **c is the marginal propensity to consume (MPC) out of disposable income**
- **key assumption of Keynesian consumption function is that MPC is 0<c<1**

- average propensity to consume is simply the ratio of consumption to disposable income (proportion of income that is used for consumption)

$$\frac{C}{Y-T} = \frac{C0}{Y-T} + c$$

- APC > MPC but approaches MPC as Y-T increases

4.2.4 – Equilibrium in Two-sector model

- Can solve the above model for equilibrium Y using the following technique

First we substitute the various components of PAE

$$PAE = C + I^p$$

$$PAE = C_0 + cY + I_0$$

$$PAE = [C_0 + I_0] + cY$$

Then for equilibrium we have

$$Y = [C_0 + I_0] + cY$$

Collecting the terms in Y

$$Y - cY = [C_0 + I_0]$$

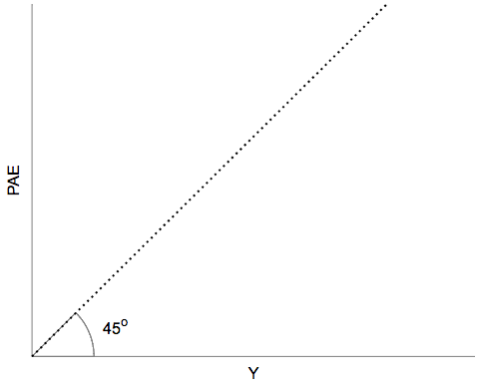
$$(1 - c)Y = [C_0 + I_0]$$

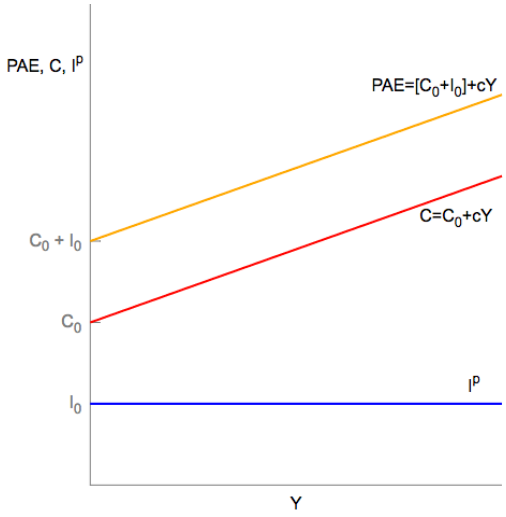
$$Y^e = \frac{1}{(1-c)}[C_0 + I_0]$$

- Y^e to indicate the equilibrium level of output
- Two sector model implies that the equilibrium level of real GDP depends upon the sum of the levels of autonomous consumption expenditure and planned investment

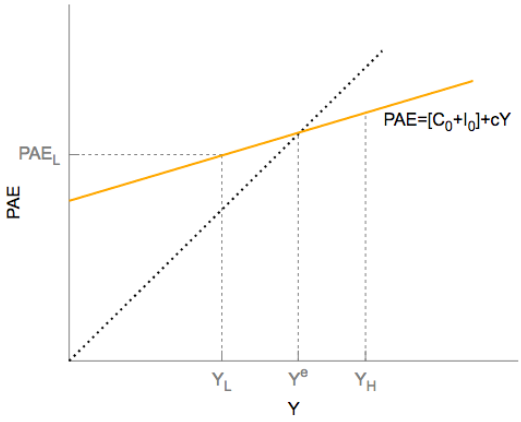
4.2.5 – graphical representation

- Two sector income expenditure model can be represented in a diagram – Y = PAE
- While the 45=degree line represents all possible points of equilibrium, it is not by itself sufficient to indicate what will be the level of equilibrium GDP
- On the vertical axis we measure PAE and its components consumption and planned investment
- The consumption function has an autonomous component C_0 (vertical intercept) and a component that depends on Y
- It has an upward slope equal to the MPC which is less than one
- The PAE line is simply obtained by vertically summing the values for consumption and planned invested for each level of Y
- To determine equilibrium GDP, we add the PAE line to the 45-degree diagram, equilibrium GDP obtains at the level of Y for which the PAE line cuts the 45-degree line



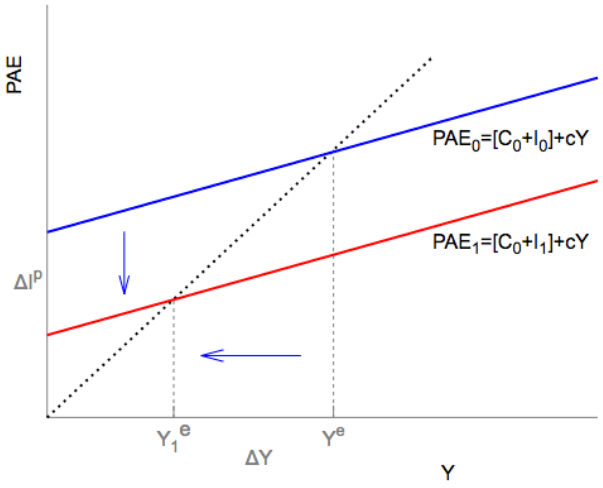


4.2.6 – dis-equilibrium



- The figure below demonstrates how the economy behaves if for some reason the level of production is not at Y^e
- We illustrate the situation in which for a given PAE curve, level of aggregate output is either $Y_L < Y^e$ or $Y_H > Y^e$
- Since the desired level of expenditure exceeds the level of output, the business sector will experience an unplanned decline in their level of inventories (excess demand for services)
- The business sector will respond to the excess demand and inventory decline by increasing their level of production
- Will result in an increase in output – above Y_L and will move the level of GDP towards Y^e
- For any output level below Y^e businesses will experience unplanned inventory decumulation and will have an incentive to increase production until $Y = Y^e$
- When production was at Y_H its apparent that $PAE_H < Y_H$ so business sector will experience an unplanned increase in their level of inventories and this will provide a signal for businesses to cut back on their level of production
- Output will fall below Y_H and move closer to Y^e

4.2.7 – changes in equilibrium GDP



- A reduction in planned investment from I_0 to I_1 will shift the PAE curve downwards, the reduction in PAE will produce a fall in the equilibrium level of real GDP to Y^e_1
- The change in Y is larger than the change in I^p
- **Multiplier: in the income expenditure model is a measure of the change in equilibrium GDP in response to a given exogenous change in planned expenditure**
    - **An additional dollar of exogenous PAE generates more than a dollars worth of GDP**
    - **k =** $\frac{\Delta Y}{\Delta I^p}$
    - **in order to calculate the numerical value of a multiplier we can use our above solution for equilibrium GDO**

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

    - **the multiplier for an exogenous change in planned investment is**

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

4.2.8 – mechanics of the multiplier process

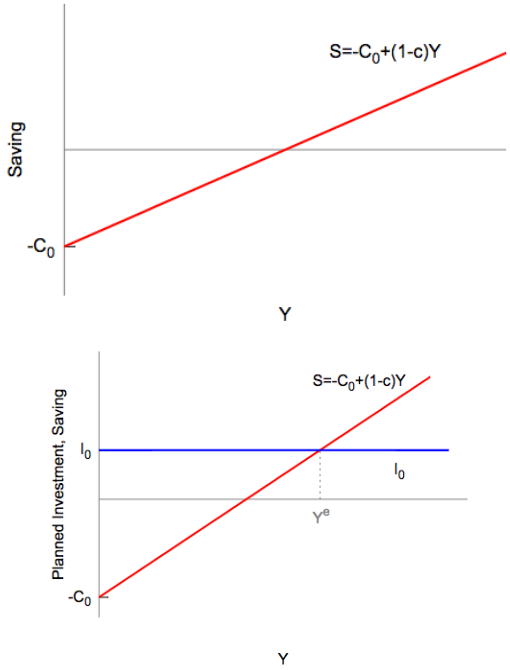
- increase in income will be spent on increased consumption and keeps circling through the economy
- the increase in GDP associated with the multiplier process is given by:
- $\Delta Y = \frac{1}{1-c} \times 100 \; when \; 0 < c < 1$

	Rounds			
	1	2	3	4
ΔI^p	100	0	0	…
ΔC	0	c×100	c×(c×100)	…
ΔY	100	c×100	c×(c×100)	…

4.2.9 – saving and planned investment in two-sector model

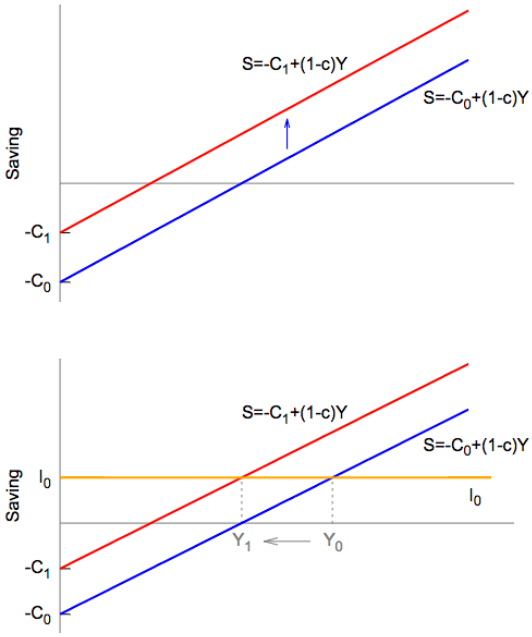
- in the two-sector model the equilibrium level of GDP – Y = PAE
- PAE = C + I^P → Y-C=I^P
    - The left hand side of the second equation is just equal to aggregate saving in the two-sector model
- instead of using Y = PAE as the condition for equilibrium, we can use an equivalent equilibrium condition os saving equal to planned investments S = I^P
- S = Y – C and C = C_0 + cY we obtain **S = -C_0 + (1-c)Y**
    - (1-c) is just the marginal propensity to save
- also obtain the same result for equilibrium GDP

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



4.2.10 – paradox of thrift

- the paradox of thrift is a example of a fallacy of composition, which is a fallacy of assuming what is true for an individual component of some whole, is also true for the whole
- a given increase in autonomous saving is equivalent to an equal decrease in autonomous consumption spending
- the attempt by all households to increase their autonomous saving results in a fall in real GDP which declines by just enough to lower induced saving so that it exacly offsets the autonomous increase
- thus while an individual household can raise its total level of saving, in the income-expenditure model this is not possible for all households in aggreagte



4.3 Open Economy Model

- we extend the two-sector model by allowing for international trade in goods and services and including imports and exports
- **planned aggregate expenditure is given by**
    - **PAE = C + I^P + X – M**
- In the case of imports, the level of domestic real income or GDP is likely to be an important determinant and we are assuming the following simple linear model → **M = mY**
    - We assume there is no autonomous component to imports, the coefficient m is the marginal (average) propensity to import and can be written as
    - $\frac{\Delta M}{\nabla Y} = m$
- the equations describing out open economy model are given by

$$C = C_0 + cY$$

$$I^p = I_0$$

$$X = X_0$$

$$M = mY$$

- can be substituted into the PAE equation

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

$$PAE = C_0 + cY + I_0 + X_0 - mY$$

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

- to determine equilibrium GDP we use the condition for equilibrium

$$Y = PAE$$

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

$$Y(1 - (c - m)) = [C_0 + I_0 + X_0]$$

- in the open economy, the multiplier depends not only on the marginal propensity to consumer, but also on the marginal propensity to import
- other things equal, the multiplier for the open economy is smaller in magnitude than for the closed economy:
- $$\frac{1}{(1-c)+m} < \frac{1}{1-c}$$