EXPECTATIONS IN MACROECONOMICS

1. THE ADAPTIVE EXPECTATIONS HYPOTHESIS

★ The idea of adaptive expectations is that a person will change his expectation of any variable by some fraction of the difference between the variable's actual value last period and what he was expecting it to be last period.

- Suppose you expected the inflation rate of previous year to be 10% to form an expectation of what the rate of inflation will be this year. If last year, the actual rate of inflation was 10%, the adaptive expectations hypothesis suggests that you will not change your expectation about the inflation rate for this year; you will expect 10% for this year too.

- People will change their expectation of any variable, only if there is a difference between what they were expecting it to be last year and what it actually was last period.

1. The adaptive expectations hypothesis has the appealing feature that while people can be fooled temporarily by the ~~by~~ sudden and stagnant changes in the variable they were expecting, they will not be fooled in the longer run.

2. This hypothesis is apparently fairly general: we could easily substitute unemployment, or interest rate, or the rate of growth of real income in place of inflation rate and the hypothesis would be just as reasonable.

3. The third attractive feature - it allows us to relate expected, unobservable variables to actual, observable variables. To see this, we must put the hypothesis into a simple algebraic form -

$$Y_t^e - Y_{t-1}^e = \alpha (Y_{t-1} - Y_{t-1}^e) \quad \text{——} \quad (1)$$

where, $Y_t^e \rightarrow$ expected income in period t

$Y_{t-1}^e \rightarrow$ actual income in period t-1

$\alpha \rightarrow$ positive coefficient < 1

$$\Rightarrow Y_t^e = \alpha Y_{t-1} + (1-\alpha) Y_{t-1}^e \quad \text{——} \quad (2)$$

If (2) is generally true, then it must be true for last period as well, and the period before that, and so on.

$$Y_t^e = \alpha Y_{t-1} + \alpha(1-\alpha) Y_{t-2} + \alpha(1-\alpha)^2 Y_{t-3} + \alpha(1-\alpha)^3 Y_{t-4} + \ldots \quad \text{——} \quad (3)$$

(3) links unobservable variable — expected income to the observable variables — actual income in previous periods.

The most recent observations on actual income dominate the formation of expectations about future income. As a result, if we link the unobservable expected income to the observable values of actual income, only the last 5 periods we will, not be far wrong.

★ Implausibility!

→ first: Imagine an economy in which the inflation rate oscillates each period between 0 & 10 per cent. The people will always expect something between ~~0 & 10~~ 0 to 10% (according to AEH). But is it likely when the pattern is so obvious! They wouldn't guess in between and ~~with guess~~ should guess actual numbers (0% or 10%).

→ Another: When the variable about which an expectation is being formed is continually rising or continually falling. For in this case, the AEH predicts that the expectation of the variable will always be less than the variable itself (if the variable is rising) or always greater than it (if it is falling).

2. THEORY OF RATIONAL EXPECTATIONS

- The RET states that economic agents (people & businesses) form their expectations about the future based on all available information, including - economic theory, models & principles, past data and current information.

- Sensible people will use all the available information relating to the process determining a variable when forming their forecast or expectation of that variable.
It is usual to assume that people act rationally, so, when modelling how people form their expectations about any variable, economists should assume that expectations are formed on the basis of all the available information relating to the true or actual process governing the behaviour of the variable.

- Imagine an economic variable Y, the value of which in any period t is determined by its own lagged values and by lagged values of X and Z -

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} \quad \text{---} (1)$$

where, Y, X and Z are all variables
and α_0, α_1 and α_2 so on are constant coefficients.

* This hypothesis was originally applied to the problem of forecasting the future price of a good which took time to produce: its originator was John Muth (1961).

But: Consider a person who, at the end of period t-1, is trying to form an expectation about the value that Y is going to take in period t. If he is rational, his expectation of what Y is going to be in period t, the expectation being formed on the basis of his information set, at the end of period t-1, will be formed in line with the process determining Y as follows -

(5) —— $E_{t-1} Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1}$

where, $E_{t-1} Y_t$ is the expectation of Y_t formed on the basis of the information available at the end of period t-1 → $E(Y_t | I_{t-1})$. (I → Information)

Implication from eqn (5) → If Y does indeed continue to follow the process shown in (4) then this person's expectation will be perfectly accurate or, the person's forecasting or expectational error is zero.

* The expectational error is defined as the difference between the actual value a variable takes and the value the person was expecting it to take.

→ Expectational Error, being zero every period, is not a general result. We have assumed that it is 'deterministic'. Most of the economic processes are not thought of as deterministic but as 'stochastic', that is, they include an inherently unpredictable element.

→ One way to incorporate this element of randomness in process is to add a random variable term v_t → which may be positive or negative.

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} + v_t \quad \text{——— (6)}$$

→ ★ It is usual to think of v as a variable with a probability distribution centred at zero and having a constant and finite variance (σ^2).

→ An important feature of v is that its value in period t is unknown at the end of period t as it is not part of the information set at period t-1. Now, the person has to form some expectation of the value that v is going to take in period t.

$$E_{t-1} Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} + E_{t-1} v_t$$

where, $E_{t-1} v_t$ is the expectation of v_t formed on the basis of all the information available at the end of period t-1.

★ If process determining v is such that v is a random term with a mean of zero, the value of which can't be predicted on the basis of any available info. set in period t-1, it follows that the best guess a rational agent can make of the current value of v is that it will equal its mean value, zero.

$$E_{t-1} V_t = 0$$

If actual value of Y is determined in accordance with eqn (6), it follows that the expectational error will be given by -

$$Y_t - E_{t-1} Y_t = V_t$$

General Characteristics of Rational Expectations

1. The errors of rational expectations are on avg. 0:

- Once the process determining Y is allowed to be stochastic, (including v), the rational expectation of Y will not always be perfectly accurate, for the random component v is inherently unpredictable. Its value only becomes known after it has occurred.
- The best the rational forecaster can do is expect the mean value of V, which is assumed to be 0. Sometimes, the error will be positive, sometimes negative, sometimes zero. But on avg., the negative errors will cancel out with the positive ones, leaving an avg. error of zero.

- The size of expectational errors depends upon the size of the unpredictable component of the process itself. Since v can be large and negative as well as large and positive, the mean value of v and hence the avg. expectational errors will still be zero.

2. The errors of Rational expectations exhibits no pattern:

- The problem discussed previously, about the implausibility of AEH – if the variable being forecast is always rising, an AEH of it would be below, always, the actual value of the variable. There would always be a positive error. Also, AEH does not tell when the forecasting method will change or how.
- RET is less vulnerable to this criticism as it rules out any pattern in forecasting errors and is more precise about when the method of forming expectations will change.
- for if expectations are rationally formed, the forecasting error will equal v. And by assumption, this random element itself exhibits no pattern. Since v exhibits no pattern, then neither does the forecasting error if ~~forecast~~ expectations are rational.

What if v does exhibit a pattern?

i.e. $V_t = \beta_1 V_{t-1} + \epsilon_t$ ——— (7)

where, ϵ_t is a random error with mean zero,
β_1 is a coefficient ranging between -1 & $+1$.

Ans - If v is being determined by the process described in eqn (7), then rational people will form their expectation of the current period's value of v in the previous period, $t-1$, it follows that the forecast of v will diverge from the actual value of v by the unknown, unpredictable element ϵ_t.

This latter element, exhibits no pattern and has a mean value of zero. Thus, even if v did exhibit a pattern, the rational forecast of Y would, on average, still be correct and the forecasting error would exhibit no pattern.

3. Rational expectations are the most accurate expectations.

The Rational expectation - expectation formed in accordance with the process actually determining the variable - will be a more accurate expectation than one formed on another basis.

The actual size of the variance of v sets an upper limit on the accuracy of any method of forecasting Y.

If expectations are formed rationally the expectational error in any period is identified as v in that period. The likely range of the forecasting errors is therefore same as the likely range of the unpredictable component of the process determining Y.

In this case, then, the upper limit of accuracy is reached — no with any other method of forecasting, the level of accuracy can't be higher.

General Criticisms

1. The plausibility of Rationality

Critics argue that this assumption of perfect rationality is unrealistic. People might:

- have limited cognitive abilities and struggle to analyse complex economic info. perfectly.
- be subject to emotions, biases and heuristics that can cloud their judgement.

→ If the assumption that firms and consumers act as if they do understand these complexities leads to theories which make accurate predictions, then the assumption of mathematical awareness is thereby shown to be a useful one.

AGGREGATE SUPPLY AND DEMAND

Background -

- In the great Depression - 1930s, output fell by nearly 30%; unemployment rate averaged 18.8% (1931-40).
- Unemployment rates of 10% in 2009.

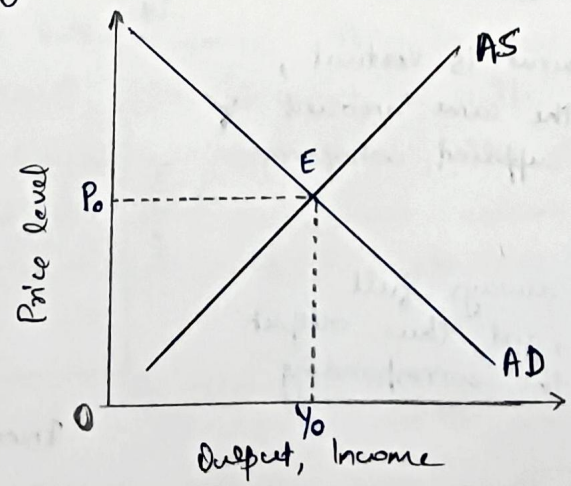
★ The AD-AS model is the basic microeconomic tool for studying output fluctuations and the determination of the price level and the inflation rate.

→ The aggregate supply curve describes, for each given price level, the quantity of output firms are willing to supply.

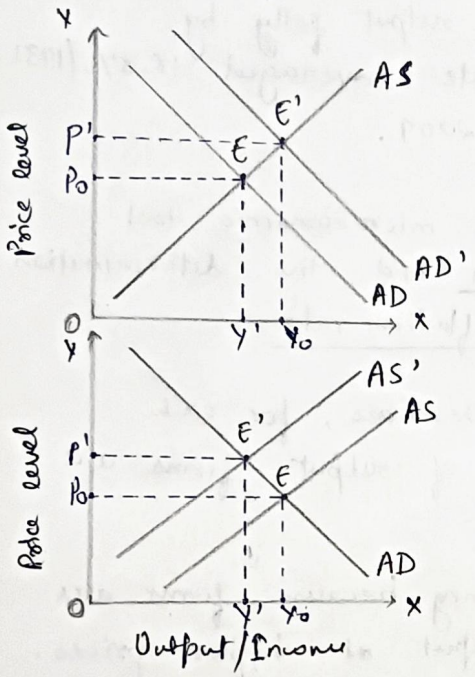
- The AS curve is upward sloping because firms are willing to supply more output at higher prices.

→ The Aggregate Demand (AD) curve shows the combinations of the price level and level of output at which the goods and money markets are simultaneously in equilibrium.

- The AD curve is downward sloping because higher prices reduces the value of the money supply, which reduces the demand for output.



The intersection of the AD & AS curves of E determines the equilibrium level of output, Y_0, and the equilibrium price level, P_0.



- An increase in money supply shifts the aggregate demand curve, to the right, which means
- increase in money stock causes both the level of output and price level to rise.

- This figure shows the results of an adverse (upward & leftward) AS shock.
- This leftward shift of the AS curve cuts output and raises prices.

eg:- the 1973 OPEC oil embargo is a classic example of such a shock.

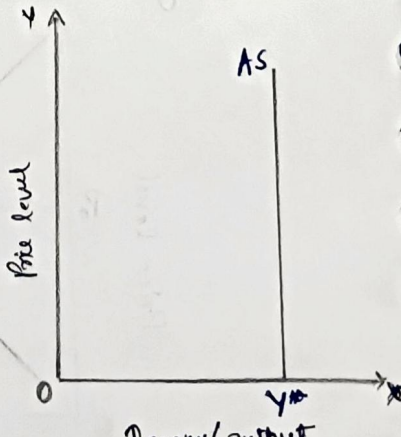
Aggregate Supply Curve-

The AS curve describes, for each given level of price, the quantity of output firms are willing to supply.

- In short run, AS curve is Horizontal [Keynesian]
- In long run, AS curve is Vertical [classical]

1. Classical supply curve

The classical AS curve is vertical, indicating that the same amount of goods will be supplied whatever the price level.

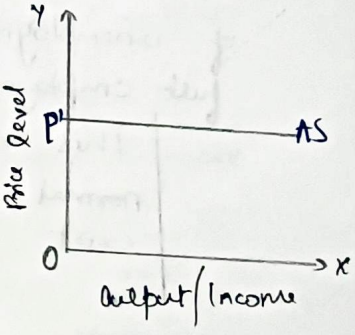


Assumption- there is always full employment of labor, and thus output is always at the corresponding level, Y^*.

- Level of output corresponding to full employment of the labor force is called as Potential GDP, Y^*.
- Potential GDP grows over time as the economy accumulates resources and as technology improves. So, the position of the classical AS curve moves to the right over time.
- Potential GDP changes each year, but the changes do not depend on the price level.
- We can draw a single vertical line at Potential GDP and call it 'long run AS curve'.

Keynesian AS Curve –

The Keynesian AS curve is horizontal, indicating that firms will supply whatever amount of goods is demanded at the existing price level.



Assumption – there is unemployment, firms can obtain as much labor as they want at the current wage.

- The Average costs of firms production are assumed not to change as their output levels change.
- In the short run, firms are reluctant to change prices (and wages) when demand shifts. Instead, for a little while, they increase or decrease output. As a result, the AS curve is quite flat in short-run.
- In keynesian AS curve, the price level doesn't depend on GDP, since we assume that we are in an economy with no expected inflation.

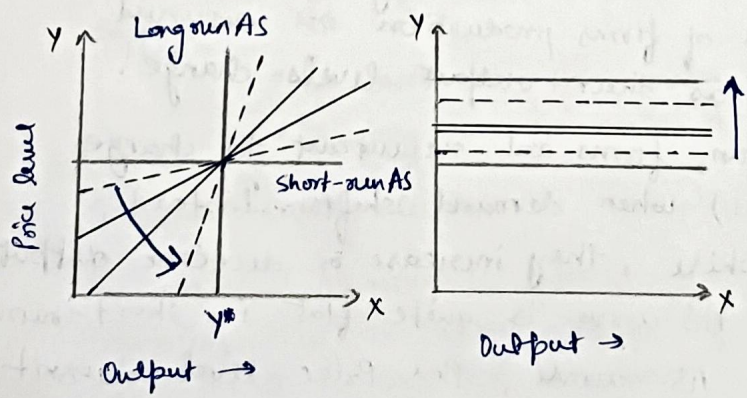
Frictional Unemployment - Labor market frictions, which occur because the labor market is always in a state of flux. Some people are moving and changing jobs; others are looking for jobs for the first time; some firms are expanding, others have lost business.

Because it takes time for an individual to find the right job, there will always be some frictional unemployment as people search for jobs.

Natural rate of Unemployment - This is the rate of unemployment associated with the full employment level of output, Y^*.

> This rate of Unemployment arises from the normal labor market frictions that exist when the labor market is in equilibrium.

PRICE ADJUSTMENT MECHANISM - AS CURVE



- AS curve gives a description of the mechanism by which prices rise or fall over time.

$$P_{t+1} = P_t [1 + \lambda (Y - Y^*)]$$

Where, P_{t+1} is the price level next period,
P_t is the price level today, and
Y^* is Potential output.

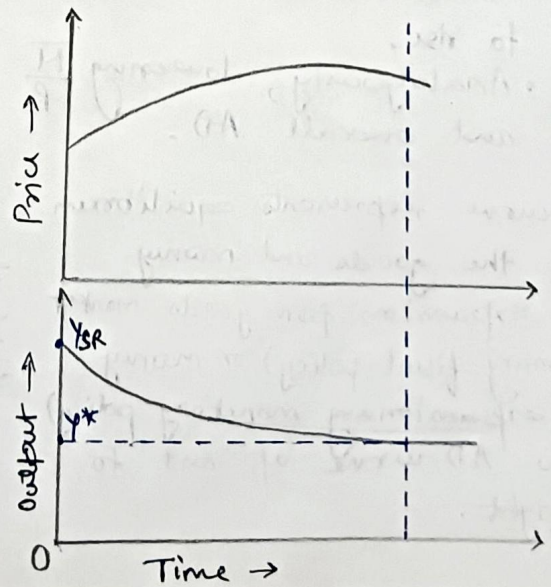
- If output is above potential output, prices will rise and be higher next year;
- If prices are below potential output, prices will fall and be lower next period.
- Prices will continue to rise or fall over time until output returns to potential output.

$$P_{t+1} = P_t \text{ if and only if } Y = Y^*$$

- GDP gap / Output gap is the difference between GDP and potential GDP, $(Y - Y^*)$.
- If λ is large, the AS mechanism will return the economy to potential output more quickly;
- If λ is small, we might want to use AD policy to speed up the process.

Another way of looking at the adjustment process.

→



THE AGGREGATE DEMAND CURVE

- The AD curve shows the combinations of the price level and the level of output at which the goods and money markets are simultaneously in equilibrium.
- AD curve can shift by -

  Expansionary policies - govt. spending increment, cuts in taxes, increase in Money supply. [rightward shift]

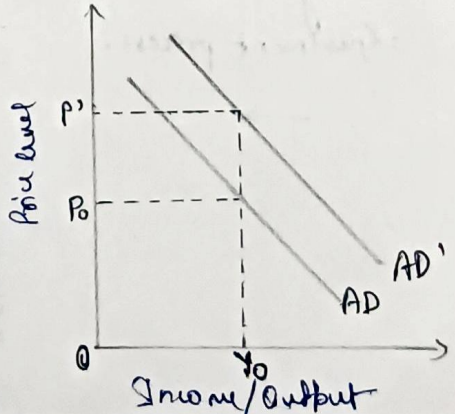
  Consumer and Investor confidence - confidence can increase or droop.

- The key to the AD relation between output and prices is that AD depends on the real money supply. It is the value of the money provided by the Central Bank and the Banking System.

If we write Nominal Money Supply (no. of dollars) as $\overline{M}$ and price level as P, we can rewrite, real Money Supply = $\frac{\overline{M}}{P}$

- When $\frac{\overline{M}}{P}$ rises, interest rates fall, investment increases, leading overall AD to rise.
- Analogously, lowering $\frac{\overline{M}}{P}$ lowers investment and overall AD.

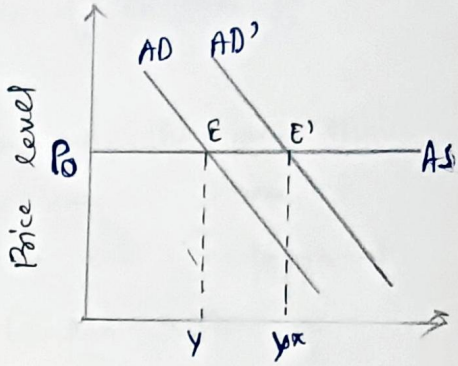
- The AD curve represents equilibrium in both the goods and money markets. expansion from goods market (expansionary fiscal policy) or money market (expansionary monetary policy) shifts the AD curve up and to the right.



AD under Alternative Supply Assumptions

Keynesian Case

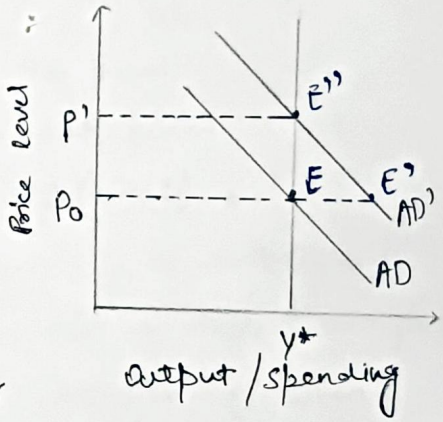
- Initially, at E, both the goods and asset markets are at equilibrium
- Now, the AD increases, which shifts AD curve to right. The new equilibrium is at E' where output has increased but there is no effect on price level.



[Perfectly Elastic Supply]

Classical Case

- In this case, firms will supply Y* level of output whatever the price level.
- Firms cannot obtain labor to produce more output in response to increased demand.
- The increase in the demand for goods therefore leads only to higher prices, and not to higher output.



IS-LM MODEL

THE GOODS MARKET & THE IS CURVE

- The IS curve shows combinations of interest rates and levels of output such ~~as~~ that planned ~~saving~~ spending equals income.

Investment Demand and Interest Rate

The desired/planned rate of investment is lower higher the interest rate. **Why?**

Investment is spending on addition to the firm's capital such as machines or buildings, for which firm borrows. The higher the interest rate for such borrowing, the lower the profits that firms can expect to make by borrowing to buy new machines or buildings, and therefore, the less they will be willing to borrow and invest. Conversely, firms will want to borrow and invest more when interest rates are lower.

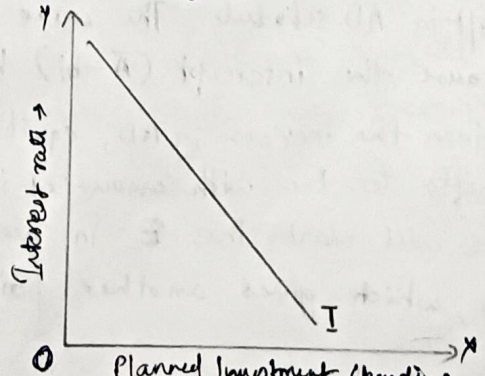
Investment spending function –

$$I = \bar{I} - bi \quad , \quad b > 0$$

[If **b** is large, a small inc. in i generates a large drop in I]

i is the rate of interest
b responsiveness of I to i.
$\bar{I}$ autonomous investment spending

The Investment schedule shows the planned level of investment spending at each rate of interest.



Changes in $\bar{I}$, autonomous investment spending, shifts the investment schedule. An increase in $\bar{I}$ means that at each level of interest rate, firms plan to invest at a higher rate. This would be shown by a rightward shift of investment schedule.

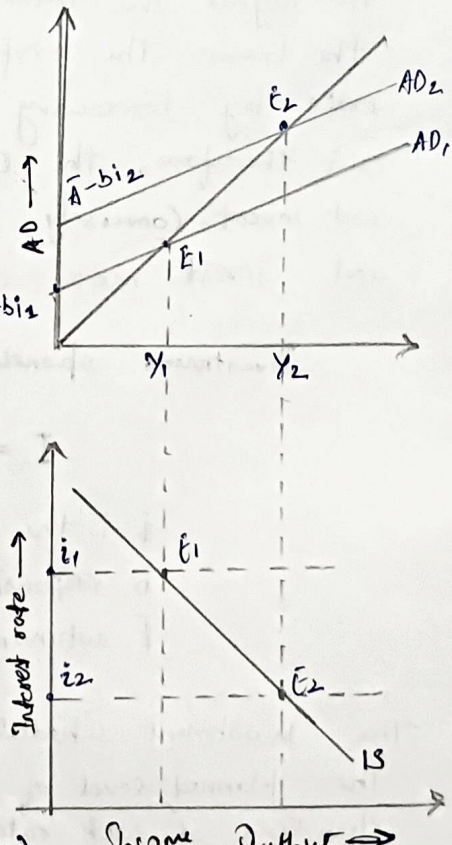
Interest rate and the AD

$$AD = C + I + G + NX$$
$$= [\bar{C} + c\overline{TR} + c(1-t)Y] + (\bar{I} - bi) + \bar{G} + \overline{NX}$$
$$= \boxed{\bar{A} + c(1-t)Y - bi}$$

where,
$$\bar{A} = \bar{C} + c\overline{TR} + \bar{I} + \bar{G} + \overline{NX}$$

Derivation of IS curve

- For a given level of interest rate (i_1), we can draw the AD function, with an intercept $\bar{A} - bi_1$.
- The equilibrium level of income obtained is Y_1 at point E_1. Since that equilibrium level of income was derived for a ~~i index~~ i_1 interest rate, we plot that pair (i_1, Y_1) in the bottom panel as point E_1. This gives us point E_1 on the IS curve.
- Consider next, a lower interest rate (i_2). This is marked by an upward shift in AD schedule. The curve shifts because the intercept ($\bar{A} - bi$) has increased.
- Given the increase in AD, equilibrium shifts to E_2 with associated income level (Y_2). We will mark this E_2 in next panel with a lower interest rate, (i_2), which gives another point on the IS curve.



- We can apply same procedure to all levels of interest rate and generate all points that make up IS curve.

→ They have in common the property that they represent combinations of interest rate and income (output) at which the goods market clears.
That is why IS curve is called the goods market equilibrium schedule.

We can also derive the IS curve by using the goods market equilibrium condition that income equals planned spending,

$$Y = AD = \bar{A} + c(1-t)Y - bi$$

which can be simplified to,

$$\boxed{Y = \alpha_G(\bar{A} - bi), \quad \alpha_G = \frac{1}{1-c(1-t)}}$$

where, α_G is the multiplier

Slope of IS curve -

→ We already know that the IS curve is negatively sloped because a higher level of interest rate reduces investment spending, thereby reducing AD and thus equi. level of income.

→ The steepness of the curve depends on

1. How sensitive investment spending is to changes in the interest rate
2. α_G, multiplier.

1.→ $I = \bar{I} - bi$, b is the responsiveness of I to Δi. If b is large, there will be a large change in equilibrium level of income, corresponding to a relatively small change in interest rate, IS curve will be very flat. [Vice-versa

2. The greater the multiplier, the larger the rise in income. Larger the multiplier, the flatter the IS curve.

- The smaller the sensitivity of investment spending to the interest rate and the smaller the multiplier, the steeper the IS curve.

Given, $Y = \alpha_G(\bar{A} - bi)$

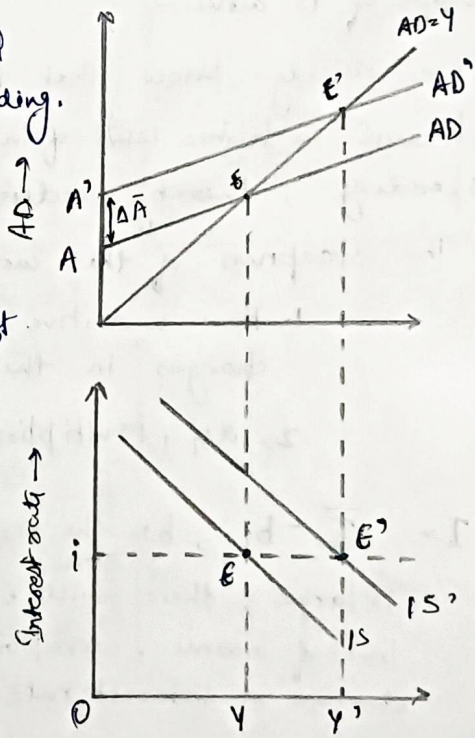
Turning this equation to express the interest rate as a function of the level of income

$$i = \frac{\bar{A}}{b} - \frac{Y}{\alpha_G b}$$

Thus, for a given change in Y, the associated change in i will be larger in size as b is smaller and as α_G is smaller.

Shift in IS Curve

- A shift in the IS curve is caused by a change in Autonomous spending.
- An increase in $\bar{A}$, increases AD and increases the income level at a given interest rate. This is represented by a rightward shift of the IS curve.
- How much shift? The change in income as a result of the change in autonomous spending is just the multiplier times the change in autonomous spending. This means that the IS curve is shifted horizontally by a distance equal to the multiplier times the change in autonomous spending. Govt. purchases (inc.) or transfer payments (inc.) shifts IS curve rightwards.



THE MONEY MARKET & LM CURVE

The LM curve (or schedule) shows combinations of interest rates and levels of output such that money demand equals money supply.

Money Demand

- The demand for money is a demand for real money balances. The higher the ~~real~~ price level, the more nominal balances a person has to hold to be able to purchase a given quantity of goods.
- The demand for real balances depends upon

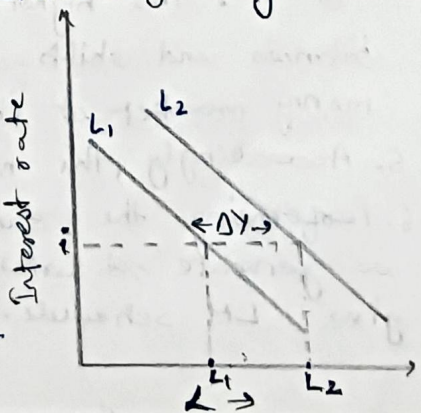
1. the level of real income because individuals hold money to pay for purchases which depend on income. [positive relationship].

2. Cost of holding money / interest rate - one has to forgo the interest of holding assets rather than holding money. The higher the interest rate, the more costly it is to hold money, accordingly, the less cash will be held at each level of income. [negatively related]

Demand for money $(L) = kY - hi$, $k, h > 0$

$L_1 = kY_1 - hi$
$L_2 = kY_2 - hi$
] → same i but different Y

Parameters k & h reflect the sensi. of the demand to the level of income and i respectively.



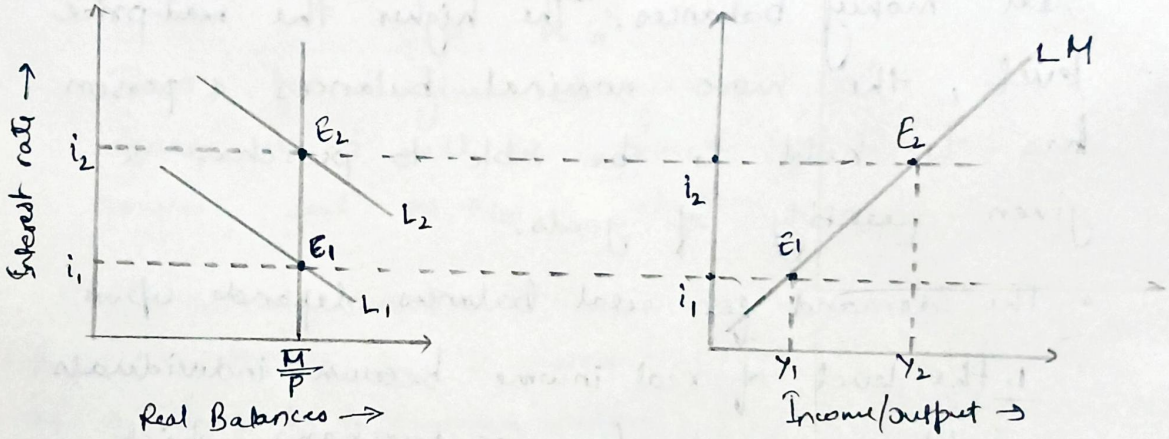
Money Supply

The nominal quantity of Money (M) is controlled by the Central Bank. We take the nominal qty. of Money as given at the level $\bar{M}$,

we assume the price level is constant, $\bar{P}$

So, real money supply is at the level $\frac{\bar{M}}{\bar{P}}$.

Derivation of LM Curve



1. Starting with the income level Y_1, the corresponding money demand curve, L_1, is drawn as a decreasing function of the interest rate.
2. The existing money supply, $\bar{M}/\bar{P}$, is shown by a vertical line, independent of the interest rate.
3. At i_1, the MD = MS, E_1 is an equilibrium point in the money market.
4. Consider next, the effect of an increase in income to Y_2. This higher income causes inc. in demand for real balances and shifts L_1 to L_2. To maintain equilibrium in the money market at this lvl of income, i_1 rises to i_2.
5. Accordingly, the new equilibrium is E_2.
6. Performing the same exercise for all income levels, we generate a series of points that can be linked to give LM schedule.

★ The LM schedule, or money market equilibrium schedule, shows all combinations of interest rates and levels of income such that the demand for real balances is equal to the supply.

⇒ Along the LM schedule, the money market is in equilibrium

- The LM curve is positively sloped. An increase in the interest rates reduces the demand for real balances
- Accordingly, the money market implies that an increase in the i is accompanied by an inc. in the level of income.

$$\frac{\overline{M}}{\overline{P}} = kY - hi$$

Solving for i,

$$i = \frac{1}{h}\left(kY - \frac{\overline{M}}{\overline{P}}\right)$$ [This relationship is the LM curve]

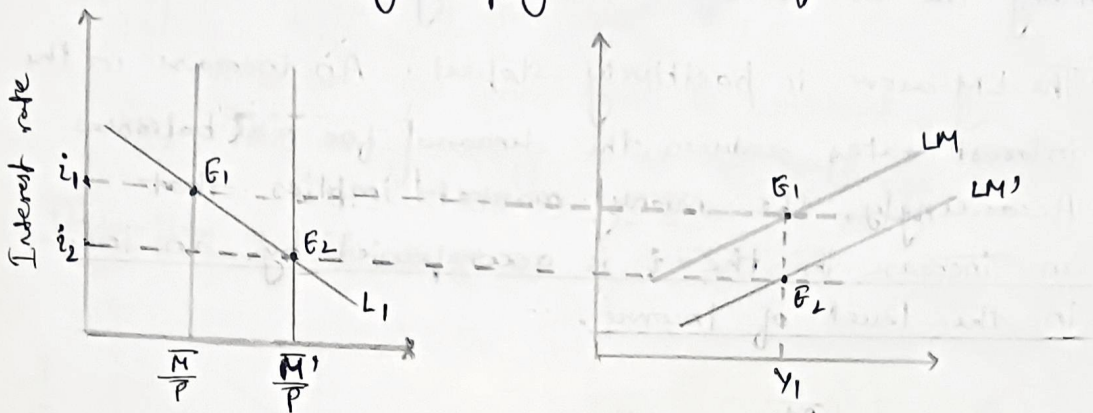
Slope of LM curve (k & h)

The greater the responsiveness of the demand for money to income as measured by k, and the lower the responsiveness of the demand for money to the interest rate, h, the steeper the LM curve will be.

- If the demand for money is relatively insensitive to the interest rate and thus h is close to 0, the LM curve is nearly vertical.
- If the demand for money is very sensitive to the interest rate and thus h is large, the LM curve is close to horizontal.

Shift in the LM curve

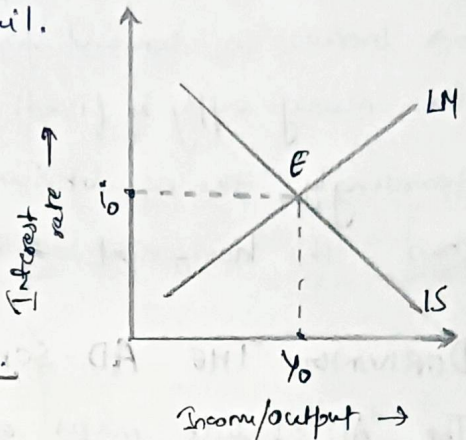
The real money supply is held constant along the LM curve. It follows that a change in the real money supply will shift the LM curve.



- The real money supply increases to $\frac{\bar{M}'}{P}$, which is represented by a rightward shift of the money supply schedule.
- To restore money market equil. at the same income level Y_1, the interest rate has to decline to i_2. The new equilibrium is E_2, with the rightward & downward shift of LM curve.
- At each level of income, the equil. i has to be lower to induce people to hold larger real qty. of money.
- Alternatively, at each level of interest rate, the level of income has to be higher to raise the transactions demand for money and thereby absorb the higher real money supply.

EQUILIBRIUM IN THE GOODS AND MONEY MARKETS

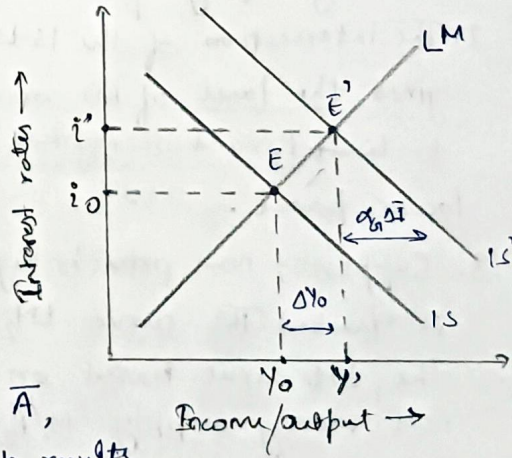
- At point E, both the goods market and the money market are in equil.
- It means, at point E, interest rates and income levels are such that the public holds the existing money stock and planned spending equals output.



- Assumptions – 1. the price level is constant at $\bar{P}$ where Y_0, equilibrium level of ~~income~~ output is supplied
  2. Firms are willing to supply whatever amount of output is demanded at that price level.
  3. These corresponds to the assumption of a flat, short-run AS-curve.

Changes in Y and i (equil.)

- The equil. levels of income and the interest rate change when either the IS or the LM curve shifts.
- Figure shows effects of an inc. in autonomous investment, which raises $\bar{A}$, therefore shifts IS rightward which results increase in interest rate (as AS is fixed) and level of income.
- Inc. in autonomous spending, $\Delta\bar{I}$, shifts the IS curve by the amount $\alpha_{exp}\Delta\bar{I}$, Here, $\Delta\bar{I}$ is more than ΔY_0, which explains ~~the~~ a less multiplier.



- Why a less multiplier effect?

But What is the economics of what is happening?

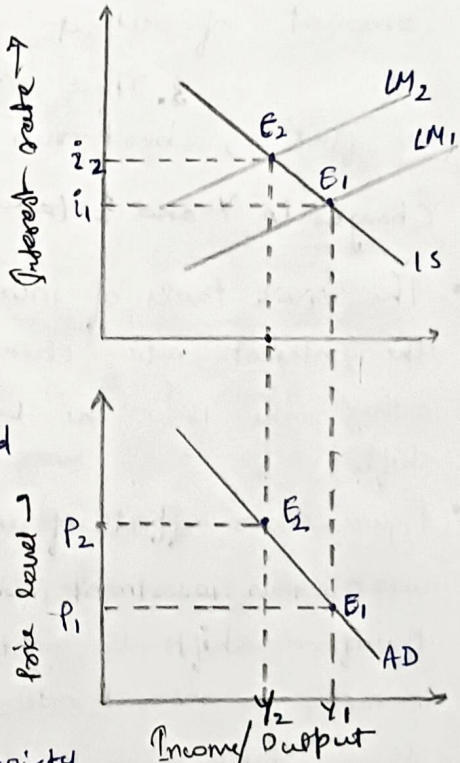
Increase in autonomous spending → Increase in income → → Increase in demand for money → interest rate rises (as money supply is fixed) → investment spending is reduced

Accordingly, the equilibrium change in income is less than the horizontal shift of the IS curve, $\alpha_G \Delta \bar{I}$.

DERIVING THE AD-SCHEDULE

- The AD schedule maps out the IS-LM equilibrium holding autonomous spending and the nominal money supply constant and allowing prices to vary.

1. Suppose P_1 is the price level in the economy, at which IS-LM equil.
   - Real money supply $= \frac{\bar{M}}{P}$
2. The intersection of the IS-LM$_1$ curves gives the level of AD corresponding to ~~limit~~ P_1 and is marked in lower panel.
3. Suppose, now price is higher, P_2. ~~and is marked~~ The curve LM_2 shows the LM curve based on the real money supply $\bar{M}/P_2$. Point E_2 shows the corresponding point on the AD curve.
4. Repeating this operation for a variety of price levels, and connect the points to derive the AD schedule.

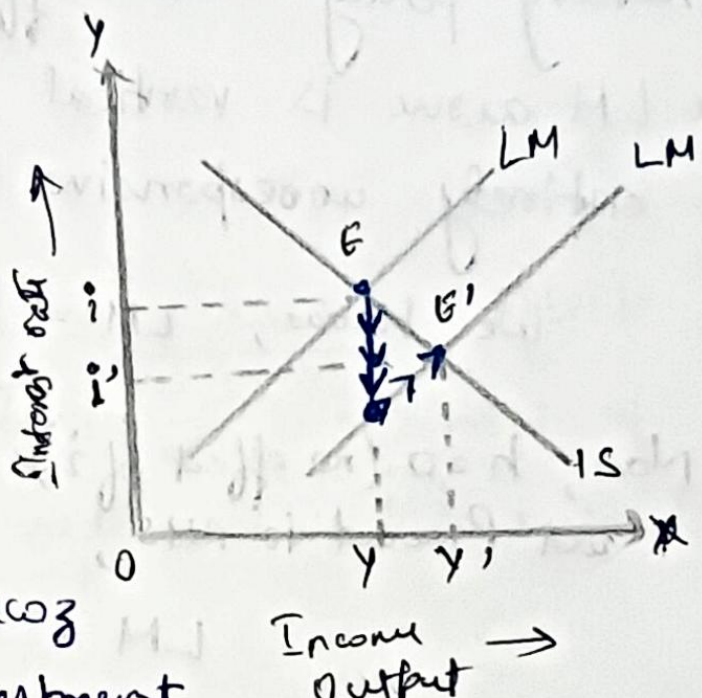


MONETARY POLICY

Instruments of a Monetary Policy -

1. Bank reserve requirements (CRR & SLR)
2. Bank rate and Repo Rate
3. Open Market Operations
4. Moral Suasion, Selective credit control, Marginal requirements.

- The initial equilibrium is at E.
- An expansionary monetary policy will increase qty. of money, LM will shift to LM', with a new equil. at E'.
- E' has a lower interest rate and a higher income level because interest rate (declined) causes investment spending to rise → inc. income.



LM curve	IS curve	Effectiveness

- Keynes himself did stated that he was not aware of there ever having been a situation of Liquidity trap.
- Liquidity trap can be of critical practical concern — when interest rates are so close to zero that they can't go any lower.

The Classical Case

- The polar opposite of Horizontal LM curve — which implies 'monetary policy can't affect the level of income.'
- The LM curve is vertical when the demand for money is entirely unresponsive to the interest rate.

We know, $LM = \frac{\bar{M}}{\bar{P}} = kY - hi$

Now, $h = 0$ (no effect of i)
and P moved to RHS,

$$LM = \bar{M} = k(\bar{P} \times Y)$$

- Here, the classical quantity theory of money is used where nominal GDP ($P \times Y$) depends only on the qty. of money.
- This theory is motivated by the assumption that demand for money doesn't depend on interest rate.
- By drawing Vertical LM, the shifts in IS curve do not affect the level of income. Thus, we can conclude that -

> "When the LM curve is vertical, monetary policy has a maximal effect on the level of income, and fiscal policy has no effect on income."

FISCAL POLICY

- Recalling, IS curve slopes downward because a decrease in the interest rates increases investment spending, thereby increasing AD and the level of output at which the goods market is in equilibrium.
  - Changes in fiscal policy shift the IS curve.
  - Equation of the IS curve,

$$Y = \alpha_G(\bar{A} - bi), \quad \alpha_G = \frac{1}{1-c(1-t)}$$

  - Both govt. spending and tax rate affect the IS schedule, as, $\bar{G}$ is a component of autonomous spending ($\bar{A}$) and income tax rate (t) is part of multiplier.

1. An increase in Govt. Spending -

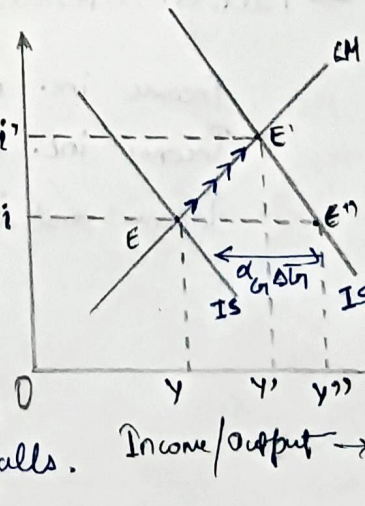
→ If economy is in equilibrium initially at E, and govt. spending rises by 100, we would move to E'' if the interest rate stayed constant.

→ At E'' the goods market is in equilibrium. But the money market is no longer in equilibrium.

→ Income has increased, and therefore the qty. of money demanded is higher.

→ Because there is an excess demand for real balances, the interest rate rises.

→ Firm's planned investment spending declines at higher interest rates, and thus AD falls.



→ At unchanged interest rates, higher levels of govt. spending increase the level of AD. To meet the increased demand for goods, output must rise. So, at each level of the interest rate, equilibrium income must rise by α_G times the increase in govt. spending.

CROWDING OUT

Crowding Out occurs when expansionary fiscal policy causes interest rates to rise, thereby reducing private spending, particularly investment.

- The reason that income rises only to Y' rather than Y'' is that the rise in the interest rate from i to i' reduces the level of investment spending.
- We say that the increase in govt. spending crowds out investment spending.

→ Factors determining how much crowding out takes place-

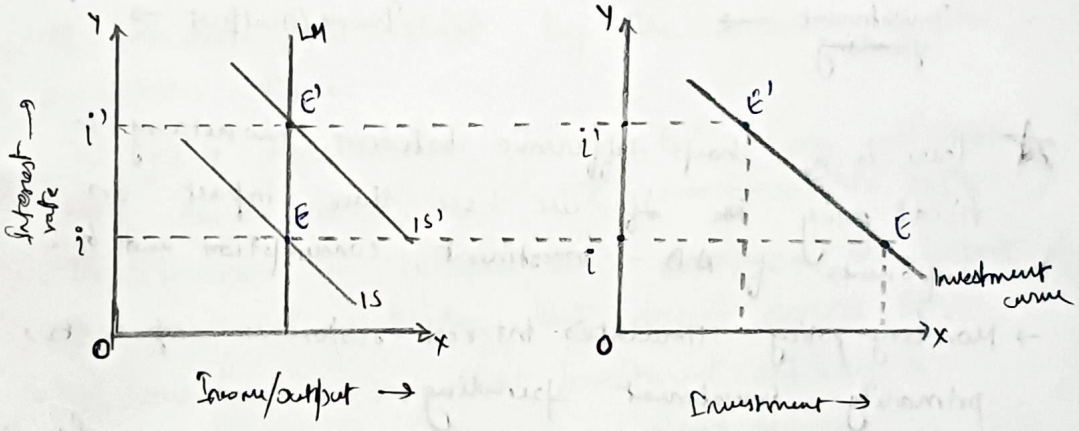
Income inc. more, i inc. less → flatter the LM schedule
Income inc. less, i inc less → flatter the IS schedule
Income and i inc. more → larger the multiplier α_G →
→ larger the horizontal shift of IS

★ LIQUIDITY TRAP (zero crowding out)

- If the economy is in the liquidity trap, and thus the LM curve is horizontal, an increase in govt. spending has its full multiplier effect on the equil. level of income.
  - No change in $i \rightarrow$ no change in investment spending.

★ CLASSICAL CASE (full crowding out)

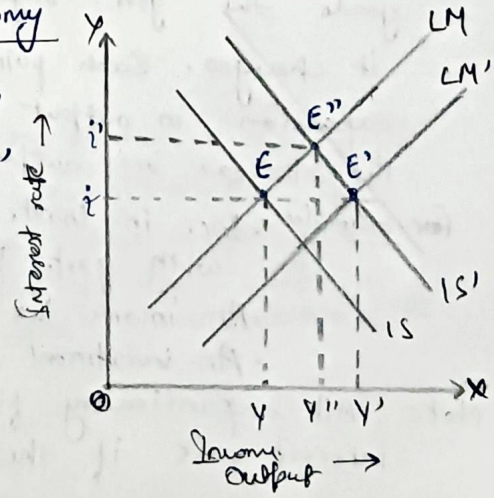
- LM curve is vertical, an ΔG has no effect on the equil. level of income and increases only the interest rate.



- Monetary Accomodation of fiscal expansion -

★ Assumption → There is unemployment in economy

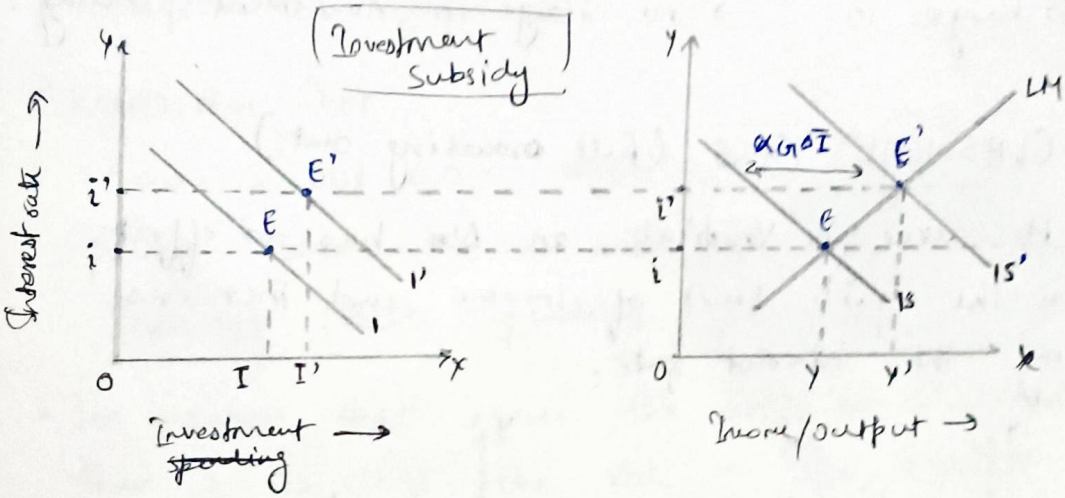
Monetary policy is accomodating when, in the course of a fiscal expansion, the money supply is increased, in order to prevent interest rates from increasing.



COMPOSITION OF OUTPUT

First, let's summarize policy effects on Income & Interest rates.

POLICY	INCOME*	INTEREST RATES*
Monetary (expansion)	+	−
fiscal (expansion)	+	+



★ There is a sharp difference between monetary & fiscal policy if we see their impact on components of AD - investment, consumption and G.

→ Monetary policy stimulates interest-responsive components, primarily Investment spending,

→ fiscal policy, by contrast, depends precisely on what goods the govt. buys or what taxes or transfers it changes. Each policy affects level of AD and causes expansion in output, but, the composition of the increase in output depends on the specific policy.

for examples
- Inc. in Govt. spending raises Cons. spending along with govt. purchases.
- An income tax cut has a direct effect on cons. spending.
- An investment subsidy increases investment spending.

Note: All expansionary fiscal policies will raise the interest rate if the qty. of money is unchanged.

An Investment Subsidy

- The govt. can raise investment spending through an investment subsidy, whereby a firm's tax payments are reduced when it increases its investment spending.
  - When the govt. subsidizes investment, it essentially pays part of the cost of each firm's investment.
  - As can be seen in diagram, an investment subsidy shifts the investment schedule.

→ At each interest rate, firms now plan to invest more. With higher investment spending, AD increases.

  - The increase in autonomous investment force IS schedule to shift by the amount of the multiplier times.
  - The new equilibrium is at E' where interest rates have risen, but still investment is higher. This increase in interest rate dampens the impact of investment subsidy but doesn't reverse it.
  - So, now we can say that Investment subsidy is an ~~part~~ example of expansionary fiscal policy in which both consumption (induced by higher income) and investment rise.

Policy Mix

→ Changes in the fiscal and monetary policies have different effects on the composition of output.

→ It suggests that policymakers can choose a **policy mix** — mixture of both — that will not only get the economy to full employment but also make a contribution to solving other policy problems.

UNIT-2

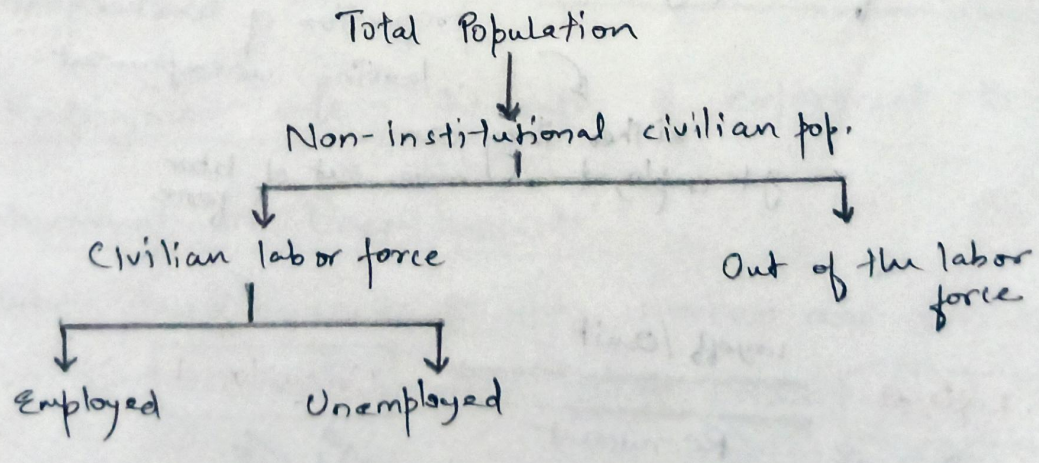
Think about what happens when firms respond to an increase in demand by increasing production.

Higher production → Higher employment → lower unemployment → higher wages → increase in production costs → firms increase prices → workers ask for higher wages → further increase in prices - and so on.

So far, we have simply ignored this sequence of events: By assuming a constant price level in the IS-LM model. So long as our focus was on the short-run, this assumption was acceptable.

Now, our attention turns to medium-run, we must now abandon this assumption, explore how wages and prices adjust over time, and how this, in turn, affects output.

A tour of the Labor Market



★ Key terms -

1. **Labour force** - labour force includes the total number of workers which are either employed or unemployed.

2. **Unemployed** - A person is unemployed if he is willing and is able for the job but is unable to get a job.

3. **Unemployment rate** - $\frac{\text{No. of workers unemployed}}{\text{labour force}} \times 100$

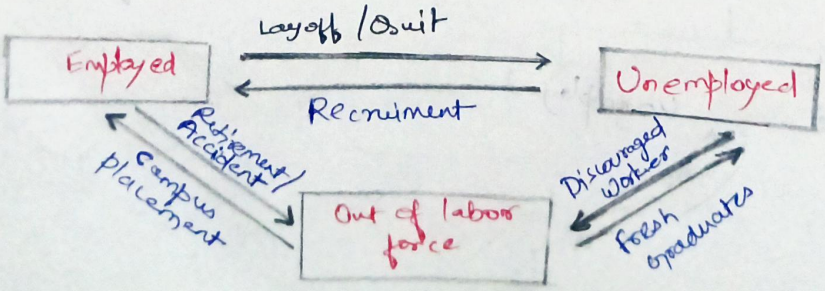
   - It is the ratio of the unemployed to the labor force.

4. **Labor force participation rate** - $\frac{\text{Total labor force}}{\text{Working/Adult Population}} \times 100$

5. Layoff - when employer fires a worker
   Quit - when worker voluntarily resign a job.

6. **Duration of Unemployment** - $\frac{1}{\text{proportion of workers leaving unemployment}}$

   either they can get employed or move out of labor force



- A given unemployment rate may reflect either:
  - An active labor market - Many separation and hires, i.e., many workers entering and exiting unemployment.
  - A sclerotic labor market - few separations and hires, and a stagnant unemployment pool.

- CPS - Current Population Survey is a monthly survey that provides estimates and trends in employment, unemployment, earnings and other characteristics of the general labor force, the pop. as a whole and various pop. subgroups.

- Average duration of unemployment - the length of time people spend unemployed - seeking or available for work.

- Many who are classified as out of the "labor force" are in fact discouraged workers - a worker not actively looking for a job but will take it if they find one.

- Employment rate - the ratio of employment to population.

★ Movements in Unemployment

- When unemployment is high, workers are worse off in 2 ways -
  - Employed workers face a higher probability of losing their job.
  - Unemployed workers face a lower probability of finding a job; or they can expect to remain unemployed for a longer time.

Wage Determination

- The aggregate nominal wage (W) depends on:
  - the expected price level – P^e
  - the unemployment rate – u
  - the catch-all variable – z

$$W = P^e F(u, z) \quad (-, +)$$

→ P^e (+)

Why does the price level affects the nominal wages?

- Because both workers and firms care about real wages ($\frac{W}{P}$), not nominal wages.
- The nominal wage depends upon the expected price level (rather than the actual price level) because when nominal wages are set, the relevant price levels are not yet known.

→ u (−)

- An increase in the unemployment rate decreases wages.
- Higher unemployment rate either weakens workers' bargaining power or allows firms to pay lower wages and still keep workers willing to work.

→ z (+)

- It stands for all the other factors that affect wages given the P^e and u, for example –
  - unemployment insurance
  - employment protection

Price Determination

- The prices set by firms depends on their costs, which in turn depends on the nature of the production function – the relation between the inputs used in production and the qty. of output produced, and on the prices of these inputs.
- Assumption – firms produce goods using labor as the only factor of production.

Production function → $Y = AN$

where,

Y is output

N is employment

A is labor productivity

→ further assuming,

- labor productivity – ~~out~~ output per worker – is constant and equal to A.
- A is constant, at $A = 1$

→ With this, the production function becomes

$$Y = N$$

which implies that the cost of producing one more unit of output is the cost of employing one more worker, at wage – W.

★ If there were perfect competition in the goods market, the price of a unit of output would be equal to marginal cost, $P = W$.

But, many goods market are not competitive and firms charge a price higher than their MC.

Assuming, firms set their prices according to -

$$P = (1+m)W$$

where m is the markup (of price) over the cost.

[m is positive and the Price P will exceed the cost W by a factor equal to $(1+m)$]

Natural Rate of Unemployment

[No we will assume - nominal wages depend on the actual price level P, rather than on expected, P^e.]

1. Wage-Setting Relation

After the assumption, wage determination becomes,

$$W = Pf(u, z)$$

dividing both sides by price level,

$$\frac{W}{P} = f(u, z)$$
$$(-, +)$$

- Wage determination implies a negative relation between the real wage $(\frac{W}{P})$, and the unemployment rate.
- Higher the unemployment rate, the lower the real wage chosen by wage setters.

- the intuition is - If there is high unemployment rate, workers bargaining power gets weaker, and the real wage will be lower.
- This relation between real wage and rate of unemployment is wage-setting relation. It is drawn as the downward sloping curve WS.

2. Price-Setting Relation

$$P = (1+m)W$$

dividing both sides by W (nominal wage),

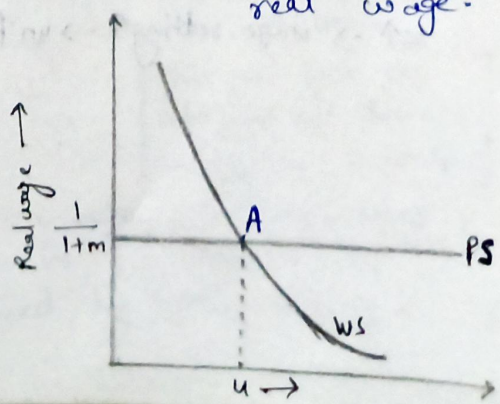
$$\frac{P}{W} = 1+m$$

[this implies, ratio of the price level to the wage equals 1 plus the markup]

now, inverting both sides to get the implied real wage,

$$\frac{W}{P} = \frac{1}{1+m}$$

- This eqn says, Price-setting decisions determine the real wage paid by firms.
- An increase in the markup leads firms to increase their prices given the wage they have to pay; equivalently, it leads to a decrease in the real wage.
- The real wage implied by price-setting is $\frac{1}{1+m}$, it does not depend upon the unemployment rate.



Equilibrium Real Wages and Unemployment

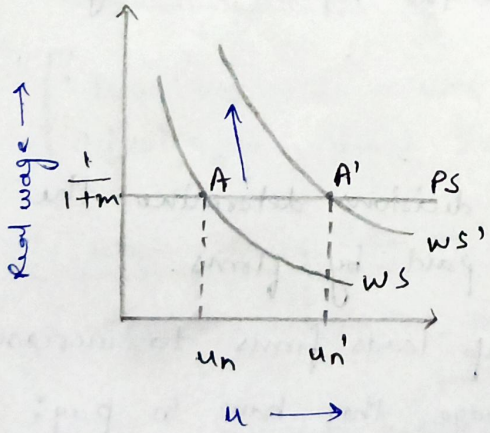
Equilibrium in labor market requires -

real wage chosen in Wage-setting = real wage implied by price-setting

$$F(u_n, z) = \frac{1}{1+m}$$

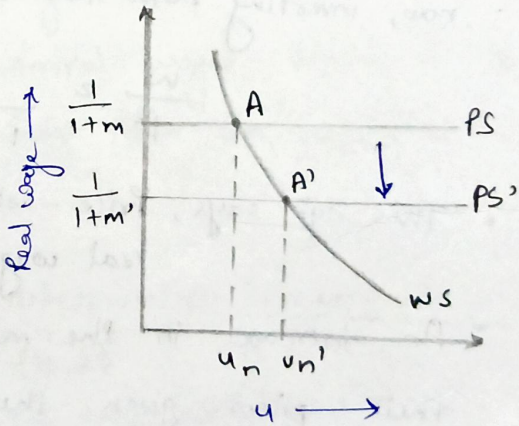
[u_n → equilibrium unemployment rate]

★ The equilibrium unemployment rate, u_n, is called the natural rate of unemployment where real wage chosen in wage-setting is equal to the real wage implied by price-setting. The positions of WS-PS curves and u^* depends upon z and m.



z (unemployment benefits)

z↑ → wage setting↑ → u_n↑



m (markups)

m↑ → real wage↓ → u_n↑

From Unemployment to Employment

★ The level of employment that prevails when unemployment is equal to its natural rate is natural level of employment.

- relation among unemployment, employment and labor force.

$$u \equiv \frac{U}{L} = \frac{L-N}{L} = 1 - \frac{N}{L}$$

where, U - unemployment
N - employment
L - Labor force.

$$u = 1 - \frac{N}{L}$$

rearranging to get employment in terms of the labor force and the unemployment rate gives:

$$N = L(1-u)$$

at u_n as the natural rate of unemployment,

$$N_n = L(1-u_n)$$

for example, if Labor force = 150 million and u_n is 5%,
the natural level of employment = $150 \times (1-0.05)$
= 142.5 million

From Employment to Output

★ The level of production when employment is equal to the natural rate (level) of employment is the natural level of output.

We know, $\Rightarrow Y_n = N_n = L(1-u_n)$ (Y_n → natural lvl. of output)

production function → $Y = N \Rightarrow f\left(1 - \frac{Y_n}{L}, z\right) = \frac{1}{1+m}$

[this comes from the relations we derived among u, N and output]

Y_n is such that, at the associated rate of unemployment ($u_n = 1 - \frac{Y_n}{L}$), the real wage chosen in wage-setting is equal to the real wage implied by price-setting.

AGGREGATE SUPPLY

Excellent

- The aggregat supply relation captures the effects of output on the price level. It is derived from the behaviour of wages and prices.
- Recall the equations from wage and price determination -

$$W = P^e f(u, z)$$

$$P = (1+\mu)W$$

Deriving AS relation -

☆ Step 1. Eliminating the nominal wage from $W = P^e f(u,z)$ and $P = (1+\mu)W$,

$$P = P^e (1+\mu) f(u, z)$$

→ In words, the price level depends on the expected price level and the unemployment rate.

→ We assume that μ and z are constant.

☆ Step 2 · Expressing the unemployment rate in terms of output:

$$u = \frac{U}{L} = \frac{L-N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{L}$$

[definition of u] [definition of U] [simplification of fraction] [prod. fn Y = N]

$$u = 1 - \frac{Y}{L}$$

→ In words, for a given labor force, the higher is output, the lower is the unemployment rate.

★ Step 3. Replacing the unemployment rate in the equation with its definition:

$$P = P^e(1+\mu)\, F\left(1-\frac{Y}{L}, z\right)$$

→ The price level P depends on the expected price level P^e and the level of output Y (and also on μ, z and L, which we all take as constant here).

Properties of AS relation

$$P = P^e(1+\mu)\, F\left(1-\frac{Y}{L}, z\right)$$

★ 1. An increase in output leads to an increase in the price level, given the expected price level.

- This is a result of 4 underlying steps:

1. $Y\uparrow \Rightarrow N\uparrow$
2. $N\uparrow \rightarrow u\downarrow$
3. $u\downarrow \rightarrow W\uparrow$
4. $W\uparrow \rightarrow P\uparrow$

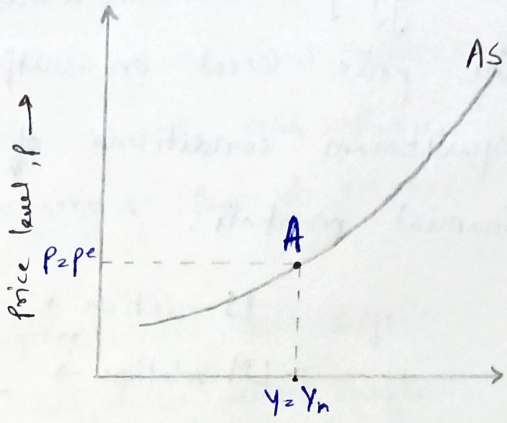
★ 2. Given unemployment, an increase in the expected price level leads, one for one, to an increase in the actual price level.

- This effect works through wages:

1. $P^e\uparrow \rightarrow W\uparrow$
2. $W\uparrow \rightarrow P\uparrow$

If output is equal to the natural level of output, the price level is equal to the expected price level.

- Given the expected price level, an increase in output leads to an increase in the price level.



Properties of AS curve

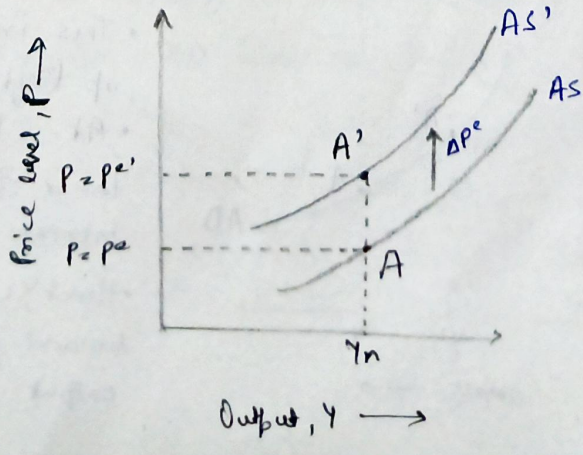
★ 1. The AS curve is upward sloping.
As explained earlier, an increase in output leads to an increase in the price level.

★ 2. The AS curve goes through point A, where $Y = Y_n$ and $P = P^e$. This property has two implications -

i) when $Y > Y_n$, $P > P^e$

ii) when $Y < Y_n$, $P < P^e$

★ 3. An increase in P^e shifts the AS curve up, and a decrease in P^e shifts the AS curve down.



AGGREGATE DEMAND

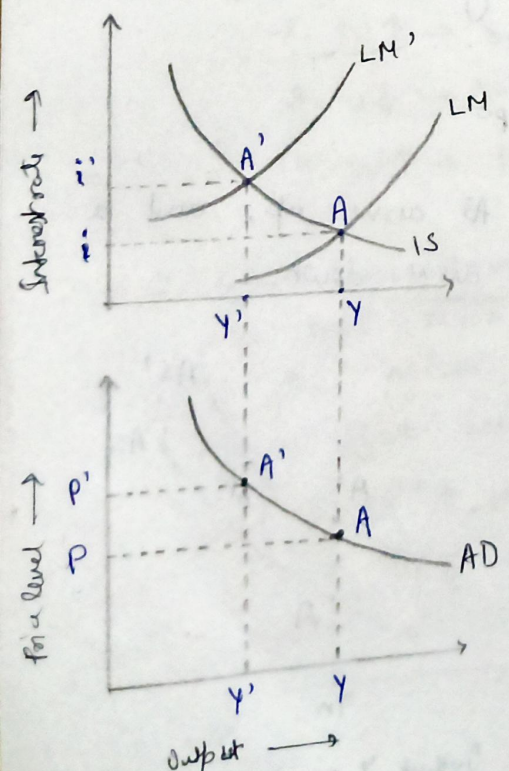
Excellent

The aggregate demand relation captures the effect of the price level on output. It is derived from the equilibrium conditions ~~of~~ in the goods and financial markets.

IS relation → $Y = C(Y-T) + I(Y,i) + G$

LM relation → $\frac{M}{P} = YL(i)$

- Previously, we discussed that changes in the real money stock, $\frac{M}{P}$ comes from changes in nominal money, M.
- But, $\frac{M}{P}$ can also change with the changes in price level, P. A 10% increase in the price level P has the same effect on the real money stock as a 10% decrease in stock of real money/nominal money.



Derivation of AD Curve

- Consider the effects of an increase in the price level from P to P'.
- Given nominal money stock, M, the increase in P leads to a decrease in real money stock, $\frac{M}{P}$.
- This implies that the LM curve shifts up (leftward).
- At a ~~two~~ given level of output, the lower real money stock leads to an increase in the interest rate.
- Hence, with the increase in i, to i', demand for goods decreases and output falls.

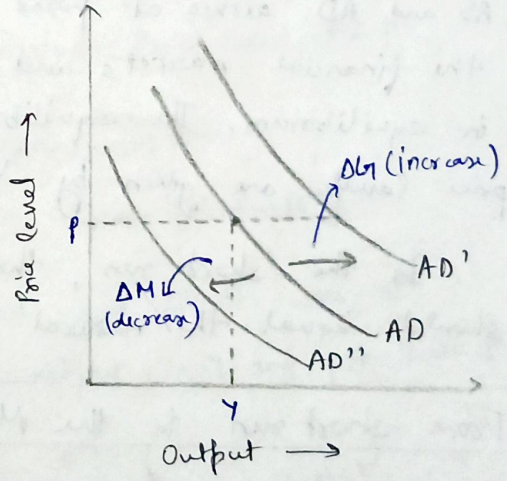
★ The increase in the price level leads to decrease in the real money stock. This monetary contraction leads to an increase in the interest rate, which leads in turn to a lower demand for goods and lower output. This negative relation between output and the price level is called the aggregate demand relation.

★ Shifts of AD curve

Any variable other than the price level that shifts either the IS curve or the LM curve also shifts the aggregate demand relation.

$$Y = Y\left(\frac{M}{P}, G, T\right)$$
$$(+, +, -)$$

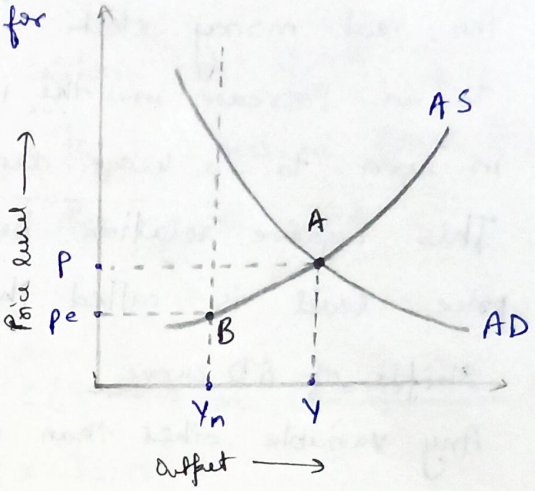
→ Output Y is an (a)
- increasing f^n of $\frac{M}{P}$,
- increasing f^n of G,
- decreasing f^n of T (taxes).



- At a given price level, an increase in govt. spending increases output, shifting the AD curve to the right.
- At a given price level, an decrease in nominal money decreases output, shifting the AD curve to the left.

Equilibrium in the Short-run

- The AS relation curve is drawn, for a given value P^e. It is upward sloping and goes through point B: $Y = Y_n$ and $P = P^e$.
- The AD curve is drawn for given values of M, G and T. It is downward sloping, suggesting a higher price level refers to a lower level of output.

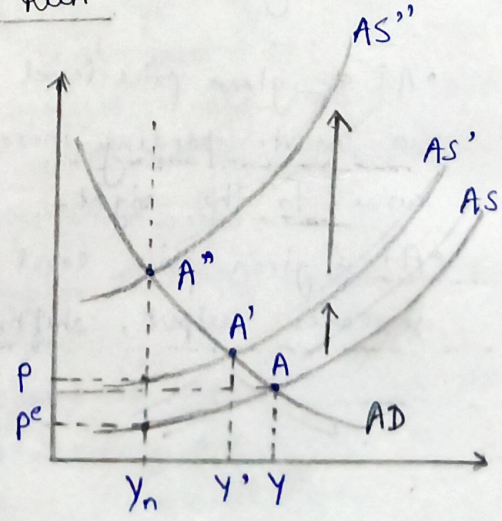


- The equilibrium is given by the intersection of the AS and AD curves at point A, where the goods market, the financial markets and the labor markets are all in equilibrium. The equilibrium level of output and price level are given by Y and P.

In the short run, there is no reason why output should equal the natural level of output.

From short run to the Medium Run

- We have already given condition that the short-run equilibrium is at A where output is Y, higher than Y_n and P is also higher than P^e.
- Now, wage setters will revise upward their expectations of the future price level. This will cause the AS curve to shift upward.



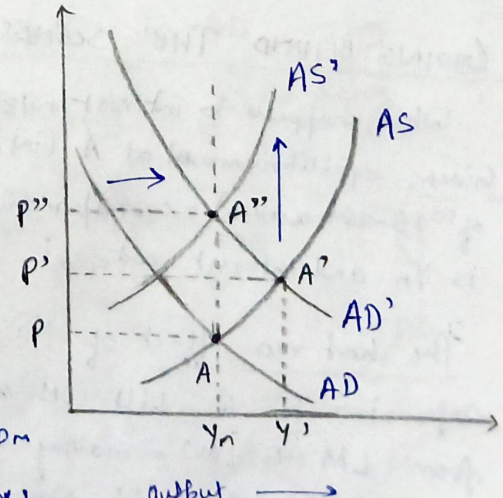
- Expectation of a higher price level will also lead to a higher nominal wage, which in turn leads to a higher price level. New equilibrium is at A'.
- The adjustment doesnot end at A' as the output is still more than the natural level. Since still $Y > Y_n$, $P > P^e$. Because of this, wage setters are likely to continue to revise upwards their expectation of the price level. Output continues to fall.
- It ends when the AS curve has shifted all the way to AS'', when the equilibrium has moved all the way to A'' where equilibrium level of output, $Y = Y_n$ and equilibrium price level, $P = P^e$.

EFFECTS OF A MONETARY EXPANSION

INCREASE IN THE LEVEL OF MONEY SUPPLY [M to M']

Given, output is at its natural level and AD-AS cross at point A, where corresponding level of output is Y and price level P.

★ for a given price level, P, the increase in nominal money M leads to an increase in the real money stock $\frac{M}{P}$, leading to an increase in output. The AD curve shifts to the right, from AD to AD'. In the short run, the economy goes from A to A'. Output increases from Y_n to Y' and price level increases from P to P'.



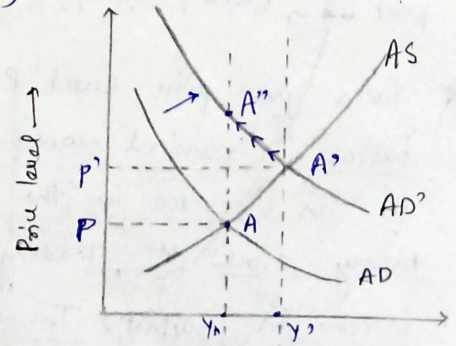
Over time, the adjustment of price level comes into play.

As output is higher than Y_n, the price level is higher than P^e. So, wage setters revise their expectations, which causes AS to shift up over time.

The economy moves along the AD' curve and this adjustment process stops when output has returned to Y_n, where $P = P^e$.

In medium run, the AS curve is given by AS'' and the economy is at point A'': Output is back to Y_n, and the price level is equal to P^e. (P'').

Note: If Y is back to Y_n, the real money stock must also be back to its initial value. In other words, the proportional increase in prices must be equal to the proportional increase in the nominal money stock, (If M ↑ 10% ⟶ P ↑ 10%)

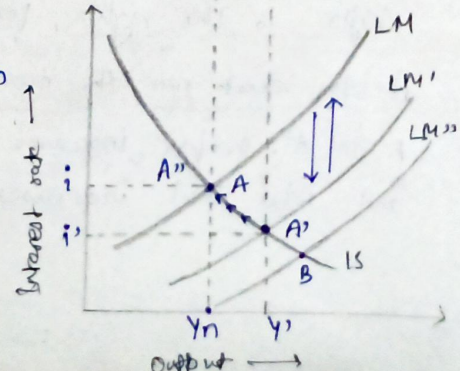


GOING BEHIND THE SCENES

What happens to interest rate?

Given, equilibrium at A (intersections of IS-LM curves) - corresponding output is Y_n and interest rate, i.

The short run effect of the monetary expansion is to shift LM curve down from LM to LM' - moving the equilibrium from point A to A'. Now, the interest rate is lower and output is higher.

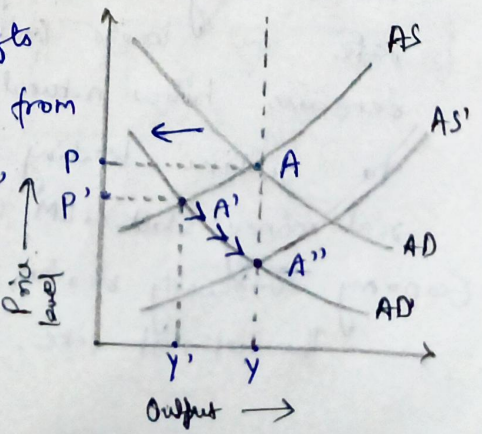


THE NUTRALITY OF MONEY

- In the short run, a monetary expansion leads to an increase in output, a decrease in the interest rate and an increase in the price level.
- In the medium run, there is this concept of neutrality of money, where the increase in nominal money is reflected entirely in a proportional increase in the price level. The increase in nominal money has no effect on output or on the interest rate.
- This doesnot mean that monetary policy cannot or should not be used to affect output. An expansionary monetary policy can help the economy move out of a recession but it is a warning that monetary policy can't sustain higher output forever.

A DECREASE IN THE BUDGET DEFECIT

- Let's look at the effects of a shift in AD coming from a shift in IS curve. Suppose govt. is running a budget deficit and decideds to reduce its spending from G_1 to G_1' while leaving taxes T unchanged.
- In the short run, the AD shifts leftwards and output decreases, from Y_n to Y'. Price also decreases. Now, economy is at point A'.

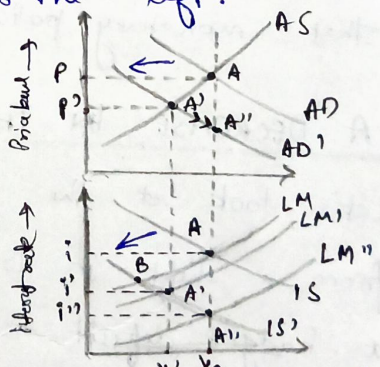


- But in medium run, since output $\neq$ is below natural rate, AS curve keeps shifting down. The economy moves to point A''. By then, recession is over, and output is back at Y_n.

- While both policies eventually return output to its natural level, a decrease in the budget deficit also leads to:
  (a) Lower price level
  (b) Lower interest rate

What happens with Output & Interest rates?

- Before any change, equilibrium is given by intersection of IS-LM curves, at point A. With the reduced govt. spending, IS curve shifts to the left.



- Price ~~increases~~ decreases as output decreases,
① → the real money stock increases
② → leading to a shift in LM curve, down to LM' (shift is partially offset(ed) by ①.

The economy reaches point A'. Both output and interest rate are lower than before. As long as the output remains below natural level, price level continues to decline, leading to a further increase in the real money stock. LM curve continues to shift down. Economy eventually reaches to A'' where output is back at Y_n. The interest rate is lower than before, i to i''.

The composition of output is also different.

rewriting IS equation,

$$Y_n = C(Y_n - T) + I(Y_n, i) + G$$

- Consumption is same as before,
- Govt. spending has been decreased,
- Hence, Investment must be higher - higher by an amount exactly equal to the decrease in G. This is due to a decrease in interest rate.

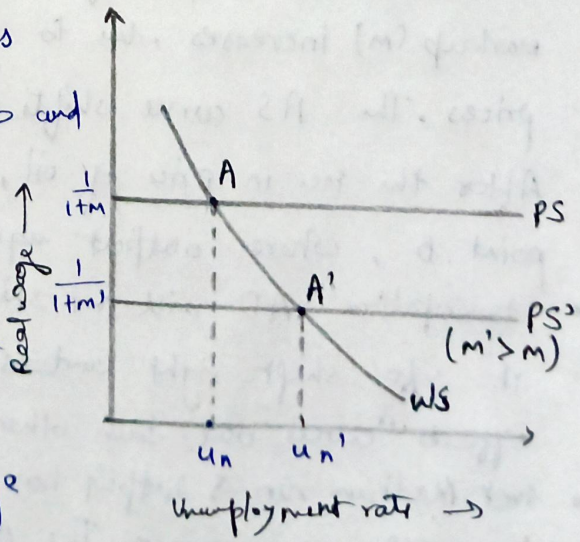
AN INCREASE IN THE PRICE OF OIL

Why price hike? (1970s)

- formation of OPEC - acting as a monopoly
- wars and revolutions in Middle East.
- (In 2000s) - fast growth of emerging countries (particularly China) leading to a rapid increase in demand for oil.

Effect on Natural Rate of Unemployment

- The higher price of oil causes an increase in the markup and a downward shift of the price-setting line.
- The higher the markup, the lower the real wage implied by price-setting. The real wage is lower.



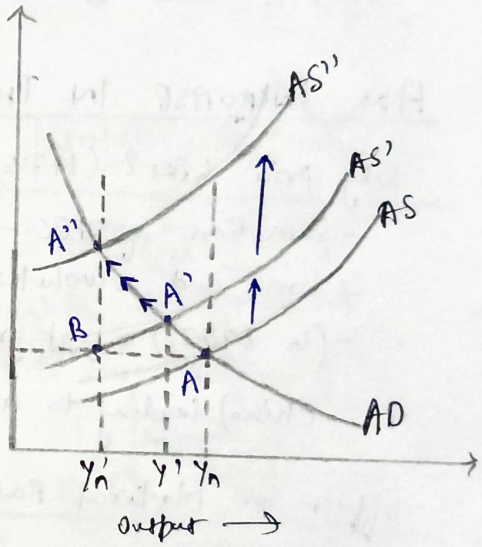
- The natural unemployment rate is higher – getting workers to accept the lower real wage requires an increase in unemployment.
- Inc. in natural rate of unemployment → decrease in natural level of employment → identical decrease in natural level of output.

★ Hence, an increase in price of oil leads to a decrease in the natural level of output.

Dynamics of Adjustment

- Given, output $= Y_n$ and $P = P^e$.
  Increase in price led to decrease in output from Y_n to Y'_n.
- In the short run, AS relation,

$$P = P^e(1+m)F\left(1-\frac{Y}{L}, z\right)$$



- With the inc. in price of oil, markup (m) increases, due to which, firms increase their prices. The AS curve shifts up.
  After the inc. in price of oil, the new AS curve goes through point B, where output equals new Y'_n and $P = P^e$.
- Assumption – AD will not shift (due to – some factors make it to shift right and some force it to shift left, these effects cancel out each other)
- Medium run → Output has fallen but natural level of output has fallen even more. The AS curve continues to shift up and economy moves from A' to A'', where $Y = Y'_n$ and P is higher than before.

	Short-run			Medium Run		
	Y	i	P	Y	i	P
Monetary expansion	increase	decrease	increase (small)	no change	no change	increase
Budget def. reduction	decrease	decrease	decrease (small)	no change	decrease	decrease

Shocks – an unexpected / unpredictable event that affects an economy, either positively or negatively.
Economic models cannot explain the cause factors behind shocks, like consumer confidence, etc.

Each shock has dynamic effects on output and its components. These dynamic effects are called the propagation mechanisms of the shock.

Excellent

THE PHILLIPS CURVE

- In 1958, A.W. Phillips drew a diagram plotting the rate of inflation against the rate of unemployment in the UK for each year from 1861 to 1957. He found clear evidence of a negative relation between inflation and unemployment.

- Paul Samuelson and Robert Solow, two years later, replicated Phillip's ~~ex~~ exercise for the US - 1900-1960. There also appeared to be a negative relation between inflation and unemployment in the US.

★ However, in 1970s, this relation broke down. In the US and most OECD countries, there was both high inflation and high unemployment.
A relation reappeared, but it reappeared as a relation between the unemployment rate and the change in the inflation rate.

What this referred to was that ~~the~~ high unemployment leads not to inflation, but to a decrease in inflation over time.

Inflation, Expected Inflation & Unemployment

$$P = P^e (1+m) f(u,z) \quad \text{——— ①}$$

(Aggregate supply relation between the price level, expected price level, and the unemployment rate)

- → It will be convinient here to assume a specific form for $f(u,z)$ -

$$F(u,z) = 1 - \alpha u + z \quad \text{——— ②}$$

→ higher the unemployment rate, lower the wage.
→ higher z, the higher the wage.

- Replacing the function f by ①,

$$P = P^e (1+m)(1-\alpha u+z) \quad \text{——— ③}$$

- Finally, let π denote inflation rate,

★ $$\pi = \pi^e + (m+z) - \alpha u \quad \text{——— ④}$$

Equation ④ is important and its effects at work are -

① An increase in expected inflation π^e, leads to an increase in actual inflation π.

If wage setters expect a higher price level, they set a higher nominal wage, which leads to an increase in the price level. We can say, an increase in P^e leads, one for one, to an increase in P(actual).

② Given π^e, an increase in the markup, m, or an increase in ~~either~~ z, leads to an increase in inflation π.

from eqn. ③ given P^e, an increase in either m or z increases the price level P. Using the same previous argument: Given expected inflation π^e, an increase in either m or z leads to an increase in inflation π.

③ Given expected inflation π^e, an increase in 'u' leads to a decrease in inflation π.

Given π^e, an inc. in unemployment rate, u, leads to a lower nominal wage, which leads to a lower price level, P.

One more step, we will use time indexes so that we can refer to variables like π, π^e or u in a specific year.

$$\pi_t = \pi^e_t + (m+z) - \alpha u_t \quad \text{——} \quad ⑤$$

The variables π_t, π^e_t and u_t are referred in year t. There are no time indexes on m and z because we shall typically think of both m and z as constant while we look at movements in π, π^e and u.

THE EARLY INCARNATION

With the avg. inflation rate equal to zero in the past, it is reasonable for wage setters to expect that inflation will be equal to zero over the next year as well. So, let's assume $\pi_t^e = 0$

eqn (5) becomes,

$$\pi_t = (m + z) - \alpha u_t$$

This is precisely the -ve relation between u and π that Phillips found for UK and Solow-Samuelson for the US.

The story behind this is simple: Given p^e, which workers simply take to be last year's price level, lower unemployment leads to a higher nominal wage → higher price level → higher inflation.

This mechanism has sometimes been called the wage-price spiral.

MUTATIONS (In US)

Around 1970, this relation broke down. Reasons -

(a) In 1970, US was hit twice by a large increase in the price of oil. This increased the nonlabor costs of the firms, increasing their relative prices, (to increase in the markup, m). Eqn (5) shows that an increase in m leads to an inc. in inflation, even at a given rate of unemployment.

(b) From a change in the behaviour in inflation, wage setters too changed the way they changed their expectations.

From 1960s, the rate of inflation, rather than sometimes positive and sometimes negative, became consistently positive. And also more persistent: high inflation in one year became more likely to be followed by high inflation the next year.

(c) This persistence of inflation led workers and firms to revise the way they formed their expectations. This change in expectation formation changed the nature of the relation between unemployment and inflation.

Suppose π^e formed according to -

$$\pi^e_t = \theta \pi_{t-1}$$

where, the value of the parameter θ (theta) captures the effects of last year's inflation rate, π_{t-1}, on this year's expected inflation rate, π^e_t.

- Higher the value of θ, higher the expected inflation rate is.

(d) So, previously (before 1970s), when inflation rates were not very persistent, the firms & workers ignored the past year's inflation rate. Hence, θ was close to zero and $\pi^e_t = 0$.

(c) But, as inflation became more persistent, workers and firms started changing their expectations.

→ If inflation had been high last year, inflation is likely to be high this year as well. The value of θ increased. By the mid-1970s, people expected this year's inflation rate to be the same as last year's inflation rate — θ was now equal to 1.

Implications of different values of θ for the relation between u & π.

When, $\pi_t = \pi_t^e + (m+z) - \alpha u_t$

$\Rightarrow \pi_t = \theta \pi_{t-1} + (m+z) - \alpha u_t$

- when θ equals zero, (we get original phillips curve)

$\Rightarrow \pi_t = (m+z) - \alpha u_t$

- when θ is positive (now π_t depends upon π_{t-1} and on u)

$\Rightarrow \pi_t = \theta \pi_{t-1} + (m+z) - \alpha u_t$

- when $\theta = 1$

$$\pi_t - \pi_{t-1} = (m+z) - \alpha u_t$$

So, when $\theta = 1$, the u affects not the inflation rate, but rather the change in the inflation rate: High unemployment leads to decreasing inflation, low unemployment leads to increasing inflation.

From 1970 onward, as θ increased from 0 to 1, the simple relation between u and π disappeared. but a new relation emerged, this time between u and change in inflation rate (negative). This new relation is often called modified / expectations-augmented / accelerationist Phillips curve.

Original = Increase in u_t → lower inflation
Modified = Increase in u_t → decreasing inflation

PHILLIPS CURVE AND THE NATURAL RATE OF UNEMPLOYMENT

- The original Phillips curve implied that there was no such thing as a natural unemployment rate: if policymakers were willing to tolerate a higher inflation, they can maintain a lower unemployment forever.
- **Milton** Friedman & Edmund Phelps questioned the existence of such a trade-off; on arguments -
  → such a trade-off could only exist only if wage setters systematically underpredicted inflation - but in real world, they are unlikely to make same mistake forever.
  → Also, if the govt. opted to sustain lower unemployment by accepting higher inflation, the trade-off would ultimately disappear, since u cannot be sustained below a certain level, a level they called, the "natural rate of unemployment."

We know, at u_n, $\pi_t = \pi_t^e$ (by definition)

$$\pi_t = \pi_t^e + (m+z) - \alpha u_t$$

imposing condition,

$$0 = (m+z) - \alpha u_n$$

$$\rightarrow u_n = \frac{m+z}{\alpha} \quad \text{(6)}$$

(higher the m & z, higher the u_n)

Rewriting eqn (5) as,

$$\pi_t - \pi_t^e = -\alpha\left(u_t - \frac{m+z}{\alpha}\right)$$

$$\rightarrow \pi_t - \pi_t^e = -\alpha(u_t - u_n) \quad \text{(7)}$$

$$\rightarrow \pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

(+) (since π_t^e is well approximated by last year's inflation rate, π_{t-1})

Eqn (7) is important for two reasons:

(a) It gives us another way of thinking about the PC, as a relation between u_t, u_n and $\pi_t - \pi_{t-1}$ (change in inflation rate)

- the change in the inflation rate depends on the difference between actual and the natural unemployment rates.
- When the actual u is higher than u_n, the inflation rate decreases; when actual u is lower than the u_n, the inflation rate increases.

(b) It also gives us another way of thinking about u_n.

- The natural rate of unemployment is the rate of unemployment required to keep the inflation rate constant. This is why it is also called non-accelerating inflation rate of unemployment (NAIRU).

NEUTRALITY OF MONEY

!! What are the effects of change in the rate of growth of nominal money on unemployment and inflation in medium run?

We know, in medium run, $\pi_t^e = \pi_t$, thus the $u_t = u_n$.

We have, this AD relation, $Y = Y\left(\frac{M}{P}, G, T\right)$

If u_t returns to u_n, output must must return to Y_n. So,

$$Y_n = Y\left(\frac{M}{P}, G, T\right)$$

Here, if Y_n is constant RHS of the equation must be constant.

If we assume unchanged fiscal policy, (constant G & T), this implies that real money stock must also be constant.

This implies in turn that, rate of inflation must be equal to the rate of money growth.

$\pi = g_M$

★ In medium run, rate of inflation is determined by rate of money growth.

★ Why different countries have different Natural Unemployment Rates?

→ Since u_n depends upon m, z and value of α, and these factors have different values across nations, their natural unemployment rates also differ.

→ For example, Euro area, has much higher avg. unemployment rate (9%). Such high average over a long period of time suggests a high natural unemployment rate there.

→ We can look into the factors affecting wage and price setting behaviours in Europe for explanations. One of them is labor-market rigidities.

DISINFLATION, CREDIBILITY AND UNEMPLOYMENT

- In 1979, US unemployment rate was 5.8% but the inflation rate was running above 13%. In August 1979, President Carter appointed Paul Volcker as Chairman of Fed. Reserve Board.
- Fighting inflation implied tightening monetary policy → decreasing output growth → accepting higher unemployment. (for some time)

[Volcker wanted to achieve 4% inflation rate.]

- Some economists argued, that such a disinflation would likely to be very costly. Their starting point was this eqn -

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

Acc. to this eqn, the only way to bring down inflation is to accept unemployment above the natural rate for some time.

- Some economists argued that, this disinflation might in fact be much less costly.

★ **LUCAS CRITIQUE** - Lucas argued: Why shouldn't wage setters take policy changes directly into account? If wage setters believed that the Fed was commited to lower inflation, they might well expect inflation to be lower in the future than in the past.

- They argued that if the Fed was fully credible, the decrease in inflation might not require any increase in the unemployment rate.

$$\pi_t = \pi_t^e - \alpha (u_t - u_n)$$

$$4\% = 4\% - 0\%$$

The essential ingridient of successful disinflation, was credibility of monetary policy — the belief by wage setters that the central bank was truly commited to reducing inflation.

- A large lesson still stands: the behaviour of inflation depends very much on how people and firms form expectations.
- The Lucas Critique still stands: The past relation between unemployment and inflation may be a poor guide to what happens when policy changes.

HIGH INFLATION & The Phillips Curve

When the inflation rate becomes high, inflation also tends to become more variable. As a result, workers and firms become more reluctant to enter into labor contracts that set nominal wages for a long period of time.

Now, terms of wage agreements change with the level of inflation, Nominal wages are set for shorter periods. Wage Indexation, a provision that automatically increases wages in line with inflation, becomes more prevalent.

★ Example based on Wage Indexation –

→ Economy has two types of labor contracts.

→ A proportion λ of labor contracts is indexed: Nominal wages move one for one with price level changes.

→ others, $1-\lambda$ are not indexed.

Given, $\pi_t - \pi_t^e = -\alpha(u_t - u_n)$

Under assumption → $\pi_t = [\lambda\pi_t + (1-\lambda)\pi_t^e] - \alpha(u_t - u_n)$

★ The term in brackets on the right reflects that a proportion λ of contracts is indexed which responds to π_t and a proportion, $1-\lambda$, responds to π_t^e (expected inflation).

If we assume, $\pi_t^e = \pi_{t-1}$,

$$\pi_t = [\lambda\pi_t + (1-\lambda)\pi_{t-1}] - \alpha(u_t - u_n)$$

If $\lambda = 0$, all wages are set on the basis of π_t^e, which is equal to last year's inflation π_{t-1}

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

when λ is positive, a proportion λ of wages is set on the basis of actual inflation rather than expected inflation.

Reorganising eqn - Move the term in brackets to the left, factor $(1-\lambda)$ on the left of the equation, and divide both sides by $1-\lambda$, to get -

$$\pi_t - \pi_{t-1} = -\frac{\alpha}{(1-\lambda)}(u_t - u_n)$$

Wage indexation increases the effect of unemployment on inflation. Higher the proportion of wage contracts indexed, higher the λ — larger the effect unemployment rate has on the change in inflation — higher the coefficient $\frac{\alpha}{1-\lambda}$.

Intuition : Without wage indexation, lower unemployment increases wages → inc. prices. But because wages won't respond to prices right away, there is no further increas in prices within the year. With wage indexation, this effect is higher.

DEFLATION & The Phillips Curve

When the economy starts experiencing deflation, the Phillips curve relation breaks down. The reluctance of workers to accept decreases in their nominal wages, that occurs when their nominal wages increase more slowly than inflation. This implies that the Phillips curve relation may disappear, or atleast become weaker, when the economy is ~~weaker~~ close to zero.

UNIT - 4
CONSUMPTION & SAVING

Before plunging into the theory and data of modern consumption models, let's look at a quick-and-dirty model.

→ Suppose your entire future consists of two periods, 'now' and 'later'. 'Now' is the coming year and 'later' is the rest of your life, let's say following 99 years.

→ If you earn Y_{now} this year and Y_{later} each year thereafter, earnings over your lifetime will total → $Y_{now} + 99 \times Y_{later}$.

→ Suppose too that your standard of living is constant, no feast, no famine as well. Now, if you are to consume C each year, then lifetime spending will be $100 \times C$.

→ Spreading lifetime income over lifetime consumption gives the quick-and-dirty consumption function:

$$C = \frac{Y_{now} + 99 \times Y_{later}}{100}$$

* If your this year's income rises by $1000, your consumption function would rise by only $10/year. The short-run MPC to consume would be only 0.1.
* In contrast, if this $1000 rise is in your permanent income (both Y_{now} & Y_{later}), your consumption would rise by the full $1000 and long-run MPC would be 1.

These are the key ideas of Modern Consumption Theory.

★ Early Keynesian theories, had current consumption and current income moving in lockstep without trying to separate temporary versus permanent changes in income.

$$[C = \bar{C} + cYD \qquad 0 < c < 1]$$

LIFE CYCLE THEORY

- The life-cycle hypothesis views individuals as planning their consumption and savings behaviour over long periods with the intention of allocating their consumption in the best possible way over their entire lifetimes.
- Instead of relying on a sigle value (traditional) for the MPC, life-cycle theory (based on maximizing behaviour) implies income and wealth.

⇒ Key assumption is that most people choose stable lifestyles, consuming at about the same level in every period.

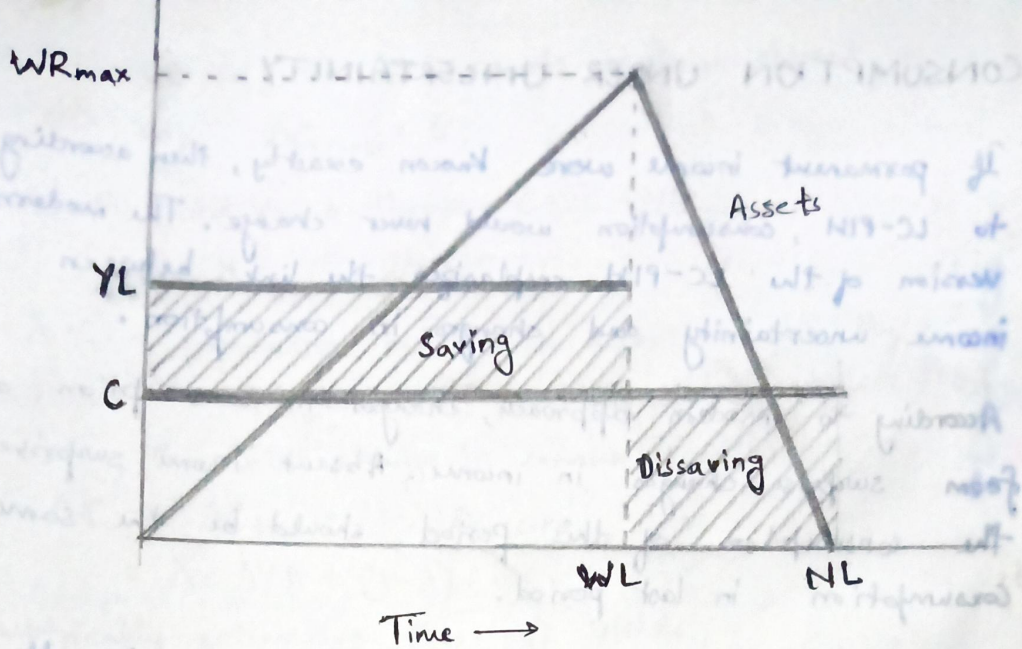
The general formula is

$$C = \frac{WL}{NL} \times YL$$

- WL ⇒ lifetime resources (annual income times years of working life
- YL ⇒ Annual labor income
- NL ⇒ No. of years of life (remaining).

So, the MPC is $\frac{WL}{NL}$.

★ How MPC - changes by variations in income: The MPC out of permanent income is large and the MPC out of transitory income is small, fairly close to zero. Also, the MPC out of wealth should equal the MPC out of Transitory income, very small.



PERMANENT-INCOME THEORY

Permanent Income is the steady rate of expenditure a person could maintain for the rest of his life, given the present level of wealth and the income earned now and in the future.

Milton Friedman introduced the theory "permanent income" with an example: Consider a person who receives income only once a week, on fridays. We don't expect that person to consume only on friday, with zero consumption on the other days of week. People prefer a smooth consumption flow rather than plenty today and scarcity tomorrow or yestoday.

In its simplest form, this theory argues that consumption is proportional to permanent income: $C = cY_P$

★ • An ass. professor who is promoted to professor and given a raise will think that the increase in income is permanent.
• A worker who has high overtime in a given year will likely regard that year's increased income as transitory.
→ This difference matters because transitory income is assumed not to have any substantial effect on consumption.

CONSUMPTION UNDER UNCERTAINITY

If permanent income were known exactly, then according to LC-PIH, consumption would never change. The modern version of the LC-PIH emplasizes the link between income uncertainity and changes in consumption.

According to modern approach, changes in consumption arise from surprise changes in income. Absent income surprises, the consumption of this period should be the same as consumption in last period.

The modern approach of LC-PIH begins by formally stating the lifetime utility maximization problem of a representative consumer. In a particular period, a consumer enjoys utility from consumption in that period only.

Consumers choose consumption in each period to maximize lifetime utility subject to total lifetime consumption equaling lifetime resources. The optimal choice is the consumption path that equates the marginal utility of consumption across periods, ie,

$$MU_{t+1} = MU_t$$

THE LC-PIH : Traditional model strikes back

The actual behavior of consumption exhibits both excess sensitivity and excess smoothness (to predictable changes in income and to surprise changes in income respectively).

To test for excess sensitivity, John Campbell and Greg Mankiw have developed a way of combining the LC-PIH and the traditional consumption function.

→ Acc. to LC-PIH, the ΔC equals surprise element, ϵ,

so, $\Delta C_{LC\text{-}PIH} = \epsilon$.

→ Acc. to the traditional theory, $C = \bar{C} + cYD$,

so, $\Delta C_{trad} = cYD$

→ If λ% of population behaves in accordance with the traditional model, and the remaining $(1-\lambda)$ follow the LC-PIH, the total change in consumptions is

$$\Delta C = \lambda \Delta C_{trad} + (1-\lambda)\Delta C_{LC\text{-}PIH}$$
$$= \lambda c \Delta YD + (1-\lambda)\epsilon$$

- Empirically estimating this eqn yields,

$$\Delta C = 0.53\ \Delta YD$$

★ It suggests that half of consumption behavior is explained by current income rather than permanent income.

LIQUIDITY CONSTRAINTS AND MYOPIA

★ Why LC-PIH miss explaining so much of consumption behavior?

1. Liquidity constraints exist when a consumer cannot borrow to sustain current consumption in the expectation of higher future income.

★ for example, most students look forward to a much higher income in the future. The LC theory holds that they should be spending according to their lifetime incomes, which will be much more than today. To do that, they have to borrow, but it is entirely possible that they can't borrow enough to support consumption at permanent level.

- Such students are liquidity constrained.
- When they take jobs, consumption will rise a lot when income rises, because the liquidity constrained is relieved.
- Thus, consumption will be more closely related to current income than is implied by the LC-PIH.

- Similarly, individuals who cannot borrow when their incomes decline temporarily would be liquidity constrained.

2. MYOPIA - this is the alternative explanation for the sensitivity of consumption to current income - consumers are myopic.

For example, David Wilcox of fed announced that the social security benefits will be increased, but it didn't lead to a change in consumption until the benefits were actually paid.
The delay could be either because recipients didn't had the assets to enable them to adjust spending before they received higher payments (liquidity constraints) or because they fail to pay attention to the announcements (myopia), or perhaps because the donot believe the announcements.

UNCERTAINITY AND BUFFER STOCK SAVING

- The life-cycle Hypothesis is that people save largely to finance retirement. However, additional saving goals also matter. Some saving is done to provide inheritances for children, some saving is precautionary, old people are reluctant to spend as they fear having to pay large bills for medical care, for emergency needs as well - In other words, savings are used as buffer stock.

- This evidence is consistent with a version of LC model in which uncertainity about future income and future needs is explicitly included.

- Consumers can save more to avoid sharp cut in their consumption in bad times. On the other hand, most consumers are impatient - they would prefer to spend now rather than save for the future.
- These effects lead to a much lower or much higher MPC than would be predicted by standard LC-PIH model.
- Now, we can say that consumers act as a buffer stock agents when young and somewhere around 40, savings behavior is more focused on retirement and the traditional LC-PIH works well.

CONSUMPTION AND STOCK MARKET

- MPC out of wealth - stock market, etc. - is small, about 0.05 to 0.15. Stock ~~matt~~ market matters for consumption, but the magnitude of the relation is hard to pin down.
- Value of stocks has been volatile in recent years. In 1997, the value of stocks listed on the New York Stock Exchange (NYSE) rose about $1.5 trillion. An MPC of ~~0.05~~ 0.05 would have increased consumption by $75 billion. This is a large increase at that time.
- In the first seven months of 2002, the value of the NYSE fell by more than $1.5 trillion, but consumption rose fairly strongly over this period.

CONSUMPTION, SAVING AND INTEREST RATES

- Anyone who saves receives a return in the form of interest or of dividends and capital gains on stocks. Surely, an increase in the rate, would make people to save more.
- It is true that when interest rate rises, saving is made more attractive. But it is also made less necessary.
- For example, consider someone who has decided to save an amount that will ensure that $10,000 per year will be available for retirement, the interest rate is suppose, 5%, and the person is saving $1,000 per year.
- Now, let the interest rate rise to 10%. With such a high interest rate, individual needs to save less now for retirement. It is now possible to provide same retirement income by saving $650/year. Thus, an increase in interest rate might reduce saving.
- The suggestions from the data are ambiguous. Typically, research suggests that the effects of interest rates on saving are small and hard to find.

THE BARRO-RICARDO PROBLEM

Given the size of the govt. spending, does it matter whether sufficient taxes are levied to pay for what we spend? The traditional AD-AS model answers as:

★ lower taxes mean higher AD → higher interest rates → more crowding out → less investment for the future.

Neo Classical economists, led by Robert Barro, gives a different answer: Deficits doesn't matter. Reasoning -

1. Imagine the govt. increases spending by $100 per family and raises taxes by the same $100.
   - In this case, families have $100 less to spend overall. They adjust their budgets accordingly.
2. Now, imagine the govt. increases spending by $100 per family and doesn't raises taxes. ~~by~~ Instead, it borrows the money (creating a deficit).
3. Barro argues that in both scenarios (tax increase vs deficit), families have $100 less in resources.
4. Because families are in the same financial position (less $100) they'll make similar spending decisions regardless of how the govt. financed the spending increase.
   - Therefore, acc. to Barro, the deficit itself doesn't have a significant impact.

★ While deficit spending might not have the same immediate effects on spending as traditional model suggests, the future tax burden associated with the deficit could still influence economic decisions.

Owing a bond (govt bond) doesn't necessarily benefit the family in the long run. The value of the bond might not be offset by the expected increase in future taxes to repay the debt.
If families anticipate higher taxes due to the deficit, their spending behavior might change. They might save more and reduce current spending.

★ Do govt. bonds represent actual wealth for public?

The proposition suggests that govt. borrowing through bonds is essentially just postponing future taxation.

- Barro takes this idea a step further: People understand that the govt will raise taxes in the future to pay off the bonds. So, if govt. increases the deficit without cutting spending, people will anticipate higher taxes and save more money now to prepare for that future burden.
- This increase in saving precisely matches the deficit.
- This is known as the Barro-Ricardo equivalence proposition, or Ricardo equivalence.

Objections to Barro-Ricardo propositions:

1. Given that people have finite lifetimes, different people will pay off the debt than those who are receiving the tax cut today. People do not take into account the higher taxes their descendants will have to pay in the future.

2. It is argued that many people can't borrow, and so, do not consume acc. to their permanent income. A tax cut for these 'liquidity constrained' people eases their liquidity constraint and allows them to consume more.

INTERNATIONAL DIFFERENCES IN SAVING RATES

- For decades, U.S saving rate was lower than that in other major countries.
  1. Gross National Saving = Govt. Saving + private saving
  2. Private Saving = business saving + personal saving
- Business saving consists of retained earnings, that amount of profits not paid out to owners of the business, rather, kept to plow back into the business.
  - Why does US save less than other countries?

→ Demographic factors - large senior-citizen population.

→ Borrowing is easy in US than in most other countries.

- In US, business saving is much larger than personal saving, but it did not recieved attention because for a long time, it seemed that households treated business saving as if it were done on their behalf, and reduced their own saving exactly enough to offset any increased business saving.

INVESTMENT SPENDING

- Investment is the flow of spending that adds to the physical stock of capital.
- Capital is a stock, the given dollar value of all the buildings, machines, and inventories at a point in time.
- Both GDP and investment refer to spending flows.
- Investment is the amount spent by businesses to add to the stock of capital over a given period.

★ Salient points about the Investment sector -

1. Investment spending is very volatile and thus very responsible for much of the fluctuations of GDP across the business cycle.
2. Investment spending is a primary link through which interest rates, and therefore monetary policy, affect the economy. Tax policies affecting investment, under the control of govt., are important tools of fiscal policy.
3. On the supply side, investment over long periods determines the size of the stock of capital and thus helps determine long-run growth.

The Stock Demand for Capital and the Flow of Investment

- Businesses and consumers demand a stock of capital in the form of machines and homes.
- But the supply of capital can be thought of as a fixed stock at a point of time.
- When the demand exceeds the existing stock, a flow of investment in the form of new machines and new home construction starts to fill up the gap.

→ The demand for private homes depends on three factors primarily:

(a) Income (b) Mortgage interest rates (c) Taxes.

Example,

1. Mortgage rates drop → monthly cost of homeownership drops → demand for housing increases.
   [since new homes cannot appear overnight, prices of existing homes increases initially.]
2. Higher prices → builders have higher incentives to start new projects → new housing investment.
   [overtime, enough homes are built to satisfy this new demand]
3. Housing prices and new housing investment drop back toward their original levels.

The Desired Capital Stock

★ The marginal product of capital is the increase in output produced by using 1 more unit of capital in production.

★ The rental cost of capital is the cost of using 1 more unit of capital in production.

The firm will keep investing until the value of the output produced by adding 1 more unit of capital is equal to the cost of using that capital - the rental cost of capital.

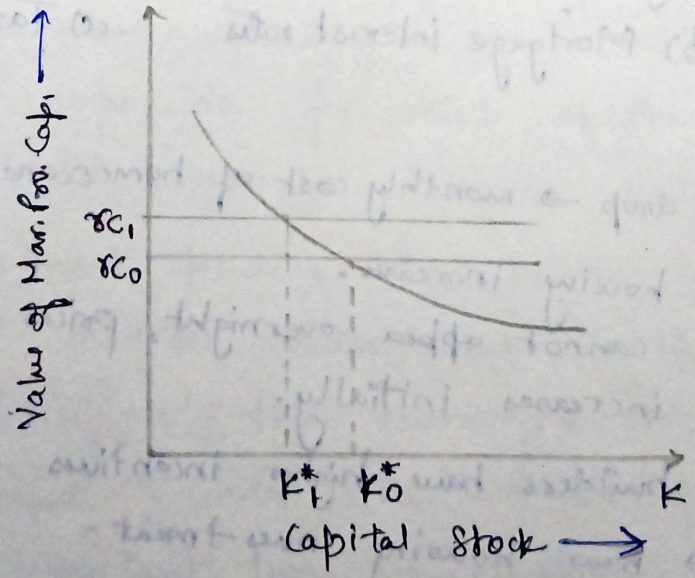


FIGURE-1: Marginal product of capital in relation to the capital stock

Rental cost, $rc = r + d = i - \pi^e + d$

d → cost of depreciation (per year)

i → interest rate of borrowing (for financing investment)

π^e → expected inflation rate

- Diminishing marginal product of capital means that the marginal product of capital drops as capital is increased.
- A high rental cost can be justified only by a high marginal product. So, an increase of the rental cost from rc_0 to rc_1 decreases the desired capital stock from K_0^* to K_1^*.

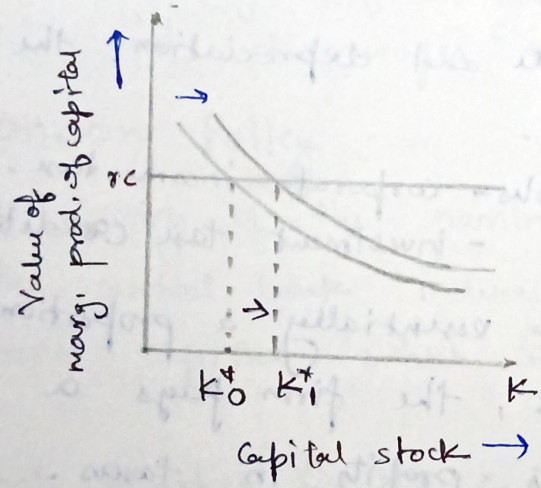


FIGURE 2:

★ Shift in the marginal product schedule to the right, due to an increase in the size of the economy.

★ Increases the desired capital stock at any given rental stock.

$$K^* \equiv g(rc, Y) \quad \text{——} \quad (1)$$

- an increase in the rental cost decreases K^*.
- an increase in GDP increases K^*.

Expected Output

- Equation (1) shows that desired capital stock depends on the level of output, for some future period, during which the capital will be in production.
- This suggests that the notion of permanent income (output) is relevant to investment as well as consumption.

- The demand for capital which depends on the normal or permanent level of output, thus depends on expectations of future output levels rather than the current level of output. However, current level of output is likely to affect expectations of permanent output.

Taxes

In addition to interest rate and depreciation, the rc is affected by taxes.
The two main tax variables - corporate income tax.
- investment tax credit.

(a) The corporate income tax is essentially a proportional tax on profits; that is, the firm pays a proportion, say, t, of its profits in taxes.
★ The higher the corporate income tax, the higher the cost of capital.

(b) The investment tax credit allows firms to deduct from their taxes a fraction, say 10%, of their investment expenditures in each year.
- Thus, a firm spending $1 M for investment purposes in a given year could deduct $100,000 from the taxes it would otherwise have to pay the govt.

★ Investment tax credit therefore reduces the rental cost of capital.

Fiscal Policy

- Fiscal policy exerts an effect through both the corporate tax rate and the investment tax credit.
- A high-tax-low-govt. spending policy keeps the real interest rate low and encourages the demand for capital.
- A low-tax-high-govt. spending policy, that produces large deficits raises the real interest rate and discourages the demand for capital.

Monetary Policy

- A lowering of the nominal interest rate by the central bank induces the firms to desire more capital, which will effect investment spending.

Stock Market & the Cost of Capital

- Rather than borrowing, firms also rais the finance for investment by selling **shares** or **equity**.
- When its share price high, a company can raise a lot of money by selling relatively few shares.
- The existing shareholders of the firm will be more willing to have the firm sell shares if its price is high.
- Thus, we expect corporations to be more willing to sell equity to finance investment when the stock market is high.

★ Hence, a booming stock market is good for investment.

The q theory of Investment

- The price of a share in a company is the price of a claim on the capital in the company.
- So, the managers of the company respond to the price of stock by investing (producing more new capital) when the price of shares is high and as producing less new capital or not investing at all when the price of shares is low.

★ q is the ratio of the market value of a firm to the replacement cost of capital.

OR It is an value the stock market place on a firm's assets relative to the cost of producing those assets.

- When this ratio is high, firms will want to produce more assets, so investment will be rapid. "High q means high investment."

★ Whenever q is greater than 1, a firm should add physical capital because for dollar's worth of new machinery, the firm can sell stock for q dollars and pocket a profit of q-1.

From Desired Capital Stock to Investment

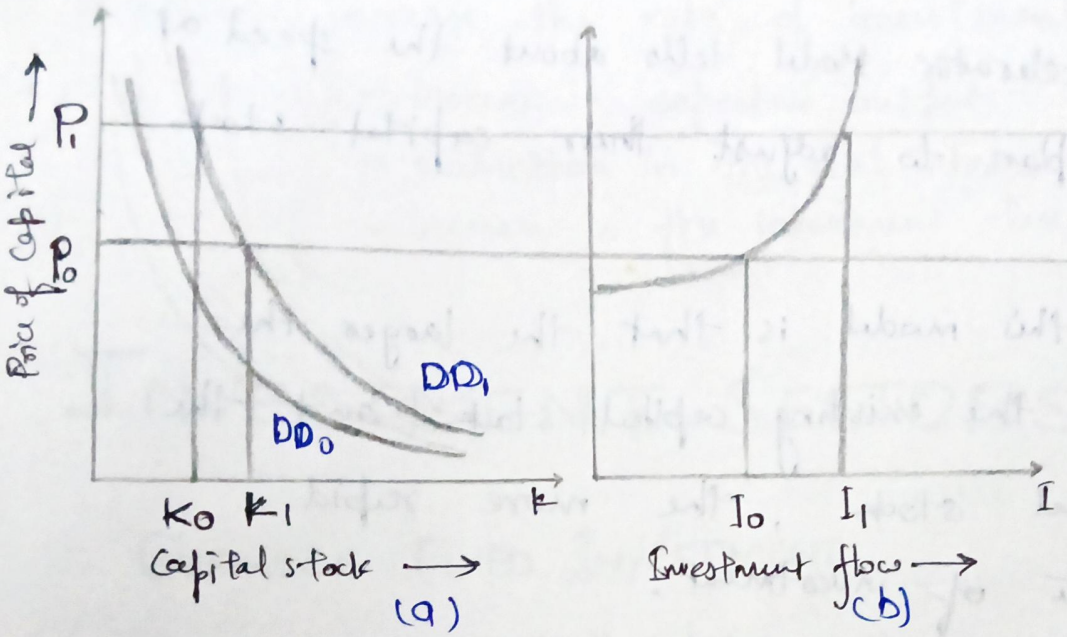


FIGURE - 3

Demand for Capital Stock and flow of Investment

- Panel (a) shows an increase in demand for the capital stock raising prices from P_0 to P_1 in the short-run and raising the capital stock from K_0 to K_1 in the long-run.
- Panel (b) shows the corresponding increase in investment flow.

Capital Stock Adjustment

- The flexible accelerator Model tells about the speed at which firms plan to adjust their capital stock over time.
- Notion behind this model is that the larger the gap between the existing capital stock and the desired capital stock, the more rapid a firm's rate of investment.

$$K_0 \equiv K_{-1} + \lambda (K^* - K_{-1}) \quad \text{——— (2)}$$

K_{-1} → capital stock at the end of the last period by t_0.

$K^* - K_{-1}$ → gap between the desired and actual capital stock

- To increase the capital stock from K_{-1} to the level of K_0, the firm has to achieve the amount of net investment $\equiv K_0 - K_{-1}$. Therefore,

$$I = K_0 - K_{-1} = \lambda (K^* - K_{-1}) \quad \text{——— (3)}$$

[which is the gradual adjustment of net investment]

- Eqn (3) - investment function that shows current investment spending determined by the desired stock of capital, K^*, and the actual stock of capital K_{-1}.

- Any factor that increases the desired capital stock, increase the rate of investment.
  - Increase in expected output
  - reduction in the real interest rate
  - increase in the investment tax credit

INVESTMENT SECTORS

1. BUSINESS FIXED INVESTMENT

- There is a close link between the earnings of firms and their investment decisions. The predominance of retained earnings as a source of financing means firms rely more on retained earnings, profits that they do not pay out to stakeholders.
  Hence, the state of a firm's balance sheet, and not just the cost of capital, is a financial determinant of investment decisions.
- Credit Rationing occurs when individuals cannot borrow even though they are willing to do so at the existing interest rates. There are many reasons for credit rationing, all stemming from the risk that the borrower goes bankrupt and will not repay the lender.

- Under such conditions, firms investment decisions will be affected - not only by the interest rate but also by the amount of ~~firms~~ funds the firms have saved out of past earnings and by their current profits as well.
- The cost of capital still affect the investment decision, because firms that retain earnings have to consider the alternative of holding financial assets and earning interest ~~rates~~ rather than investing in plant and equipment.

Irreversibility

- There is an idea that capital is "putty-putty" like a warehouse - may have high-valued alternative uses as a factory or an office building.
- Much capital is better described as "putty-clay" - once capital is built, it can't be used for much except its original purpose, like a Jet liner - is it of much use except for flying.
- The essence of putty-clay investment is that it is irreversible.

2. RESIDENTIAL INVESTVENT

- Residential investment consists of the building of single family and multifamily dwellings, which we call housing. The theory of residential investment starts by considering the demand for the existing stock of housing.
- Demand for the housing stock depends on the net return obtained by owning housing.

Net return = Gross return − costs

where, Gross return = either rent (if rented) or implicit return that the homeowner receives by living in the home + capital gains (arising from increases in the value of the housing).

Costs = interest costs (mortgage) + real estate taxes + depreciation

- An increase in the net return on housing, caused for example, by a reduction in mortgage interest rate, makes housing a more attractive form in which to hold wealth.

Monetary Policy and Housing Investment

1. Impact of Interest Rates:

(a) Long Mortgages - Most US mortgages have long maturities with fixed monthly payments.

(b) Interest Rate Investment - The demand for housing is very sensitive to both real (adjusted for inflation) and nominal (actual) interest rates.

- Doubling the interest rate roughly doubles the monthly mortgage payment, making housing significantly more expensive.

2. Tax Benefits & Inflation:

(a) Tax Deduction - In US, interest payments on mortgages are tax-deductible, encouraging homeownership.

(b) Favorable Treatment of Inflation - In US, nominal interest payments are deductible, while inflation-driven capital gains on the house are not taxed. This makes housing investment attractive during high inflation periods.

for example: High nominal interest rates with high inflation can result in a near-zero real cost of capital for the house.

3. Liquidity Effects: High nominal interest rates can still discourage homeownership despite tax benefits.

(a) Borrowers need to make large upfront payments with the capital gains coming much later. (increased house value).

(b) Bank may use fixed rules that doesn't consider inflation, making it harder to qualify for a mortgage during high inflation. (eg:- mortgage payment can't ~~exceed~~ exceed 28% of income).

3. INVENTORY INVESTMENT

- Inventories consist of raw materials, goods in the process of production, and completed goods held by firms in anticipation of the product's sale.
- The ratio of manufacturing inventories to sales in US has fallen down considerably. Adoption of just-in-time manufacturing techniques has contributed to this decline

★ The smaller the cost of ~~and~~ ordering new goods and the greater the speed with which such goods arrive, the smaller the inventory-sales ratio.

★ Also, the inventory-sales ratio fall as sales increase because there is relatively less uncertainty about sales as sales increase.

★ Finally there is the interest rate. There is an interest cost involved in ~~such~~ inventory holding, and the desired inventory-sales ratio should be expected to fall with increase in the interest rate.

- Why firms hold inventories?

(a) to meet future demand for goods, because goods cannot be instantly manufactured.

(b) It is less costly for a firm to order goods less frequently in large quantities than to order small quantities frequently.

(c) Producers produce at a relatively steady rate to smooth their production, even when demand fluctuates, building up inventories when demand is low and drawing them down when demand is high.

(d) Some inventories are held as an unavoidable part of the production process.

The Accelerator Model

This model asserts that investment spending is proportional to the change in output and is not affected by the cost of capital,

$$I = \alpha (Y - Y_{-1})$$

Unanticipated and Anticipated Inventory Investment -

- Inventory investment takes place when firms increase their inventories.
- Inventory investment could be high in two circumstances :

Unanticipated → 1. If sales are unexpectedly low, firms would find unsold inventories accumulating.

Anticipated → 2. When firms plan to build up inventories, desired investment.

- Thus, rapid accumulation of inventories could be associated with either rapidly declining AD or rapidly increasing AD.

Inventories in the Business Cycle

- The role of inventories in the business cycle is a result of a combination of unanticipated and anticipated inventory change.

(a). As a recession develops, demand slows down and firms add involuntarily to the stock of inventories. Thus, the inventory-sales ratio rises.

(b). Then production is cut, and firms meet demand by selling goods from inventories. Sales exceeds output in this phase.

(c). At the end of every recession, firms reduce their inventories, meaning that inventory investment goes negative. Finally, inventory starts piling up intentionally as the recovery starts.

Just in time inventory management

- Fluctuations in inventory investment, and GDP can be reduced if inventories could be kept in line with sales or aggregate demand.
- Just in time inventory management techniques, imported from Japan, emphasize the synchronization of suppliers and users of materials, thereby allowing firms to operate with small inventories, so production is "lean" in inventories.
- These improved methods help account for the downward trend in inventories.

INVESTMENT AND AS

- Investment is an important component of AD. Investment also increases capital, increasing the productive capacity of the economy.

★ Does investment matter for Aggregate supply?

- The short-run supply-side effect of any realistic policy will probably be too small to measure. So, claims of stimulating investment in hope of a short-run supply-side effect are probably silly.
- But the effect of modest annual increases in the capital stock can cumulate to be quite large over long periods. So, we can say that in the long-run, investment corresponds with growth.