Paradigms cont…

- **Monetarism:** The short-run version of this model did not assume full employment and did not imply continuous full employment in the economy. It is a hybrid between the classical and the Keynesian paradigms, and made the switch away from Keynesian on claim of fiscal policy efficacy. In its long-run version, it belonged in the classical paradigm.

- **Modern classical model** This is a statement of the classical paradigm under the assumptions, among others, of continuous labour market clearance even in the short-run. Also, it extends the neoclassical model by the introduction of uncertainty and rational expectations.

Paradigms cont….

- **New Classical Model:** The new classical model imposes the assumption of Ricardian equivalence on the modern classical model. This assumption is an aspect of intertemporal rationality and the Jeffersonian (democratic) notion that the government is nothing more than a representative of its electorate and is regarded as such by the public in making the decisions on its own consumption

Conclusion cont…

- The Keynesian paradigm focuses on the deviations from the general equilibrium of the competitive economy based on assumption of nominal wage rigidity.
- There can be a variety of reasons for such deviations, requiring different models for their explanations.
- Deviation from equilibrium could occur even when nominal wage is fully flexible

- IS{LM analysis assumes that the central bank uses the money supply rather than the interest rate as the monetary policy instrument and sets its level exogenously. However, the LM equation/curve, and therefore the IS{LM analysis, is inappropriate for the macroeconomic analysis of economies in which the central bank sets the interest rate exogenously. The more appropriate analysis for such economies is the IS{IRT one.

- In the short-run, money and credit are not neutral in real-world economies. They are neutral in the analytical long

Paradigms cont…

Keynesian Models

- **Traditional Keynesian Model**
- **Neo Keynesian l Model**
- **New Keynesian Model**

Paradigms cont…

Which model is appropriate for monetary analysis????

Both paradigms are useful because there is no guarantee that the economy will always operate in general equilibrium, hence the models of the Keynesian paradigm must not be neglected and vice versa. Neglecting either of them can lead to erroneous policies that impose high costs on the economy and its citizens.

NOTE!!!

For the practical formulation of monetary policy, the relevant and \interesting" question is not the a priori choice between the classical and the Keynesian models, but rather the perpetually topical one is what is the current state of the economy like and which model is most applicable to it? There is rarely a sure answer to this question. Consequently, the judgment on this question and the formulation of the proper monetary policy are an art, not a science and very often rest on faith in one's prior beliefs about the nature of the economy.

stylized facts on money and output

- Over long periods of time, there is a roughly one-to-one relationship between the money supply and the price level.

- Over long periods of time, the relationship between inflation and output growth is not significant.

- Over long periods of time, the correlation between money growth rates and nominal interest rates is very high.

- Changes in money supply and interest rates have a strong impact on aggregate demand.

- Over short periods (a few years), increases in aggregate demand, because of increases in money supply or reductions in interest rates, increase output. This effect builds to a peak and then
  gradually decreases, so that there is a \hump-shaped pattern" of the effect of monetary policy on output, with the maximum increase in output occurring with a lag longer than one year, sometimes two or more years

Stylized cont…

- the impact of an expansionary monetary policy on prices occurs with a longer lag than on output, so that the impact of monetary shocks on output does not mainly occur through price movements.

- Contractionary monetary policies initially reduce output significantly, often for longer than a year and sometimes for several years. The cost in terms of output tends to be larger if inflation is brought down gradually rather than rapidly. It is lower if the policy has greater credibility

Monetary policy and Macroeconomics Management

- Monetary policy is the central bank exercises control over the economy by exogenously controlling the money supply.
- For certain types of economies, controlling the economy's interest rate may be a surer way of controlling aggregate demand than its money supply.
- As a result, the central banks of several economies, including Ghana now rely more on the interest rate rather than on the money supply as the primary monetary policy instrument
- Monetary Policy is conducted using the appropriate aggregate demand analysis of IS-LM framework.
- Depending on the economy type and paradigm type, the IS-LM derivation adjust accordingly.

Monetary Policy Issues in LDC

- The financial sector is the pillar of monetary policy analysis

- However, the financial and macro environment of LDCs do not support traditional framework the advanced economies use. Thus, creating issues for monetary policy and macroeconomic management.

- These challenges include

❑Non-competitive financial market
❑Huge government borrowing and deficit financing
❑information asymmetry in credit market
❑Large informal sector
❑Poor institutional environment

Cont…

- For central banks to be able to implement this responsibility, the policy instruments at their disposal must be effective in influencing aggregate demand. However, for the reason enumerated above, the link between monetary policy instruments and aggregate demand is significantly weaker in developing countries than it is in advanced and emerging economies.

- The frontier of research is HOW TO MAKE MONETARY POLICY EFFECTIVE AND EFFICIENT amidst the LDCs economic and financial environment.

Conclusion

- The appropriate definition of money keeps changing. There are currently several definitions of money in common usage. These include M1, M2 and broader monetary aggregates.

- All definitions of money include currency in the hands of the public and demand/checking deposits in commercial banks.

- Banks are one type of financial intermediaries but differ from others in that their liabilities in the form of checking and savings deposits are the most liquid of all assets in the economy.

- Financial assets are created, so that an unregulated financial system tends to create a multiplicity of differentiated assets.

- The banking system is the most regulated financial institution across the globe because of the contagion effect of its crisis

THEORY OF DEMAND FOR MONEY

Lecture 2

The Heritage Theory

- What is demand for money
- Quantity equation
- Quantity theory
- Transactions demand for money
- Speculative demand for money
- Precautionary demand for money
- The modern quantity theory
- Transmission mechanism
- ♦ Direct transmission mechanism
- ♦ Indirect transmission mechanism
- ♦ Lending channel
- ♦ Permanent income

Demand for money

- Money is what we use when we demand other goods.

- **Demand for money** is a question of how much of wealth individuals wish to hold in the form of money at any point in time.

- Individuals must decide how to allocate their wealth between different kinds of assets, for example a house, income-earning securities, a checking account, and cash.

- It is important to note the demand for money is demand for the actual services yielded by the possession of a real stock of money, and not simply a demand for a nominal

Cost of holding money

- 1. Money earns little or no interest. There is an opportunity cost of holding money, which is interest rate (or any type of return) foregone minus transactions cost

- 2. Money loses purchasing power to inflation.

THEORIES OF MONEY DEMAND

- **First: Quantity Theory of Money**

Quantity theory of money is a **classical theory** that related the amount of money in the economy to nominal income.

- This theory states the changes in the quantity of money tend to affect the purchasing power of money inversely,

- That is, with every increase in the quantity of money, each monetary unit (such as shilling or dollar) tends to buy a smaller quantity of goods and services

- while a decrease in the quantity of money has the opposite effect.

Equation of Exchange

- Economist Irving Fisher is given credit for the development of this theory.
- It begins with an identity known as the equation of exchange:
- $MV = PY$, Where M is the quantity of money (or money supply).
- V is velocity of money, which serves as the link between money and output.
- P is the price level.
- Y is aggregate output (aggregate income).
- PY is the total amount of spending on final goods and services produced in the economy (aggregate nominal income or nominal GDP).

The Quantity Theory of Money

- A simple theory linking the inflation rate to the growth rate of the money supply.
- Begins with the concept of **velocity**…

Velocity

- Basic Concept: the rate at which money circulates

- Definition: the number of times the average dollar bill changes hands in a given time period

- example: In 2007,
  - $500 billion in transactions
  - money supply = $100 billion
  - The average dollar is used in five transactions in 2007
  - So, velocity = 5

Velocity, *cont.*

- This suggests the following definition:

$$V = \frac{T}{M}$$

where

V = velocity

T = value of all transactions

M = money supply

Velocity, *cont.*

- Use nominal GDP as a proxy for total transactions.

Then,

$$V = \frac{P \times Y}{M}$$

where

P	= price of output	(GDP deflator)
Y	= quantity of output	(real GDP)
$P \times Y$	= value of output	(nominal GDP)

The quantity equation

- The **quantity equation**

$$M \times V = P \times Y$$

follows from the preceding definition of velocity.

- It is an *identity*:

it holds by definition of the variables.

***Note: quantity equation* is not a *theory* for the determination of prices, incomes or even the velocity of circulation in the economy.**

Policy implications of the quantity equation

- ***persistently high rates of inflation***

Rewrite the quantity equation in terms of growth rates as:

- $M'' + V'' \equiv P'' + y''$
- where π indicates the rate of change (also called the growth rate) of the variable. This identity
- can be restated as:
- $\pi \equiv M + V - Y$
- where π is the rate of inflation and is the same as P;
- *The quantity theory of inflation indicates the inflation rate equals the growth rate of money supply minus the growth rate of aggregate output*

Types of quantity equation

- There are several major types or variant of the quantity equation.
- One set of variants focuses attention on the goods traded or the transactions in which they are traded, so that they modify the right-hand side of (1) – know as the *Commodities approach to the quantity equation*.

- The second set of variants imposes disaggregation on the media of payments (e.g. into currency and demand deposits) or changes the monetary aggregate, thereby modifying the left side of (1) – known as the *Transactions approach to the quantity equation*.

Commodities approach

- Expenditures is often measured by the multiple of the amount ***y*** of commodities sold in the economy in the current period times their average price level ***P***. Therefore, the quantity equation can be written as:

$$M \cdot V_{My} \equiv P_y \cdot y \qquad (2)$$

- where:
- V_{My} = income-velocity of circulation of money balances M in the financing of the commodities in y over the designated period
- P_y = average price (price level) of currently produced commodities in the
- economy
- y = real aggregate output/income in the economy. (2) is often also stated as:

$$M \cdot V_{My} \equiv Y \qquad (3)$$

- (3) yields velocity VMy as equaling the ratio Y/M.

Transactions approach

- Expenditures can be viewed as the number of transactions T of all goods, whether currently produced or not, in the economy times the average price P_T paid *per transaction*.
- The concept of velocity relevant here would be the rate of turnover per period of money balances in financing all such transactions.
- The quantity equation then becomes:
- $M \cdot V_{MT} \equiv P_T \cdot T$ where:
- V_{MT} = transactions-velocity of circulation per period of money balances M in financing transactions T
- P_T = average price of transactions
- T = number of transactions during the period

Quantity equation in terms of the monetary base

- The monetary base (M0) consists of C+R

- Since the central bank has better control over the M0, which it can manipulate through open market operations, than over M1 or M2, it is sometimes useful to focus on the velocity of circulation $V_{M0,y}$ of the monetary base.
- The quantity equation in terms of the monetary
- base is:
- $M0 \cdot V_{M0,y} \equiv Py \cdot y$ (5)
- where:
- $M0$ = quantity of the monetary base
- $V_{M0,y}$ = income-velocity of circulation per period of the monetary base.

The quantity theory of money, *cont.*

$$M \times \bar{V} = P \times Y$$

How the price level is determined:

– With V constant, the money supply determines nominal GDP ($P \times Y$).

– Real GDP is determined by the economy's supplies of K and L and the production function.

– The price level is
P = (nominal GDP)/(real GDP), i.e. PY/Y

The QTM is the proposition that *in long-run equilibrium, a change in the money supply in the economy causes a proportionate change in the price level, though not necessarily in disequilibrium.*

The Fisher's Quantity Theory of Money (QTM

- The Value of money (V) :
- V= 1/P   (P = prices)
- The Cash Transaction Approach

Definition of QTM:

- It states that the quantity of money is the main determinant of the price level or the value of money

Irvin Fisher: "Other things remaining unchanged, as the quantity of money in circulation increases, the price level also increases in direct proportion and the value of money decreases and vice versa"

Any Change in in the qty of money produces an exactly proportionate change in the price level

$$PT = MV + M'V'$$

The equation equates the demand for money (PT) = supply of money (MV+M'V')

Where P= price level, or l/p= the value of money;

M= the total quantity of legal tender money;

V= the velocity of circulation of M;

M'= the total quantity of credit money'

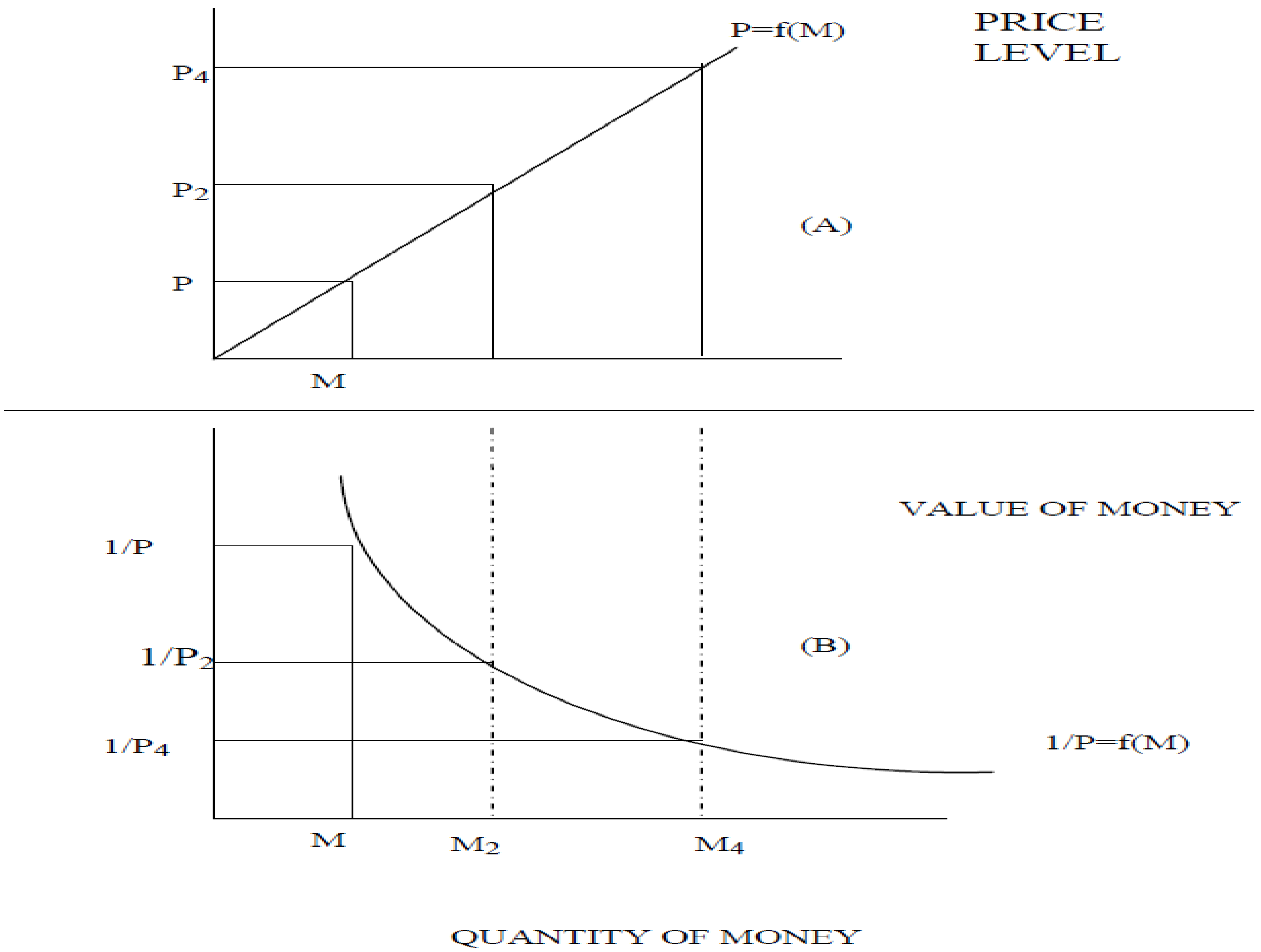
V'= the velocity of circulation of M;

T= the total amount of goods and services exchanged for money

Transactions performed by money

$$P = \frac{MV + M'V'}{T}$$

In order to find the effect of the quantity of money on price level


PRICE
LEVEL
P=f(M)
P4
P2
P
(A)
M
VALUE OF MONEY
1/P
1/P2
1/P4
(B)
1/P=f(M)
M
M2
M4
QUANTITY OF MONEY

ASSUMPTIONS OF THE THEORY

Fisher's theory is based on the following assumptions:

1. P is a passive factor in the equation of exchange which is affected by the other factors.
2. The proportion of M' to M remains constant.
3. V and V' are assumed to be constant and are independent of changes in M and M'
4. T also remains constant and is independent of other factors such as M, M1, V and V1.
5. It is assumed that the demand for money is proportional to the value of transactions.
6. The supply of money is assumed as an exogenously determined constant.
7. The theory is applicable in the long run.
8. It is based on the assumption of the existence of full employment in the economy.

Implication

- $\partial y/\partial M = 0$
- and $\partial V/\partial M = 0$.
- These imply that, following an increase in the money supply, prices will rise in proportion to the increase in the money supply.
- That is, the elasticity of the price level with respect to the money supply will be unity
- Fisher's QTM aliens with the Walrasian general equilibrium model of full employment,

Criticism of QTM and the constancy of Velocity

- Assumption of independence of V: since velocity is a ratio of expenditures to money holdings, Fisher’s assertion becomes more easily subject to doubt if the determinants of velocity are approached from the determinants of expenditures;
- The economy cannot continuously be in full employment as Keynes asserts;
- Changes in interest rates and in output can change both the demand for money and its velocity.
- Financial innovation

Table 2.1 Changes in the velocity of money

	Velocity of M1 *and* M2[11] *for USA (US$ billions)*				
	Y[12]	M1	M2	*V*1 (*Y*/M1)	*V*2 (*Y*/M2)
1991	5803.075	916.0	3472.7	6.34	1.67
1995	7397.650	1150.7	3680.0	6.43	2.01
2000	9816.975	1112.3	4962.2	8.83	1.98

	Velocity of M1 *and* M2+ *for Canada (C$ billions)*				
	Y	M1	M2+	*V*1(*Y*/M1)	*V*2 (*Y*/M2+)
1991	679.921	45.622	534.989	14.90	1.27
1995	810.426	62.674	618.447	12.93	1.31
2000	1076.577	114.919[13]	713.503	9.37	1.51

Application

- Empirical evidence
- Budget deficit and inflation

Debt monetization leads to inflation

- The Financing of a persistent deficits by means of money creation will lead to sustained inflation
- Case study: The Zimbabwean hyperinflation

Quantity Theory and Inflation

- Percentage Change in ($x \times y$) = (Percentage Change in x) + (Percentage change in y)
- Using this mathematical fact, we can rewrite the equation of exchange as follows:

$$\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$$

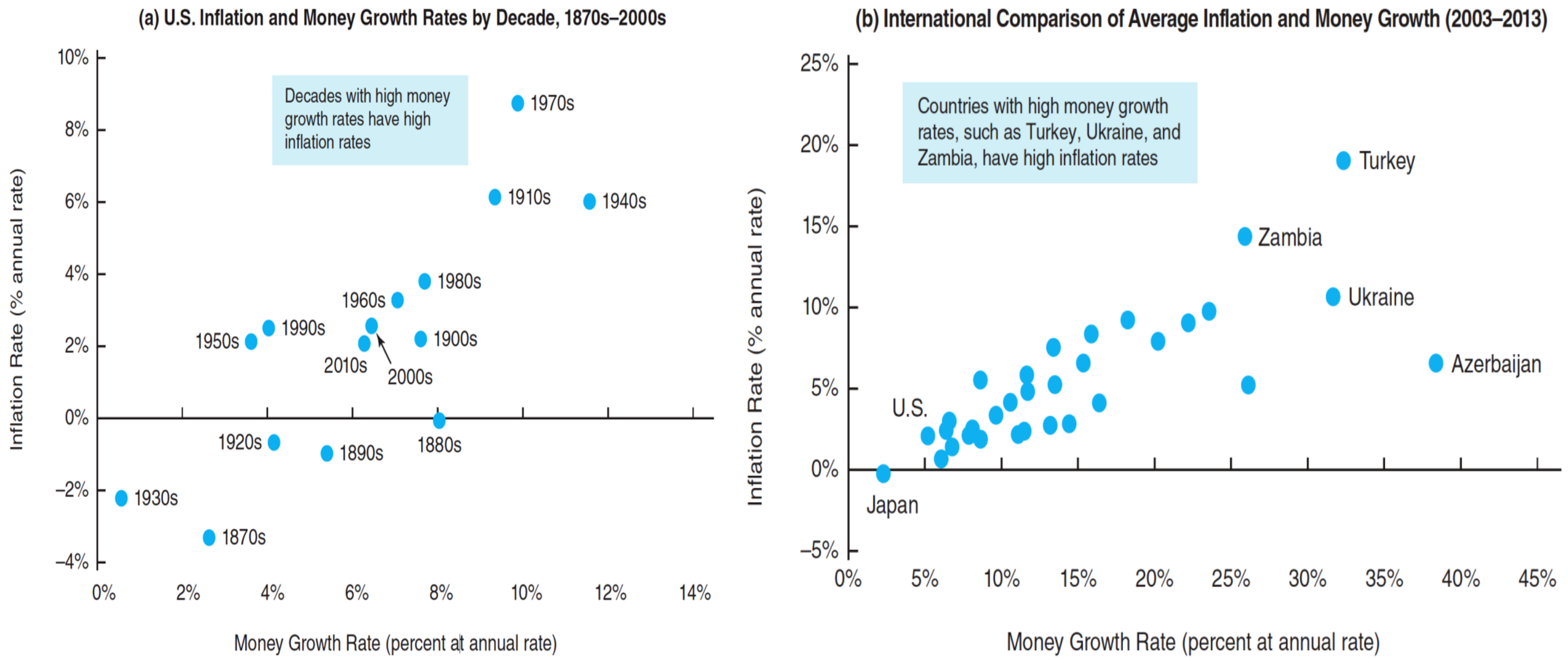
- Subtracting from both sides of the preceding equation, and recognizing that the inflation rate, is the growth rate of the price level,

$$\pi = \%\Delta P = \%\Delta M + \%\Delta V - \%\Delta Y$$

- Since we assume velocity is constant, its growth rate is zero, so the quantity theory of money is also a theory of inflation:

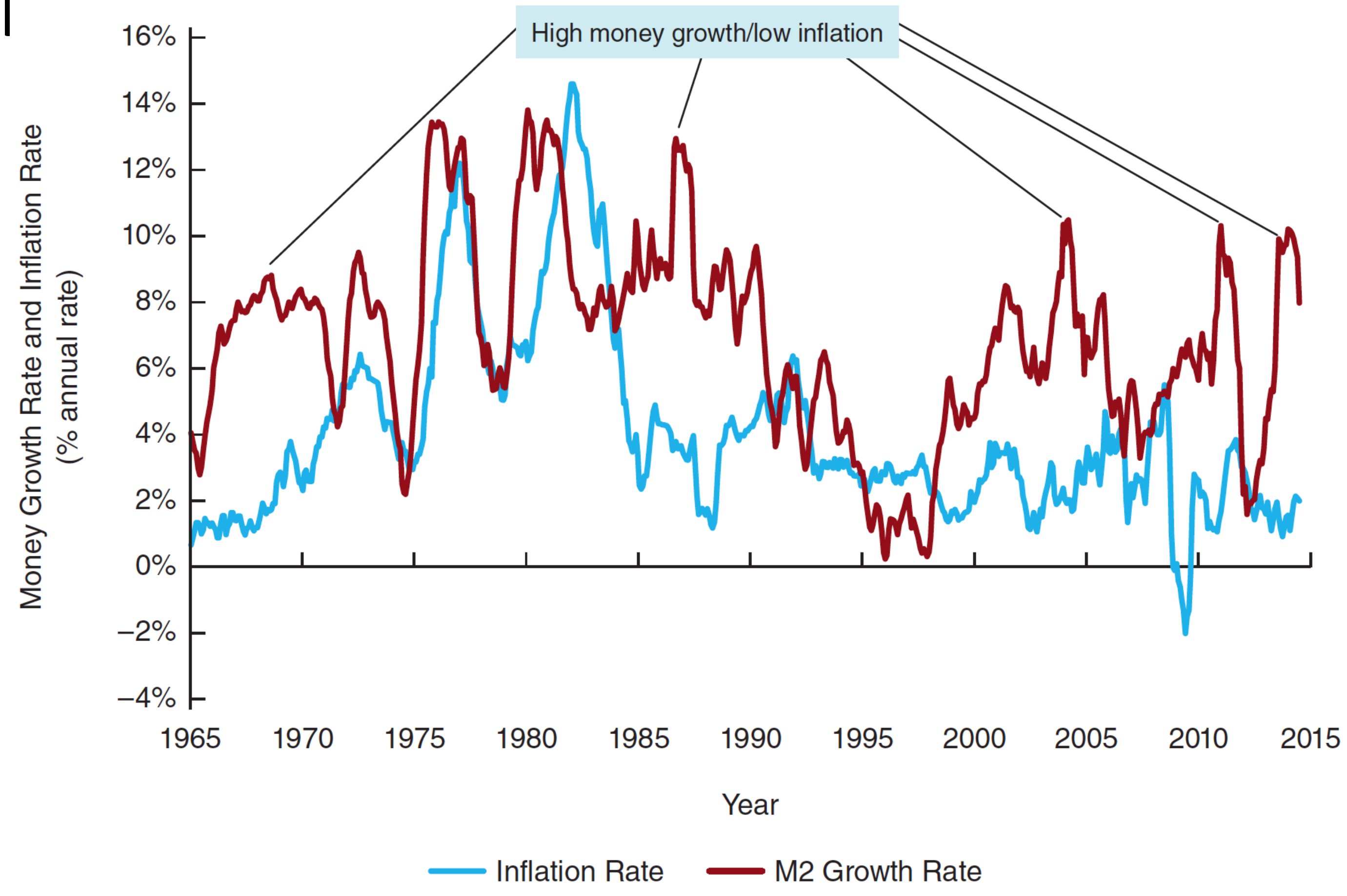
$$\pi = \%\Delta M - \%\Delta Y$$

Figure 1 Relationship Between Inflation and Money Growth



Sources: For panel (a), Milton Friedman and Anna Schwartz, *Monetary Trends in the United States and the United Kingdom: Their Relation to Income, Prices, and Interest Rates, 1867–1975;* Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/. For panel (b), International Financial Statistics. International Monetary Fund, http://www.imfstatistics.org/imf/.

Figure 2 Annual U.S. Inflation and Money Growth Rates, 1965–2015



Sources: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

Budget Deficits and Inflation

- There are two ways the government can pay for spending: raise revenue or borrow
  - Raise revenue by levying taxes or go into debt by issuing government bonds
- The government can also create money and use it to pay for the goods and services it buys

$$Def = G - T = \Delta MB + \Delta B$$

Budget Deficits and Inflation

- The government budget constraint thus reveals two important facts:
  - If the government deficit is financed by an increase in bond holdings by the public, there is no effect on the monetary base and hence on the money supply.
  - But, if the deficit is not financed by increased bond holdings by the public, the monetary base and the money supply increase.

Hyperinflation

- **Hyperinflations** are periods of extremely high inflation of more than 50% per month.
- Many economies—both poor and developed—have experienced hyperinflation over the last century, but the United States has been spared such turmoil.
- One of the most extreme examples of hyperinflation throughout world history occurred recently in Zimbabwe in the 2000s.

THE CAMBRIDGE EQUATIONS:
THE CASH BALANCES APPROACH

- **It examined the determination of prices from the perspective of the demand and supply of money. Some of the best known exponents of**

- **Theory by Cambridge Economists: Marshal, Robertson, Pigou, and Keynes**

- **Pigou (1917)**

The Theory:

- **The concept of supply of money is exogenously determined at a point in time by the banking system**
- **The concept of velocity is altogether discarded in the cash balance approach because it obscures the motives and decisions behind it**
- **The concept of demand for money plays a major role in determining the value of money**
- **It considers demand for money not as a medium of exchange but as a store of value**

The value of money is determined by the demand for cash balances: When the M^d increases, expenditure on goods and services reduces in order to increase their cash balance

What determines Demand for money??

- **The actual demand for currency and demand deposits is**:
- determined by the *proportion* of his resources that the average man chooses to keep in that form.
- This proportion depends upon the convenience obtained and
- the risk avoided through the possession of such titles, by the loss of real income involved through the provision to this use of resources that might have been devoted to the production of future commodities, and
- by the satisfaction that might be obtained by consuming resources immediately and not investing at all.

Demand for money cont.

- Pigou thus claimed that the individual is not directly concerned with the demand for money but with its relation to his total resources.

- These resources can be interpreted as wealth in stock terms or as income/expenditures in flow terms and proxy by income (Y.

Cash balance Approach

K is of its services

Representing the internal rate of (real) return on investment as *r* and

- assuming it to be an approximate measure, in equilibrium, of the satisfaction foregone by not consuming, the ratio of money balances demanded (*M*d) to total nominal expenditures (*Y*)
- is given by:

$$Md/Y = k(r); \quad k'(r) < 0$$

- where *k* is a *functional* symbol. *M*d/*Y* decreases with *r*, or, in Pigou's words, "the variable *k* will be larger the less attractive is the production use and the more attractive is the rival
- money use of resources."
- Hence, $\partial k/\partial r < 0$. Therefore, the demand for money balances,

*M*d, is: **$Md = k(r)Y$**

Determination of the price level in the cash balance approach

- Assuming a given money supply M, equilibrium in the money market with Md = $k(r)Y$ requires that: M=Md

$$M = k(r)Y$$

Writing Py for Y , with P as the price level and y as the real amount of goods,

$$M = k(r)\ Py$$

Assuming that output y is at its full employment level **yf** in equilibrium, $y = y$f , so that the equation

becomes:

- $M = k(r)\ P\boldsymbol{y}\mathbf{f}$, where $\partial y\mathrm{f}/\partial P = 0$ and $\partial y\mathrm{f}/\partial M = 0$.

Further, Pigou assumed that the equilibrium rate of return ($r*$) was determined by the marginal productivity of capital (MPK), which was taken to be independent of the money supply and the price level, so that

$\partial r*/\partial P$ =0 and

$\partial r*/\partial M$ =0.

Cash balance Approach

- Therefore, in equilibrium, $M = k(r*)\, Py^f$ so that, in equilibrium,
- $P = M/[k(r*) \cdot y^f]$
- which implies that:

$$\partial P/\partial M = 1/\left[k\left(r^*\right)\cdot y^f\right]$$

and

$$E_{P \cdot M} = (M/P)\cdot(\partial P/\partial M) = 1$$

where *EP·M.* is the elasticity of *P* with respect to *M*. Since this elasticity equals unity, the price level will, in *comparative static equilibria*, vary proportionately with the money supply.
Therefore, the equation above establishes Pigou's version of the quantity theory proposition.

Implications

- The cash balance approach starts its statement of the quantity theory as a theory of demand, supply and equilibrium in the money market and then proceeds to place it in a long-run general equilibrium approach to the economy. From a rigorous standpoint, it does not become a theory of the price level until the complete model – which includes the determination of output and interest rates – is specified.

- On the latter variables, Pigou and his colleagues in the quantity theory tradition had in mind the then generally accepted traditional classical ideas on the determination of output and interest rates.
- However, there was a setback to the theory in that it did not specify the determination of aggregate demand and its impact on output in short-run equilibrium, as well as in disequilibrium.

Velocity in the cash balance approach

- On the velocity of circulation V in Pigou's analysis, we have from (11) that:
- $V = Y/M = 1/[k(r)]$. This implies that Velocity is not constant: it depends on the rate of returns on investment

- However, the Cambridge school often fell into the habit of treating k as a constant even though it was a functional symbol with $k(r)<0$, so that velocity also became a constant both in and out of equilibrium.

Legacy of the cash balance approach

1. *The provision of convenience in transactions.*

2 *The provision of security against unexpected demands due to a sudden need or to a rise in the prices.*

- The former was related to the demand for the medium of exchange function of money and
- the latter to its store of value function. These reasons for holding money were restated by Keynes in 1936 into the transactions motive and the precautionary motive.

Question?????????

- Discuss the Cambridge Cash Balance Approach to the Quantity theory of money. How far is it superior to the Cash Transactions Approach?

Money demand and the quantity equation

- Money demand: $(M/P)^d = kY$
- Quantity equation: $M \times V = P \times Y$
- The connection between them: $k = 1/V$
- When people hold lots of money relative to their incomes (k is high), money changes hands infrequently (V is low).

Money demand and the quantity equation

- ***M*/*P*** = **real money balances**, the purchasing power of the money supply.

- A simple money demand function:

  $(M/P)^d = kY$

  where

  k = how much money people wish to hold for each dollar of income.

  (***k*** is exogenous)

Keynes Paradigm

- John Maynard Keynes's *The General Theory* (1936) represents a milestone in the development of macroeconomics and monetary thought.
- Varied and important contribution to the modern macroeconomic management, particularly the emphasis on AD;
- Modern perspectives: Decisions made under uncertainties with imperfect information on the future;
- The influence of fiscal policy and monetary policy on output
- Because of the inflexibility in wage adjustments, economy is, usually likely to end up with more or less than full employment.

Keynes contribution cont.

- Absence of full employment in the economy as in realities countries in the past and even recently have had experienced depressions and regressions;

- Non-neutrality of money:

KEYNES'S REFORMULATED QUANTITY THEORY OF MONEY

Modification:

He Integrates Monetary theory with value theory and linked the theory of interest into monetary theory

Assumptions:

- All factors of production are in perfectly elastic supply so long as there is any unemployment.
- All unemployed factors are homogeneous
- There are constant returns to scale so that prices do not rise or fall as output increases.
- Effective demand and quantity of money change in the same proportion so long as there are any unemployed resources.

Keynes QTM

- Main points

➢ The channel of influence (or the causation) between changes in qty of money and prices is an indirect one through inflation:

➢ Transmission Mechanism (Unemployment)

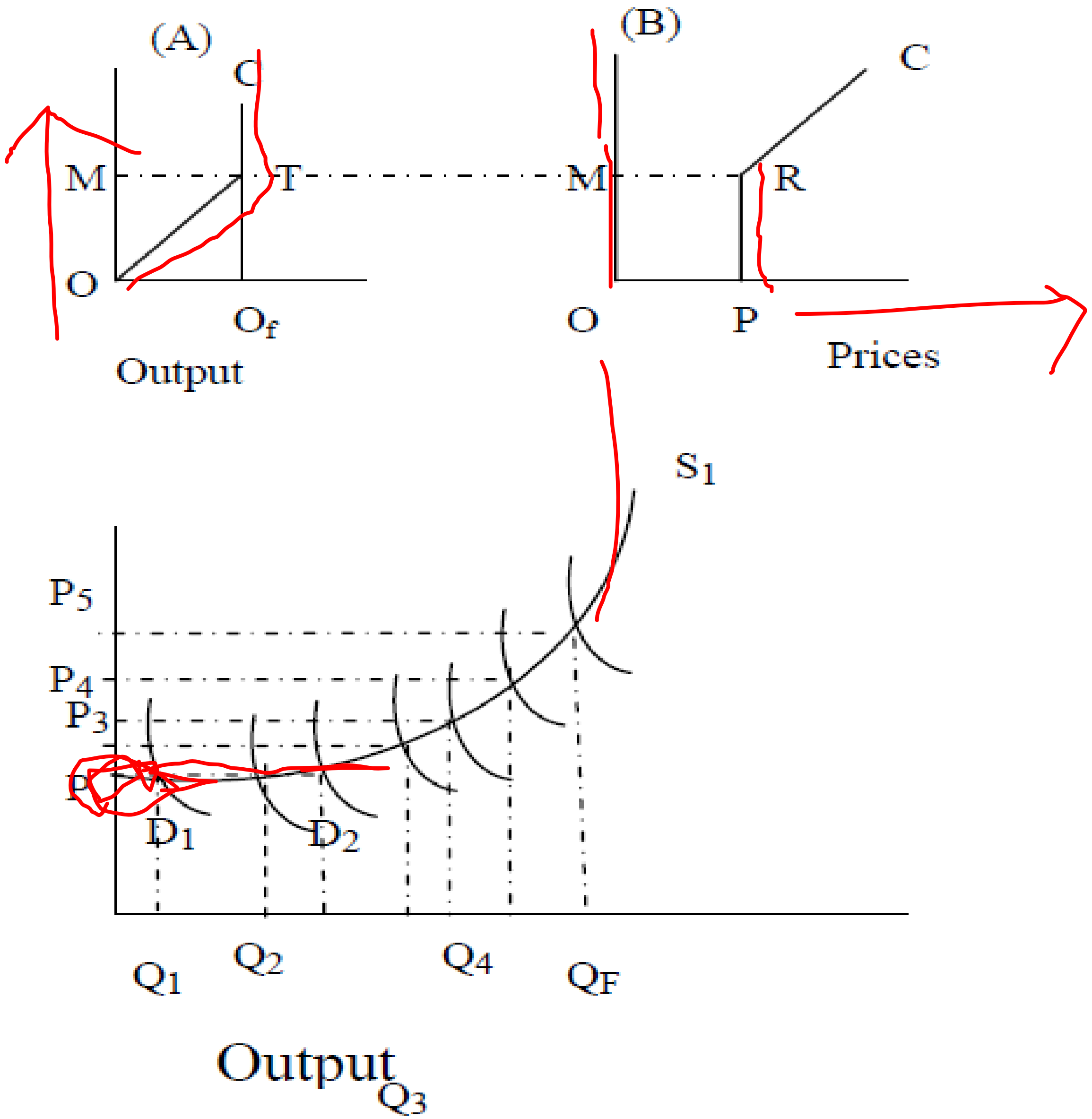
$$M^s \uparrow \longrightarrow r \downarrow \longrightarrow I \uparrow \longrightarrow AD \uparrow \longrightarrow Q \uparrow \quad Emp \uparrow$$

($\Delta P = 0$)

Full Employment

$$M^s \uparrow \longrightarrow (\Delta Q = 0) \longrightarrow P \uparrow$$

(by the same % as the change in M^s)


(A)
C
M
T
O
O_f
Output
(B)
C
M
R
O
P
Prices
S_1
P_5
P_4
P_3
P
D_1
D_2
Q_1
Q_2
Q_4
Q_F
Output
Q_3

Keynesian Theories of Money Demand

- Keynes's liquidity preference theory
- Why do individuals hold money? Three motives:
  - Transactions motive
  - Precautionary motive
  - Speculative motive
- Distinguishes between real and nominal quantities of money

Transactions Motive

- Keynes initially accepted the quantity theory view that the transactions component is proportional to income.
- Later, he and other economists recognized that new methods for payment, referred to as **payment technology**, could also affect the demand for money.
- Mtr $= M^{tr}(Y)$
- where M^{tr} increases as Y increases.

Transaction Md

- The transactions motive was further separated into

1.“**an income-motive**” to bridge the interval between the receipt of income and its disbursement by households, and

2. a “**business motive**” to bridge the interval between payments by firms and their receipts from the sale of their products:

- This reasoning implies that Y / M^{tr} is a constant k, independent of income and interest rates,
- so that Keynes’s transactions demand for money was: $M^{tr} = kY$

Precautionary Motive

- Keynes's second motive for holding money was the precautionary one, defined by him as
- *the desire for security as to the future cash equivalent of a certain proportion of total resources.*

- Keynes also recognized that people hold money as a cushion against unexpected wants.
- Keynes argued that the precautionary money balances people want to hold would also be proportional to income.

Speculative Motive

- Keynes's third motive for holding money was:
- ***speculative-motive,*** i.e*. the object of securing profit from knowing better than the market what the future will bring forth.*
- Keynes also believed people choose to hold money as a store of wealth, which he called the **speculative motive**.

Speculative Demand for Money (M^s)

- Money held speculative purposes is a liquid store of value which can be invested at an opportune time in interest-bearing bonds or securities.
- Bond prices and interest rate are invested related. B =

V: the value (price)of bond, R is the fixed rate on bonds and r = r is the r rest

$$V = \frac{R}{r}$$

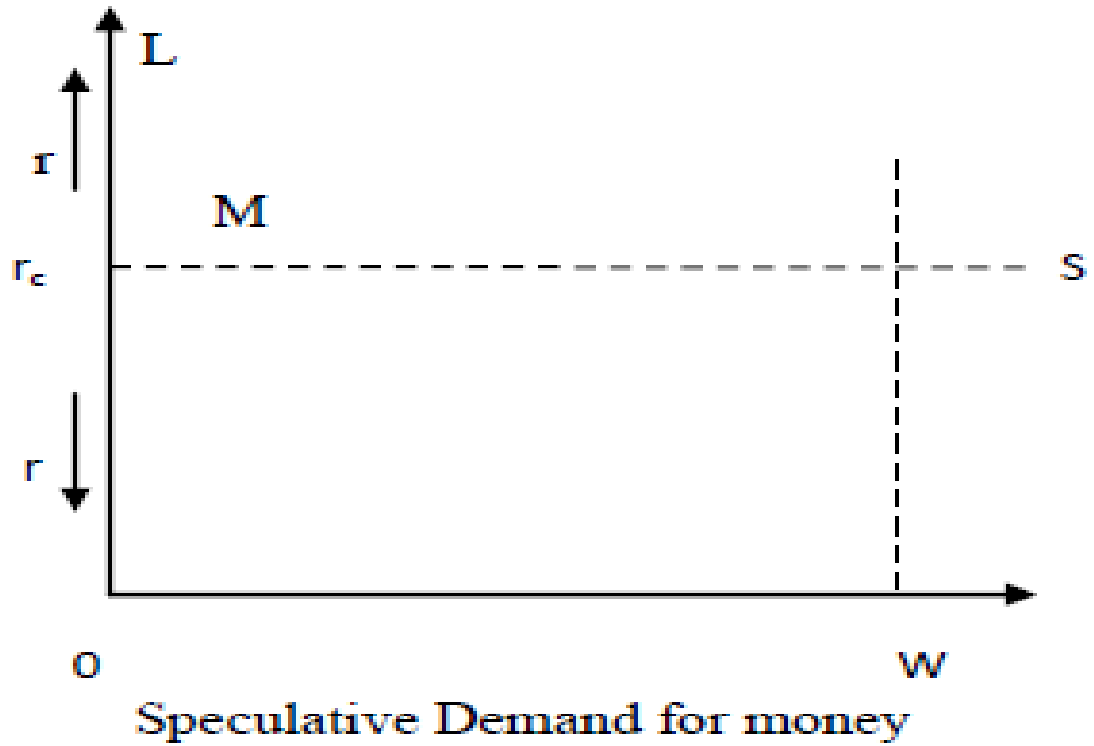
➢It's the changes hat determines M^s

$M^s = S(v, r)$

Speculative demand cont.

- Keynes has a normal or critical interest rate (r_c).
- If, $r > r_c$, an investor holds all his liquid assets in bonds
- If, $r < r_c$ an investor holds all his assets in cash
- If, $r = r_c$???

M^s cont.



When $r > r_c$ = LM,
when $r < r_c$ = OW

M^s = LMSW

Tobin's formalization of Keynes's speculative money demand

- Tobin assumes that there are only two assets, money and bonds,
- in which the individual can invest the amount of funds in his portfolio
- Money is assumed to have a known yield of zero and is therefore riskless in the sense of possessing a zero standard
- deviation of yield. The bond is a consol, also known as a "perpetuity".

Tobin’s speculative demand for money

- capital markets, the market price of a consol will equal its present discounted
- value. Therefore, the price *p*b of a consol which has a nominal coupon payment *c* per period,
- and is discounted at a market rate of interest *x* on loans

$$p_b = \frac{c}{1+x} + \frac{c}{(1+x)^2} + \cdots$$

$$= c\left(\sum_{t=1}^{\infty} \frac{1}{(1+x)^t}\right)$$

$$= c\left(\frac{1}{x}\right) = \frac{c}{x}$$

Tobin’s speculative demand

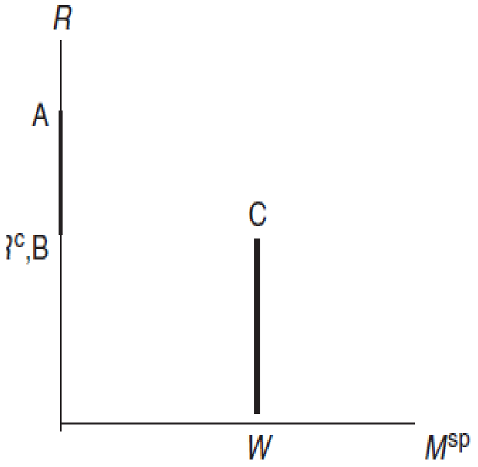
Assume that:

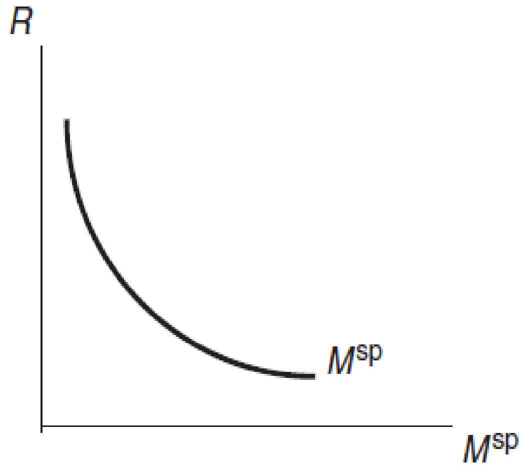
- the market interest rate is \$*R* per year
- the consol is expected to pay a coupon \$*R* per year in perpetuity. Implying that R/R=1
- Th price of the consol is \$1
- the market rate of return on consols is expected to be R^e for the future;
- This means that the expected value of the consol next year will be *R*/ R^e
- the expected capital gain or loss *G* on the consol will be: *G* = *R/* R^e −1;
- The expected yield (or the expected rate of returns) (*R*+*G*) from holding a consol costing \$1 is the sum of its coupon *R* and its capital gain *G*.
- *ER*= *R*+*G* = *R*+*R/* R^e −1

Tobin's speculative demand

- If the yield ER(*R*+*G*) were greater than zero, the rational individual would buy only consols; why???
- Therefore the optimal condition from holding bonds to money occurs at *R*+*G* =0.
- Representing this as the Keynes critical individual level interest rate to derive the *critical level* R^c of the current return *R*
- $R^c = R^c / R^e - 1 = 0$
- For a given R^e , if the current interest rate *R* is above R^c , (*R*+*G*) > 0 and only consols or bonds will be bought;
- If it is below R^c , (*R*+*G*) < 0 and only money will be held.
- Therefore, the individual's demand for money is the discontinuous step function as shown in the figure below (AB, CW)

Tobin's speculative dd for M





Keynes's analysis implies that the speculative demand for money depends inversely upon the rate of nterest, so that the speculative demand function for money can be written as:

*M*sp = *L*(*R*) which was later expanded to include financial wealth (FW) so that *Msp = L(R,FW)*

Putting the Three Motives Together

The aggregate demand for money, *M*, depends positively upon the level of income *Y* due to the transactions and precautionary motives and negatively upon the rate of interest *R(or i)* due to the speculative motive.

The demand function for money balances M^d is given by:

$$M^d = M^{tr} + M^{sp} = kY + L(R) = kPy + L(R)\text{ , where } k > 0 \text{ and } L(R) < 0.$$

$\frac{M^d}{P} = f(i, Y)$ where the demand for real money balances is

negatively related to the interest rate i,

and positively related to real income Y

Rewriting

$$\frac{P}{M^d} = \frac{1}{f(i, Y)}$$

Multiply both sides by Y and replacing M^d with M

$$V = \frac{PY}{M} = \frac{Y}{f(i, Y)}$$

Putting the Three Motives Together

- Velocity is not constant:
  - The procyclical movement of interest rates should induce procyclical movements in velocity.
  - Velocity will change as expectations about future normal levels of interest rates change

Portfolio Theories of Money Demand

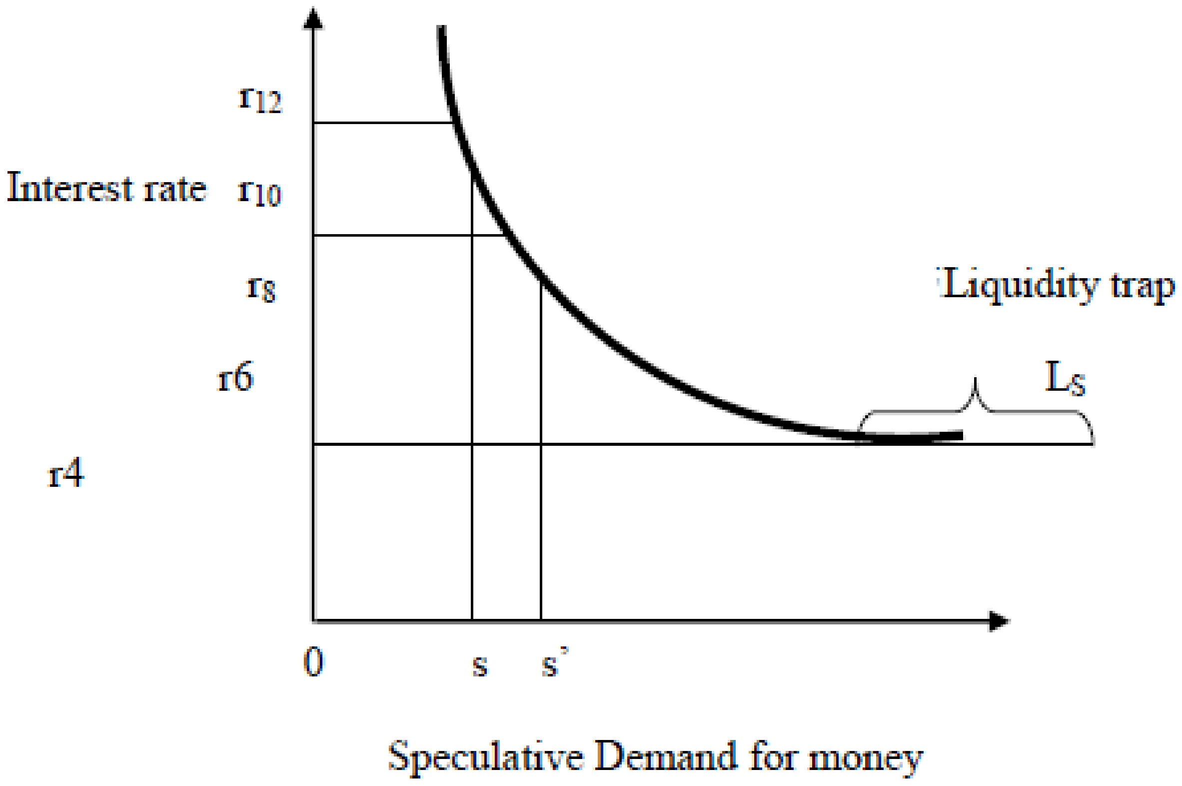
- Theory of portfolio choice and Keynesian liquidity preference
  - The theory of portfolio choice can justify the conclusion from the Keynesian liquidity preference function that the demand for real money balances is positively related to income and negatively related to the nominal interest rate.

Portfolio Theories of Money Demand

- Other factors that affect the demand for money:
  - Wealth
  - Risk
  - Liquidity of other assets;

The Volatility of the Money Demand and preference for fiscal policy other than monetary policy***

Liquidity Trap



When the market interest rate is so low that the yields on bonds will also be low making a change in quantity supply of money or monetary policy ineffective

Keynes's and the early Keynesians' preference for fiscal versus monetary policy

- Keynes asserted that the speculative demand function for money was very volatile
- – that is, this function shifts often.
- Instability into the aggregate demand, prices and output in the economy;
- the pursuit of monetary policy, which could trigger changes in the investors' expectations, very risky.
- Radcliffe report- Britain in 1958,

FRIEDMAN'S RESTATEMENT OF THE QUANTITY THEORY OF MONEY

- Friedman asserts that the QTM is in the first instance a theory of demand for money: money matters,
- **Real cash balances (M/P) is regarded as a commodity which is demanded because it yields services or returns to the person who holds it.**

- **Demand for money (M/P) is a function of the following:**

➢ Total Wealth. The total wealth is the analogue of the budget constraint. It is the total that must be divided among various forms of assets.

➢ The Division of Wealth between human and non-human forms. The major source of wealth is the productive capacity of human beings which is human wealth.

➢ The Expected Rates of Return on money and other Assets. These rates of return are the counterparts of the prices of a commodity and its substitutes and complements in the theory of consumer demand.

➢ Other Variables. Variables other than income may affect the utility attached to the services of money which deter liquidity proper.

Composition of Wealth

- **W = All sources of income or consumables**
- **Money** is taken in the broadest sense to include currency, demand deposits and time deposits which yield interest on deposits.
- **Bonds** are defined as claim to a time stream of payments that are fixed in normal units
- **equities** are defined as a claim to a time stream of payments that are fixed in real units
- **physical goods or non-human goods** are inventories of producer and consumer durable
- **Human capital** is the productive capacity of human beings.

Friedman Eq

- The present discounted value of these expected income flows from these five forms of wealth constitutes the current value of wealth which can be expressed as:
- $$w = \frac{y}{r}$$
- W is the current value of total wealth. Y is the total flow of expected income from the five forms of wealth, and r is the interest rate.

Friedman QTM

- demand function for money for an individual wealth holder with slightly different notations from his original study of 1956 as:
-
- **$M/P=f(y, w; R_m, R_b, R_e, g_p, u)$**

M = the total stock of money demanded;

P = the price level;

y = the real income;

w = the fraction of wealth in non-human form;

R_m = the expected nominal rate of return on money;

R_b = the expected rate of return on bonds, including expected changes in their prices.

R_e = Expected rate of return on equities, including expected changes in their prices;

g_p = (I/P) (dp/dt) is the expected rate of change of prices of goods and hence the expected nominal rate of return on physical assets; and

u = variables other than income that may affect the utility attached to the services of money.

$$m^{\mathrm{d}} = M^{\mathrm{d}}/P = m^{\mathrm{d}}(r_1, \ldots, r_n, \pi, w, HW/NHW)$$

where:

m^{d} = demand for money balances in real terms
M^{d} = demand for money balances in nominal terms
P = price level
r_i = yield in real terms on the ith asset
π = rate of inflation
w = wealth in real terms

HW/NHW ratio of human to non-human wealth.

Stability of velocity

- $m^d = M^d/P = m^d(r_1, \ldots, r_n, \pi, w, HW/NHW)$
- $m^d = M^d/P = m^d(r_1, \ldots, r_n, \pi, y^p, HW/NHW, u)$
- Since the velocity of circulation V equals Y/M, and M in equilibrium equals M^d, we have:

$$V = \frac{y}{m^{\mathrm{d}}(r_1, \ldots, r_n, \pi, y^{\mathrm{p}}, HW/NHW, u)}$$

Implications

- *Friedman on the money supply*
- the money demand and supply functions were separate
- Money supply is exogeneous;

- ***Friedman on inflation, neutrality of money and monetary policy***

- Friedman held that money was neutral in the long run; but not in the short run;
- Anticipated and unanticipated inflation;
- Lags
- Discretionary and non-discretionary monetary policy

Distinction between Friedman and Keynes’ demand for money theory

- Discuss?????????????????

Keynes vs Friedman

- Friedman’s main concern in deriving his demand function was with money as a real asset held as an alternative to other forms of holding wealth, whereas Keynes’s analysis was for the demand for nominal money balances.

- Friedman’s analysis also implied that money demand depends on wealth or permanent income, rather than on current income as in Keynes’s analysis.

- Friedman believed that the demand for money does not in practice become infinitely or perfectly elastic thereby agreeing with Keynes on the absence of the liquidity trap in practice.

- Friedman believed that the money demand function was stable, whereas Keynes had adduced the subjective nature of probabilities in the absence of complete information on the future returns on bonds to derive the volatility of the speculative and overall money demand.

- Friedman further asserted that the money-demand and velocity functions were even more stable than the consumption function

The Heritage Views on Transmission Mechanism

- *for the impact of monetary policy on output:*
- David Hume (1752) had specified this mechanism as being of a dual nature.
- Hume emphasized two channels of influence of increases in the money supply.

- One of these was through increased spending on commodities, mainly by those whose consumption absorbs virtually all their incomes.

➢ Direct transmission mechanism;

The other operated through the increased availability

- of loanable funds.

➢ Indirect transmission mechanism

Direct transmission mechanism channel

- This is where an increase in the money supply cause undesired money balances which are then directly spent on commodities;
- It is associated with the followers of the quantity theory.

Indirect transmission mechanism

- The Keynesian tradition and the IS–LM macroeconomic models ignore the direct transmission channel;

- Money supply increases affect the economy by lowering interest rates, which increase investment, which in turn pushes up nominal national income through the multiplier in the commodity markets.

M^T and Interest Rates

Keynes: Interest inelastic (r=0)

- Transactions balances are held because income.

Alternative View:

W. Baumol (1952)

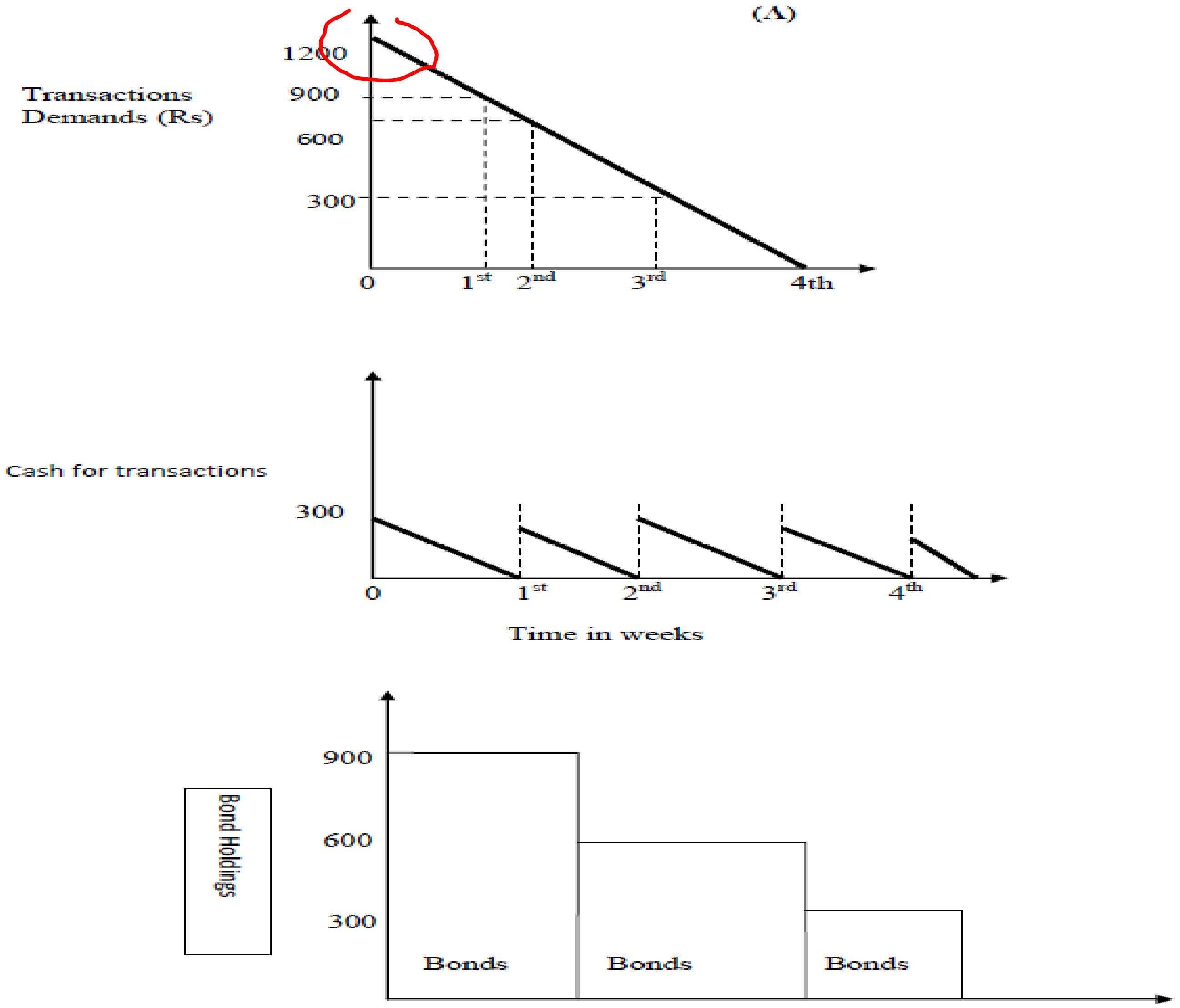
J. Tobin (1956)

M^T and income is non-linear and not proportional

- Interest rate is an important determinant
- $M^T = f(y, r)$
- A portion MT can be invested in interest-bearing assets

- Consider the cost and the inconvenience of purchase and sale of bonds to the interest expected to be earned

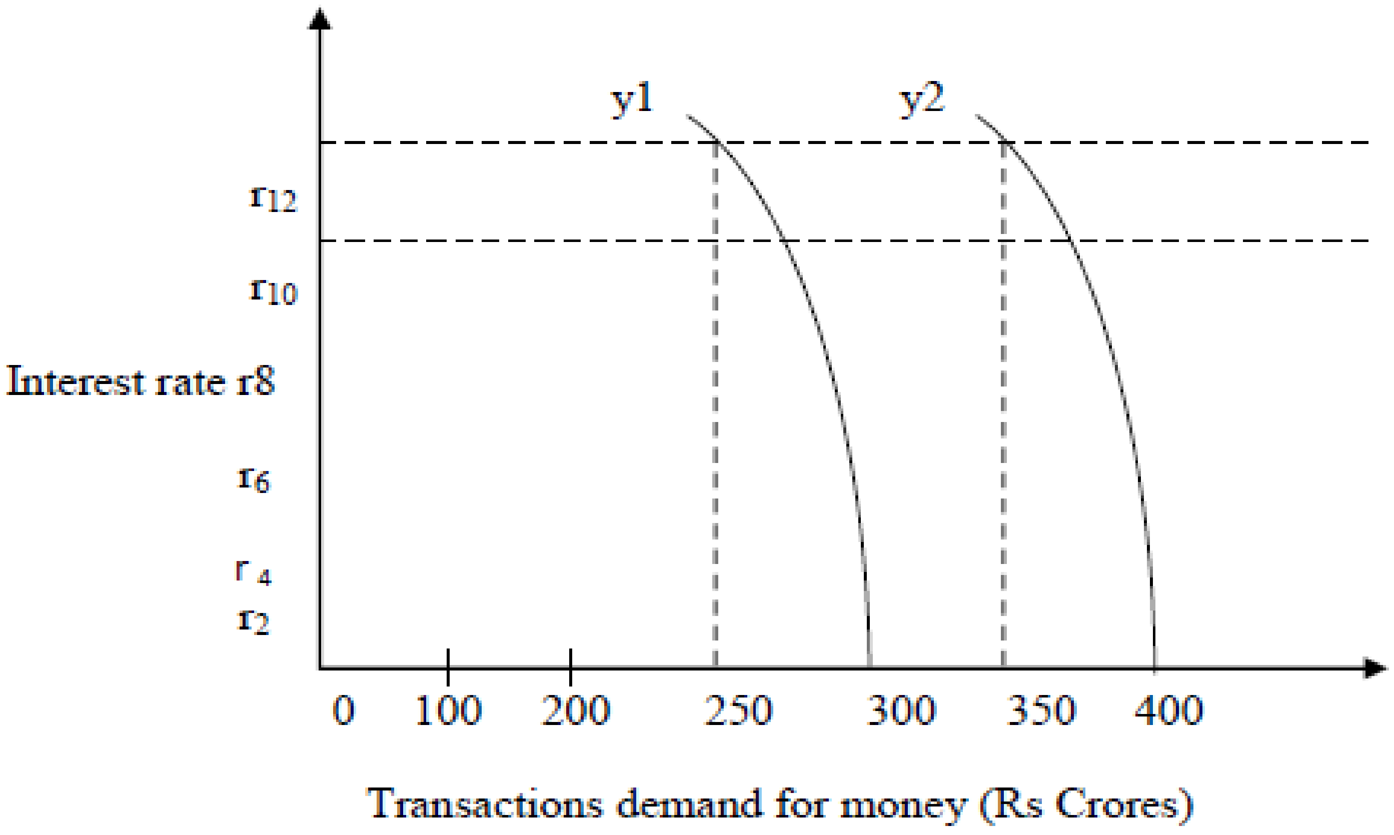
M^T and interest rates



LT = f(y, r)

Interest rate cont

- So long as interest rate is below certain level, MT will be inelastic, but if it's move above this level, it becomes sensitive to interest rate



Precautionary Demand for Money (M^p)

- M^p is keeping cash against unforeseen contingencies and unexpected needs
- Keynes: $M^p = f(y)$
- Post Keynesian: $M^p = L(y, r)$

Baumol's Inventory Theoretic Approach

- Baumol shows that M^T is neither linear nor proportional.
- Changes income lead to a less than proportionate M^T
- The theory is based on holding an optimum inventory of money of money for transaction purposes.
- A firm would always try to keep minimum transaction balances in order to earn maximum interest from its assets
- The higher the interest rate on bonds, the lesser transaction demand

Minimization of cost of transaction

C = R k /2 +b y/k

The optimal value of k is that which minimizes the total inventory cost C. by differencing C with respect to K, setting the derivative dc/dk equal to zero and solving for c , we obtain

d/c = r/ c +-by/k2 = 0

or

Multiply both sides by 2k2/r, we obtain

k2 – 2by/r

or k= 2by/ r

md / p = k/2

$= 1/2\sqrt{2by} / r$

$Md = 1/2 \dfrac{\sqrt{2by}}{R} p$

The Transaction Demand for Money: The Inventory Theoretical Approach

M^T and Interest Rates

Keynes: Interest inelastic (r=0)

- Transactions balances are held because income.

Alternative View:

W. Baumol (1952)

J. Tobin (1956)

M^T and income is non-linear and not proportional

- Interest rate is an important determinant
- $M^T = f(y, r)$
- A portion M^T can be invested in interest-bearing assets
- Consider the cost and the inconvenience of purchase and sale of bonds to the interest expected to be earned
- **The Baumol-Tobin model is Cash-management approach**

Assumptions

- The Baumol-Tobin model is based on a formula called the square-root rule. This is akin to the square-root rule for inventories.

- The square-root rule says that stores should hold inventories proportional to the square-root of sales. The same square-root rule applies to the demand for money also.

Assumptions

1. Assumes two assets: “money” and “bonds,” : the former serves as the medium for payments in the purchase of commodities whereas bonds do not;

2. There is no uncertainty in the model, so the yield on bonds is known with certainty. E.g., is interest-paying savings deposits or such riskless short-term financial assets as Treasury bills;

Assumptions

3. Holding money earns no interest. Bond holdings do so at the nominal rate *R*. There are no own-service costs of holding money or bonds, but there are transfer costs from one to the other, as outlined later;
4. Bonds can be savings deposits or other financial assets;
5. There is no uncertainty even in the timing or amount of the individual's receipts and expenditures;
6. The individual intends to finance an amount \$*Y* of expenditures, which occur in a steady stream through the given period, and already possesses the funds to meet these expenditures;
7. Since money is the medium of payments in the model, all payments are made in money;
8. The individual intends to cash bonds in lots of \$*W* spaced evenly through the period;
9. For every withdrawal, he incurs a "brokerage (bonds–money transfer) cost" that has two components: a fixed cost of \$*B*0 and a variable cost of *B*1 per dollar withdrawn. Examples of such brokerage costs are broker's commission, banking charges and own (or personal) costs in terms of time and convenience for withdrawals (long queues in banking halls) from bonds;

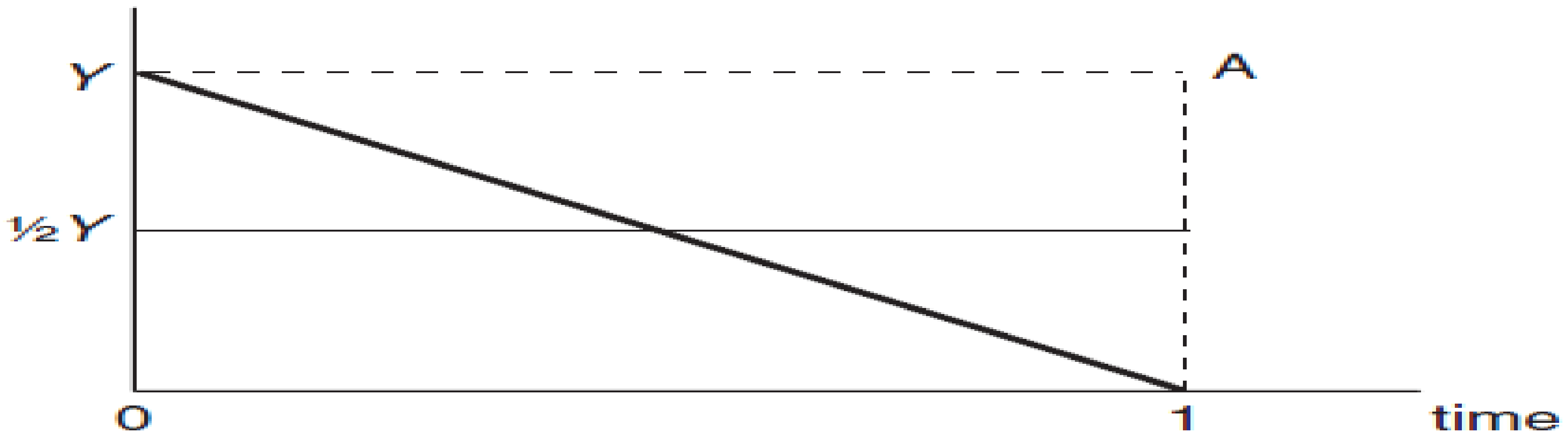
3. The overall cost per withdrawal of \$*W* is \$(*B*0 +*B*1*W*).

Baumol-Tobin model

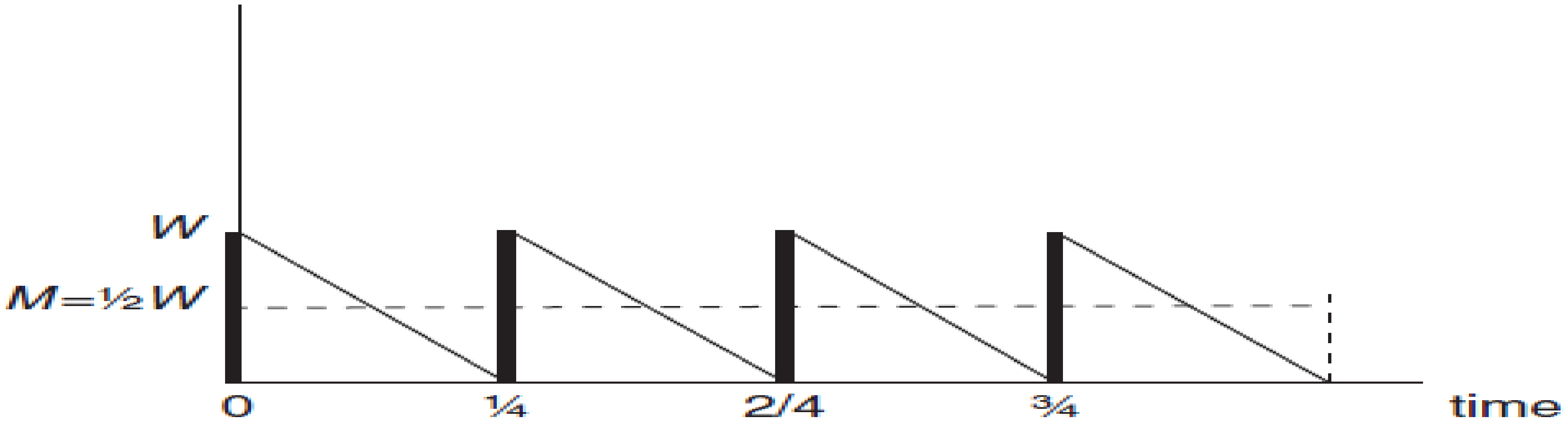
- The individual starts with $\$Y$ and spends it in a continuous even stream over the period,

- Then his average holdings, over the period, of the funds held in bonds B and money M are only $Y/2$. Hence, $M + B = \frac{1}{2}Y$.
- Further, since the individual withdraws W each time and spends it in a continuous steady stream, and draws out a similar amount the moment it is spent, his average transactions balances M are $\frac{1}{2}W$.

- the triangle 0Y1 represents the amount of income that has not been spent at the various points of time within the period and
- 1YA is the amount that has been spent. 0Y1 equals $\frac{1}{2}Y$ over the period and would be held either in money or in bonds



Y
A
½ Y
0
1
time



W
M=½W
0
¼
2/4
¾
time

Cont.

- Since the total expenditures of Y are withdrawn from bonds in lots of W, the number n of withdrawals is **(Y /W).** The cost of withdrawing Y from bonds is the cost per withdrawal times the number of withdrawals and is given by **[(B_0 +B_1W)n].**
- The interest foregone by holding money rather than bonds is RM. Since M = ½W, this interest cost equals ***RW/2***.
- The total opportunity cost C of financing Y of expenditures in this manner is the sum of then cost of withdrawing Y from investments and the interest foregone in holding average money balances of (W/2).

➢ $C = RM + (B_0 + B_1W)n$

➢ $= RW/2 + B0 \cdot Y/W + B1Y$

Cost minimization

The economic agent is expected to be rational and therefore will act in a way that minimizes his cost

Therefor differentiating C with respect to *W* equal to zero. This yields:

$$\partial C/\partial W = R/2 - B_0 \cdot Y/W^2 = 0$$

so that:

$$W = [2B_0 \cdot Y/R]^{½}$$

and

$$M^{tr} = ½W = (½B_0)^{½}Y^{-½}R^{-½}$$

This is called the *square root formula* in inventory analysis and has the easily identifiable form of a Cobb–Douglas function.

The inventory demand for money

- If Brokerage cost are considered as commodities, then it is like prices charge for brokerage services, which are commodities, so that:
- let $B_0 = P.b_0$ and $B_1 = P.b$: *then*

$$M^{\mathrm{tr,d}} = (\tfrac{1}{2}b_0)^{\frac{1}{2}} P y^{\frac{1}{2}} R^{-\frac{1}{2}}$$

and

$$M^{\mathrm{tr,d}}/P = m^{\mathrm{tr}} = (\tfrac{1}{2}b_0)^{\frac{1}{2}} y^{\frac{1}{2}} R^{-\frac{1}{2}}$$

Therefore, we can find the elasticities of the transactions demand for money with respect to y, R and P

Elasticities of the Transaction demand for money

- $E_{m.y} = ½$
- $E_{m.R} = -½$
- $E_{M.P} = 1$
- $E_{m.P} = 0$
- *Elasticity of the demand for nominal balances with respect to nominal income*
- ($E_{M.Y}$)

Implications: Profitability

- **The profitability of holding money and bonds for transactions**
- under Baumol's assumptions the individual spends his income *Y* in an even stream over the period and therefore holds ½*Y* on average in either money or bonds

- His average nominal holdings *B* of bonds are, therefore, equal to (½*Y* −*M*), where, as before, *M* equals ½*W*. The individual earns interest at the rate *R* on these bond holdings. The profit from holding either money or bonds equals this interest income from holding bonds less the brokerage cost of money withdrawals from bonds.

- That is, the profit $\boldsymbol{\pi}$ from using the combinations of money and bonds is given by:
- π = interest income from bonds − brokerage expenses

$$= R \cdot B - (B_0 + B_1 W)n$$

$$= R\{½Y - M\} - \{½B_0 Y/M + B_1 Y\}$$

$M^{tr} = (\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}$ $\qquad$ $B^{tr} = \frac{1}{2}Y - (\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}$

$$\begin{aligned}
\pi &= R\left\{\tfrac{1}{2} Y - (\tfrac{1}{2} B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}\right\} - \left\{(\tfrac{1}{2}B_0) Y / [(\tfrac{1}{2} B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}] + B_1 Y\right\} \\
&= \tfrac{1}{2} RY - (\tfrac{1}{2} B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}} - \left\{(\tfrac{1}{2} B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}}\right\} - B_1 Y \\
&= \tfrac{1}{2} RY - 2(\tfrac{1}{2} B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}} - B_1 Y
\end{aligned}$$

Simplifying, we get:

$$\begin{aligned}
\pi &= \tfrac{1}{2} RY - 2RM - B_1 Y \\
&= (\tfrac{1}{2} R - B_1) Y - 2RM
\end{aligned}$$

Cont.

- Total interest income from holding money and bonds is reduced by the interest cost of holding money and the variable cost of withdrawing *Y* from bonds.
- Since the second term on the right-hand side is nonpositive, the first term implies that, no matter what the level of income, it would not be profitable to hold bonds unless $R > 2B1$.
- π is non-positive if $R = 0$ or if the total brokerage charges exceed the

income from holding bonds.

- The latter
- The B include the time and inconvenience, etc. – sometimes referred to as the "*shoe-leather costs*" – of trips to the banks and other relevant financial institutions.

Implications

- One major implication of this model is that money being the medium of payment there is some cost involved in transforming interest-earning assets into money, that there is a brokerage fee,
- The spread of modern technology such as use of automatic teller machines, online banking reduces the brokerage cost;
- Improvement in the payment system will improve financial intermediation and inclusion;
- The level of income and economic development matter for the demand for bond and inclusion because of economic of scale: Higher income reduces per unit cost of brokerage; the model predicts that the demand for money will increase in less than proportion to the volume of transactions, that there are economies of scale in money holding for the individual.
- Efficient funds management pays

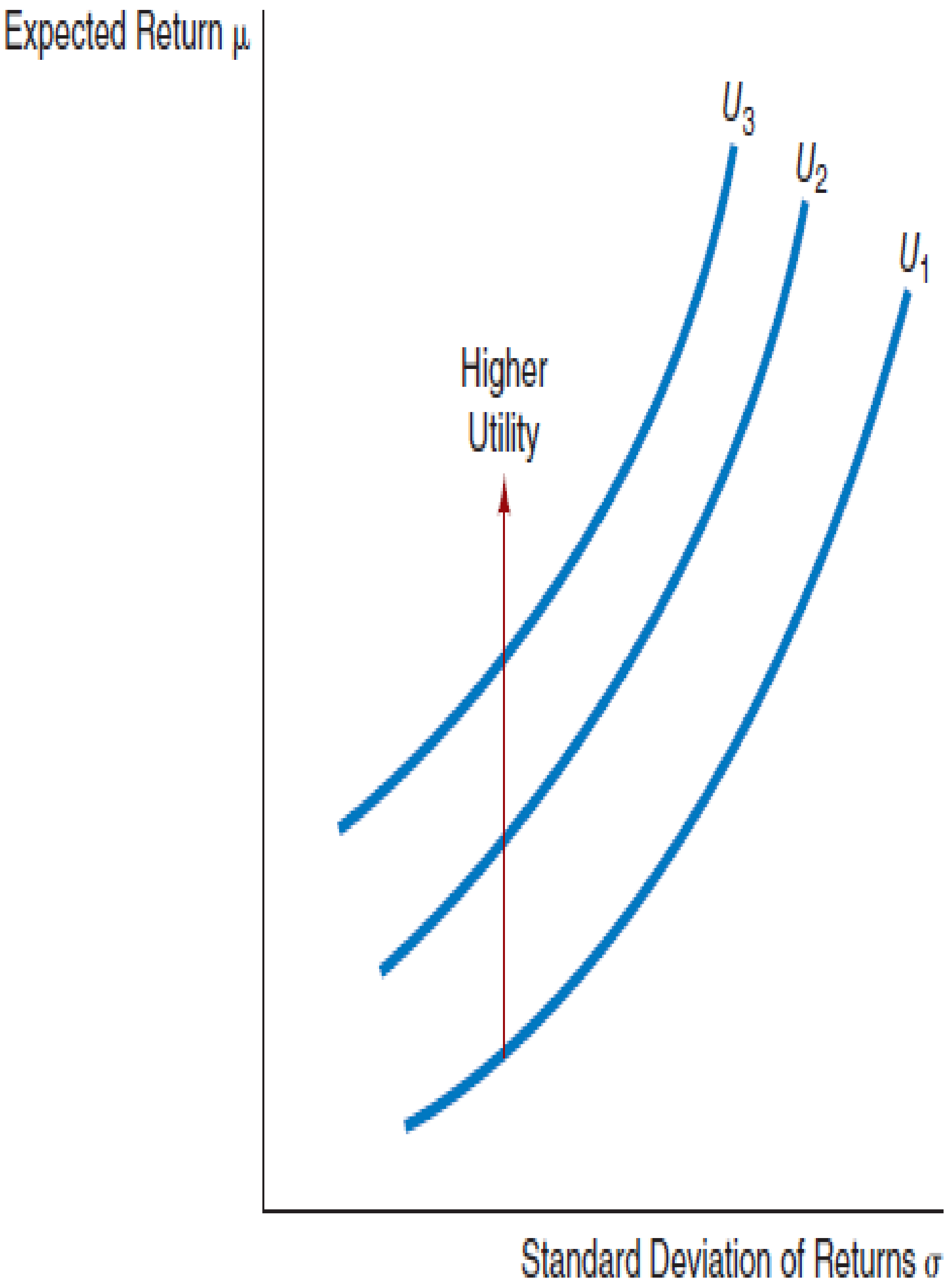
Tobin Mean-Variance Model

- Tobin's mean-variance analysis of money demand is just an application of the basic ideas of the theory of portfolio choice.
- Tobin assumes that the utility that people derive from their assets is positively related to the expected return on their portfolio of assets and
- negatively related to the riskiness of this portfolio as represented by the variance (or standard deviation) of its returns.

- This framework implies that an individual has indifference curves, which can be drawn as in Figure below

- Notice that these indifference curves slope upward because an individual is willing to accept more risk if offered a higher expected return.
- In addition, as we go to higher indifference curves, utility is higher, because for the same level of risk the expected return is higher.
- In other words,

$$U_3 > U_2 > U_1.$$



- Tobin looks at the choice between holding money, which earns a certain return of zero, versus holding bonds, whose return can be stated as:

$$R_B = i + g$$

where i = interest rate on the bond
g = capital gain

Tobin also assumes that the expected capital gain is zero[5] and that its variance is σ_g^2. That is,

$$E(g) = 0 \quad \text{and so} \quad E(R_B) = i + 0 = i$$

$$Var(g) = E[g - E(g)]^2 = E(g^2) = \sigma_g^2$$

where E = expectation of the variable inside the parentheses
Var = variance of the variable inside the parentheses

If A is the fraction of the portfolio put into bonds ($0 \leq A \leq 1$) and $1 - A$ is the fraction of the portfolio held as money, the return R on the portfolio can be written as:

$$R = AR_B + (1 - A)(0) = AR_B = A(i + g)$$

1 Then the mean and variance of the return on the portfolio, denoted respectively by μ and σ^2, can be calculated as follows:

$$\mu = E(R) = E(AR_B) = AE(R_B) = Ai$$

$$\sigma^2 = E(R - \mu)^2 = E[A(i + g) - Ai]^2 = E(Ag)^2 = A^2E(g^2) = A^2\sigma_g^2$$

Taking the square root of both sides of the equation directly above and solving for A yields:

$$A = \frac{1}{\sigma_g}\sigma \tag{2}$$

Substituting for A in the equation $\mu = Ai$ using the preceding equation gives:

$$\mu = \frac{i}{\sigma_g}\sigma \tag{3}$$

Equation 3 is known as the *opportunity locus* because it gives the combinations of μ and σ that are feasible for the individual. This equation is written in a form in which the μ variable corresponds to the y axis and the σ variable to the x axis. The opportunity locus is a straight line going through the origin with a slope of $i/\sigma g$. It is drawn in the top half of Figure 3, along with the indifference curves from Figure 2.

- The highest indifference curve that can be reached is at point B, the point of tangency of the indifference curve and the opportunity locus.

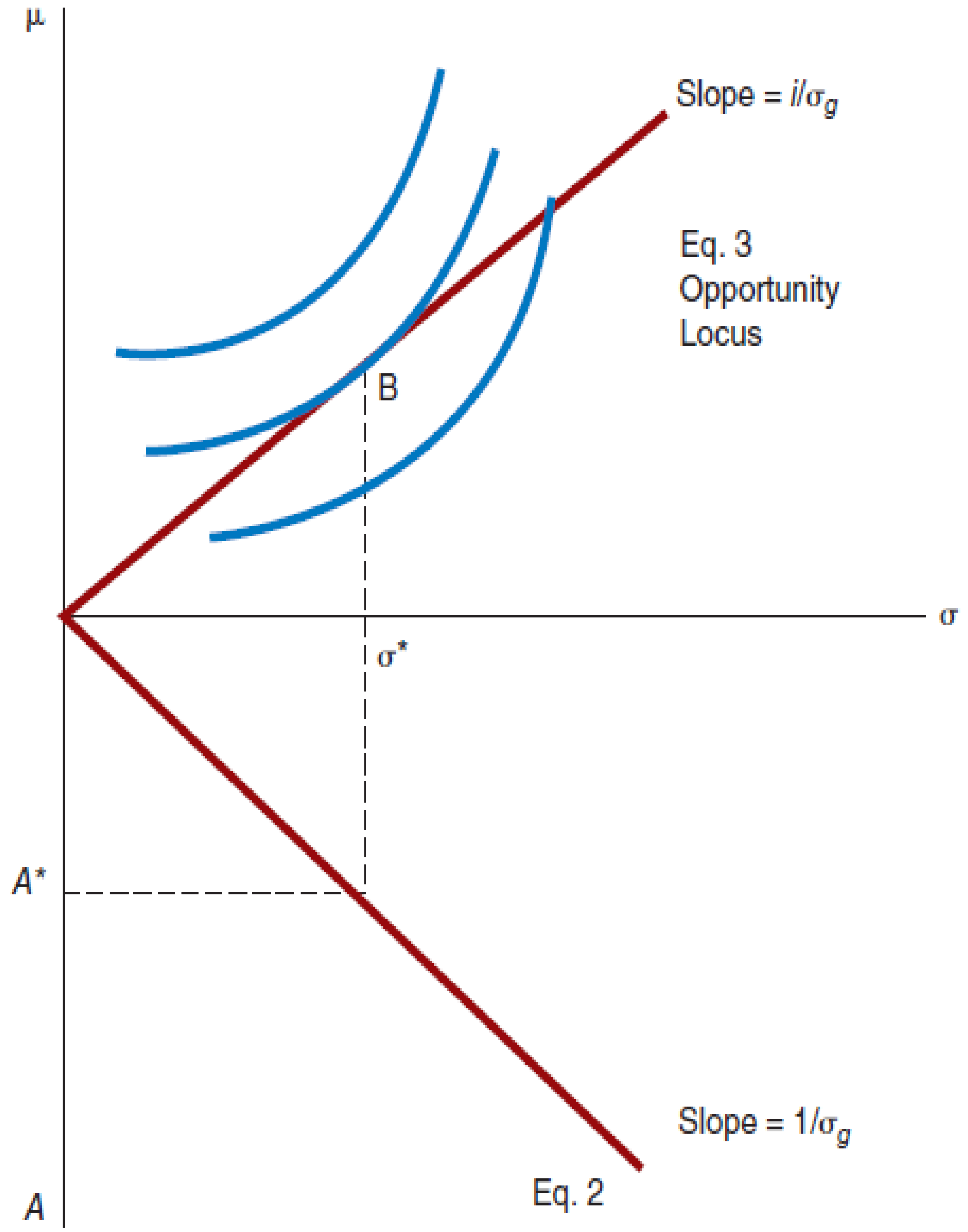
- This point determines the optimal level of risk σ^* in the figure.

- As Equation 2 indicates, the optimal level of *A*, *A**, is:

$$A^* = \frac{\sigma^*}{\sigma_g}$$

- This equation is solved in the bottom half of Figure 3.

- Equation 2 for *A* is a straight line through the origin with a slope of 1/ *g*.



Cont.

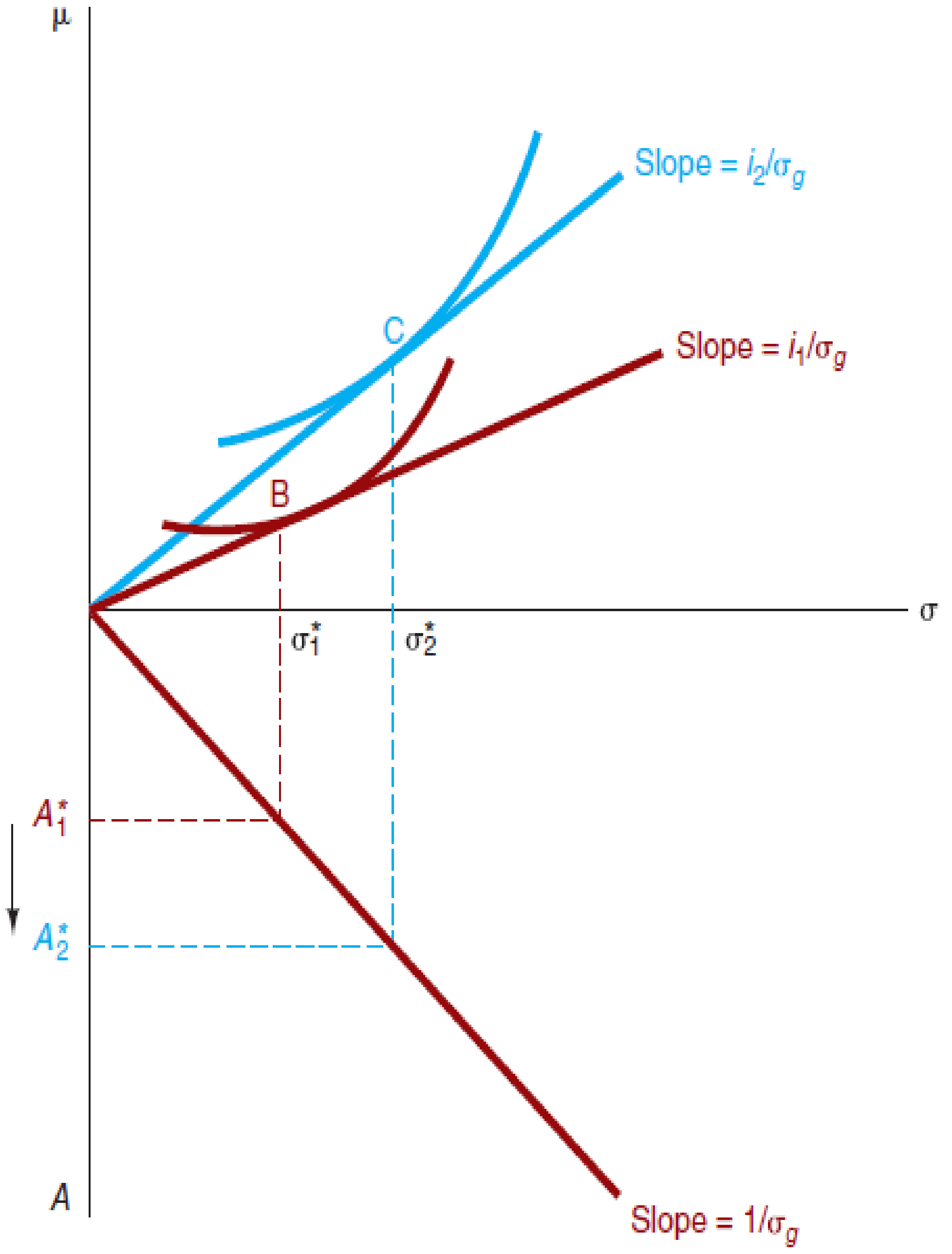
- Given σ^*, the value of *A* read off this line is the optimal value *A**. Notice that the bottom part of the figure is drawn such that *A* increases as we move down.
- Now let's ask ourselves what happens when the interest rate increases from i_1 to i_2.
- This situation is shown in Figure 4. Because σ_g is unchanged, the Equation 2 line in the bottom half of the figure does not change.
- However, the slope of the opportunity locus does increase as *i* increases. Thus the opportunity locus rotates up and we move to point C at the tangency of the new opportunity locus and the indifference curve.
- As you can see, the optimal level of risk increases from σ_1^* to σ_2^*,
- and the optimal fraction of the portfolio held in bonds rises from $A_1{}^*$ to $A_2{}^*$.
- The result is that as the interest rate on bonds rises, the demand for money falls;
- that is, 1 - *A*, the fraction of the portfolio held as money, decreases.6

Implications

- Tobin's model thus yields the same result as Keynes's analysis of the speculative demand for money:
- The demand for money is negatively correlated to the level of interest rates.
- Tobin's model, however, makes two important points that Keynes's model does not:

1. Individuals diversify their portfolios, and hold money *and* bonds at the same time.

2. Even if the expected return on bonds is greater than the expected return on money, individuals will still hold money as a store of wealth because its return is more certain.



Micro-Foundation Models of Money Demand

Money in Utility Function Models (MIUF)

Shopping Time Models (STM)

Overlapping Generations Models (OLG)

Cash in Advance Models (CIA)

Money in Utility Function (MIUF):
Medium of payments role of money

- **Facts about money:**

1. While the principal role of money is medium of payments, to perform this role, it needs to be a store of value, at least over short intervals from receipt of money to its payment to others.
2. Commodities, labor and bonds do not exchange against each other but only against money.
3. The income from the supply of labor or accruing in other ways is received in money, while the purchases of commodities and bonds have to be paid for in money.
4. The demand for money is positive, irrespective of whether the return on it is higher or lower than the return on bonds or commodities. In fact, the return on money is usually less than on bonds, but money demand is nevertheless positive, particularly through storage or production of other commodities. It is also positive even if a positive rate of inflation is expected.
5. For individuals, the demand for money is a function of total expenditures or of consumption expenditures, not of saving. In particular, it can be either greater than less than saving, but virtually never equals the saving in a given period.
6. The velocity of circulation of money is positive over periods that include both the receipt of income and the purchases of commodities, but is nevertheless not constant.

Utility function without money

- First, we consider a standard two-period model, without uncertainty, of consumer behavior for an economy with commodities, money and bonds.
- Assume that, in period 1, the individual has the frequently used two period utility function of the form: $U\ (c_1, n_1,\ c_2, n_2)$
- where c_1 and n_1 are respectively the consumption of commodities and the supply of labor in the *i*th period.
- ***U*(.)** is assumed to be an ordinal neoclassical utility function with continuous first- and second-order partial derivatives.
- Note that money does not appear in this utility function.

- or simplification, assume that the utility function has the common time-separable form, so that:

$$U(c_1, c_2) = u(c_1, n_1) + \frac{1}{1+\rho} u(c_2, n_2)$$

where ρ is the rate of time preference and u is the period utility function.

$$\frac{\partial u_i}{\partial c_i} > 0 \text{ and } \frac{\partial u_i}{\partial n_i} < 0$$

MIUF

- In each period, the individual uses his nominal income $\boldsymbol{P_1 y_1}$ plus the "inherited" (i.e. from the preceding period) amounts of **money and bonds** to buy commodities, money and bonds.
- Commodities are wholly consumed during the period whereas money and bonds are carried to the next period.
- Money does not pay interest, but bonds pay a nominal interest rate *R* per period.

- The individual's budget constraint for period 1 is:

$$P_1 c_1 + M_l + B_1 = P_1 w_1 n_1 + M_0 + (1 + R_0) B_0 \qquad \textbf{(3)}$$

- Where $\boldsymbol{M}$ is nominal money balances, $\boldsymbol{B}$ is the nominal value of bonds and $\boldsymbol{w}$ is the exogenously given real wage rate.
- At the beginning of period 2, the individual has the carryover money balances of M_1 (which do not pay interest), carryover bonds of $\boldsymbol{B_1}$ paying interest at the rate $\boldsymbol{R}$, and receives income $\boldsymbol{y_2}$.

Cont.

- In a two-period model without a bequest motive, the individual will not buy money and bonds in period 2 since they are of no use to him after the end of that period, so purchases of the two assets do not appear in the budget constraint for period 2. With $\boldsymbol{M_2 = B_2 = 0}$, the second-period budget constraint is:

$$P_2c_2 = P_2w_2n_2 + M_1 + (1+R_1)B_1 \qquad (4)$$

Since the individual is not able to issue money, we also have:

$$M_1 \geq 0$$

Solving (4) for B_1 and substituting in (3), the consolidated budget constraint for the periods is:

$$P_1c_1 + \frac{P_2c_2}{1+R_1} + M_1 - \frac{M_1}{1+R_1} = p_1w_1n_1 + \frac{P_2w_2n_2}{1+R_1} + M_0 + (1+R_0)B_0$$

which yields:

$$P_1c_1 + \frac{P_2}{1+R_1}c_2 + \frac{R_1}{1+R_1}M_1 = P_1w_1n_1 + \frac{P_2}{1+R_1}w_2n_2 + M_0 + (1+R_0)B_0$$

Dividing through by P_1 and substituting $1/(1+r_1)$ for $P_2/(P_1(1+R_1))$, we have:

$$c_1 + \frac{c_2}{1+r_1} + \frac{R_1}{1+R_1}\,\frac{M_1}{P_1} = w_1 n_1 + \frac{w_2 n_2}{1+r_1} + \frac{M_0}{P_1} + \frac{(1+R_0)B_0}{P_1} \tag{8}$$

where $1/(1+r_t) = P_{t+1}/[P(1+R_t]$, r_t is the real rate of interest in period t and P_{t+1}/P_t is the inflation rate.

Replacing M/P by m (real money balances) and B/P by b (real value of bonds), and simplifying, (8) can be restated as:

$$c_1 + \frac{c_2}{1+r_1} + \frac{R_1}{1+R_1}m_1 = w_1 n_1 + \frac{w_2 n_2}{1+r_1} + \frac{P_0}{P_1}m_0 + (1+r_0)b_0 \qquad (9)^{11}$$

The real value of money and bonds at the beginning of period t are the "endowments" of period t. Replacing $(P_0/P_1)m_0 + (1+r_0)b_0$ by a_1, we have:

$$c_1 + \frac{c_2}{1+r_1} + \frac{R_1}{1+R_1}m_1 = w_1 n_1 + \frac{w_2 n_2}{1+r_1} + a_1 \tag{10}$$

The individual maximizes (2) subject to (10), so that the Lagrangean function, with the Lagrangean multiplier λ, is:

$$L = u(c_1, n_1) + \frac{1}{1+\rho} u(c_2, n_2) + \lambda \left(w_1 n_1 + \frac{w_2 n_2}{1+r_1} + a_1 - c_1 - \frac{c_2}{1+r_1} - \frac{R_1}{1+R_1} m_1 \right) \tag{11}$$ [12]

subject to $m_1 \geq 0$.

The first-order conditions are:

$$\frac{\partial L}{\partial c_1} = \frac{\partial u(c_1, n_1)}{\partial c_1} - \lambda = 0 \tag{12}$$

$$\frac{\partial L}{\partial n_1} = \frac{\partial u(c_1, n_1)}{\partial n_1} + \lambda w_1 = 0 \tag{13}$$

$$\frac{\partial L}{\partial c_2} = \frac{1}{1+\rho} \frac{\partial u(c_2, n_2)}{\partial c_2} - \frac{\lambda}{1+r_1} = 0 \tag{14}$$

$$\frac{\partial L}{\partial n_2} = \frac{1}{1+\rho} \frac{\partial u(c_2, n_2)}{\partial n_2} + \frac{\lambda w_2}{1+r_1} = 0 \tag{15}$$

$$\frac{\partial L}{\partial m_1} = -\lambda \frac{R_1}{1+R_1}, \quad m_1 \geq 0, \quad m_1 \frac{\partial L}{\partial m_1} = 0 \tag{16}$$

- **The first four of these conditions are identical to those in a model without money (though there may be bonds) in the economy, so that their solution provides the optimal time path of consumption and labor supply, which is independent of the existence or absence of money in the model.**

- Money is not only neutral (i.e. the invariance of the real values of the real variables of the model with respect to changes in the nominal quantity of money) in this model, it is “*strongly neutral*

Money in the Utility Function (MIUF)

- **We present a model that includes money in the utility function but which is not a multi-stage model- A one period model**

Assumptions

- ***Axiom (i): Consistent preferences***

If the individual prefers a bundle of goods A to another bundle B, then he will always choose A over B.

- ***Axiom (ii): Transitive preferences***

If the individual prefers A to B and B to a third bundle of goods C, then he prefers A to C.

- ***Axiom (iii): Real balances as a good***

In the case of financial goods that are not “used directly in consumption or production” but are held for exchange for other goods in the present or the future, the individual is concerned with the former’s exchange value into commodities – that is, their real purchasing power over commodities and not with their nominal quantity.

Justification

- The inclusion of money – and other financial assets – directly into the utility function can be justified on the grounds that the utility function expresses preferences and
- that, since more of financial assets is demanded rather than less, they should be included in the utility function just like other goods.
- Given these axioms, let the individual's period utility function be specified as:

$$\boldsymbol{U(.) = U(x_1, \ldots, x_K, n, m^h)} \tag{17}$$

- where: $\boldsymbol{x_k}$ = quantity of the kth commodity, $k = 1, \ldots, K$
- $\boldsymbol{n}$ = labor supplied, in hours
- $\boldsymbol{m^h}$ = average amount of real balances held by the individual or household for their liquidity services.
- Note that (17) has K+2 goods, consisting of K commodities, labor and real balances.
- Axioms (1) to (3) only specify $U(.)$, an ordinal utility function.

- Axioms (1) to (3) only specify *U*(.), an ordinal utility function.
- $U_k = \partial U/\partial x_k > 0$ for all *k*,
- $U_n = \partial U/\partial n < 0$,
- $U_m = \partial U/\partial m^{\mathrm{h}} > 0$.
- All second-order partial derivatives of *U*(.) are assumed to be negative. That is, each of the commodities and real balances yield positive marginal utility and hours worked have negative marginal utility.

Shopping-Time Model using Money in the Indirect Utility Function (MIIUF)

- It is sometimes asserted that money does not directly yield consumption services to the individual, but that its use saves on the time spent in making payments.
- This first part of this assertion implies that the first two axioms of preferences in the preceding subsection are not applied to real balances but only to **commodities and leisure**.
- This model leaves real balances out of the direct utility function but embodies their usage for facilitating purchases and sales of commodities;
- For this model, assume that only **consumer goods and leisure directly yield utility.**

MIIUF

- We now specify the one-period utility function $U(.)$ as:
- $\boldsymbol{U(.) = U(c,L)}$
- where:
- c = consumption
- L = leisure.
- Assume that U_c, U_L >0, U_{cc}, U_{LL} >0. Consumption requires purchases of consumer goods, which necessitate time for shopping.
- This shopping time can be divided into two components, one being the selection of the commodity to be purchased and the other that of making the payment acceptable to the seller.

MIIUF

- The former is often enjoyable to most people and can be treated as an aspect of the commodity bought, or as a use of leisure, or ignored as a simplification device for our further analysis.
- The second component is an aspect of the payments system.

➢ If the buyer does not have enough of the medium of payments to pay for the purchase, he has to devote time to getting it, say, from a bank, or to find a seller who will be willing to accept the payment in the commodity or labor services that the seller can provide, where the latter is the time taken by bartering.

➢ Both are **time consuming**

- The buyer needs a certain amount of money to buy all the goods and services that he wishes to purchase.
- He can hold enough or only some proportion of this amount.
- If he holds < 100% of the amount needed, he will have to devote part of his time to effect the remaining payment by devoting some time to the payments process.
- The amount of time needed for this purpose will be positively related to the shortfall in his money holdings.

MIIUF

- The time used for this purpose is a nuisance, would have negative marginal utility and can be labeled as "**payments time", "shopping time" or " transaction time**" – that is, the time needed to effect the payments for the commodities bought.
- Leisure equals the time remaining in the day after deducting the time spent on a job and the payments time.
- Hence, $\boldsymbol{L = h_0 - n - n^T}$ (19)

where:

- h_0 = maximum available time for leisure, work and transactions
- n = time spent working
- n^T = payments time, i.e. time spent in making payments in a form acceptable to the seller

- The payments and financial environment are assumed to be such that the "*payments/transactions time function*" is:
- $n^{T} = n^{T}(m^{h}, c)$ (20)
- where $\partial n^{T}/\partial c > 0$ and $\partial n^{T}/\partial m^{h} \leq 0$.
- From (19) and (20), $\partial U/\partial n^{T} = (\partial U/\partial L)(\partial L/\partial n^{T}) < 0$.
- That is, an increase in payments time decreases leisure and therefore decreases utility.
- However, since an increase in the amount held and utilized of real balances decreases payments time,
- $\partial U/\partial m^{h} = (\partial U/\partial n^{T})(\partial n^{T}/\partial m^{h}) > 0.$

- Equation (20) specifies the time it takes to pay for an amount c of commodities while utilizing an average amount m^h of real balances.
- In a monetary economy in which the shops would only sell against money, the time required to pay for any positive level of commodities would become infinitely large as the individual tries to do without money.
- That is, as $m^h \rightarrow 0$, $n^T \rightarrow \infty$.
- For positive levels of real balances, $\partial n^T/\partial m^h \leq 0$.
- The reason for this is that, in a monetary economy, money is the most widely accepted medium of payments, so that trying to pay in any other way may mean searching for special suppliers, which would increase the payments time

- But, beyond some limit, say for $\boldsymbol{m^h \geq \alpha c}$, where α is the inverse of the velocity of circulation of money applicable to the individual, there is unlikely to be any further decrease in payments time from additional real balances, so that, beyond this limit, $\partial n^T/\partial m^h = 0$.

- A proportional form of the payments time function is:

$n^T/c = \varphi(m^h/c)$ (21)

- where $-\infty < \varphi \leq 0$, with $\boldsymbol{\varphi'}$ as the first-order derivative of φ with respect to $\boldsymbol{m^h/c}$. Satiation in real balances occurs as $\boldsymbol{\varphi \to 0}$. (21) implies that $\boldsymbol{\partial\varphi/\partial m^h \leq 0}$. Incorporating this payments time function into the utility function above, we have:

$$U(.) = U(c, h_0 - n - c\phi(m/c)) \qquad (22)$$

(22) can be rewritten as the indirect utility function:

$$V(.) = V(c, n, m^h) \qquad (23)$$

where $\frac{\partial V}{\partial m^h} = \frac{\partial U}{\partial L}\left[-c\frac{\partial \phi}{\partial m^h}\right]$. Since $\frac{\partial U}{\partial L} > 0$ but $\frac{\partial \phi}{\partial m^h} \leq 0$, $\frac{\partial V}{\partial m^h} \geq 0$.

This therefor provides a justification for economists for putting money in the utility function indirectly other than the one given earlier for the direct MIUF

Overlapping Generations Model (OLG)

- An **overlapping generations model**, abbreviated to **OLG model**, is a type of representative agent economic model in which agents live a finite length of time long enough to overlap with at least one period of another agent's life.

- As it models explicitly the different periods of life, - such as schooling, working or retirement periods --, it is the natural framework to study the allocation of resources across the different generations.
- It serves as an alternative to the money in the utility function (MIUF) and money in the production function

- The concept of an OLG model was inspired by Irving Fisher’s monograph, *The Theory of Interest*. Notable improvements were published by Maurice Allais in 1947, Paul Samuelson in 1958, and Peter Diamond in 1965.
- Books devoted to the use of the OLG model include Azariadis' Intertemporal Macroeconomics, de la Croix and Michel’s Theory of Economic Growth as well as Jagdish Handa’s Monetary Economics; Champ and Freeman (1994)

Common themes about money in OLG models

- *Fiat money: intrinsically useless and inconvertible*
- *A positive value for fiat money*
- *Fiat money as the medium for holding savings*

Assumptions and implications of OLG

1. Defining bonds as *interest-bearing* financial assets that can be used to convey purchasing power from the present to the future, there are no bonds in the model
2. Fiat money is preferable to commodities – and any other assets – as the medium for carrying forward saving to the following period.
3. There is net (positive) saving in the first lifestage.
4. Future periods will not renounce the use of fiat money or pursue policies such that fiat money will become valueless.
5. The OLG model's economy has an infinite horizon, even though the individuals in it have a finite (two-period) horizon.
6. OLG models with money generate a zero value of money in the current period if the value of money is expected to be zero in some future period.

The model

- Individuals live for two periods – that is, go through two life-stages – only.
- They are often labeled “young” in their first life-stage and “old” in their second life-stage.
- We will use the superscripts **y** and **o** to indicate the individual’s respective life-stages;
- For the economy, the periods are $t + i$, $i = 0, 1, 2, \ldots$.
- Period t is the initial period of the analysis and its old generation is called the “initial old,” whose members were born in period $t - 1$.
- Generations born in periods $0, 1, 2, \ldots,$ will be called the “future generations” and its members will be referred to merely as “individuals.”
- The OLG model starts by endowing the initial old with the initial stock of money.
- Further, it is assumed that any increase in the money stock in any period is gratuitously given as a lump-sum transfer to the old in that period.

OLG

- The number of individuals born in period t is N_t . This number is assumed to be constant at N over time.
- Under this assumption, in each period t, the population of 2N individuals consists of N young individuals and N old individuals.
- Each individual is assumed to be given a commodity endowment of $\boldsymbol{w^y}$ in the young life-stage and $\boldsymbol{w^o}$ in the old life-stage.
- $\boldsymbol{w^y}$ and $\boldsymbol{w^o}$ are in units of the single consumption good, assumed in the basic model to be non-storable (perishable).
- If fiat money is to have value, it is essential to assume that the optimal level of consumption in old age will exceed w^o
- This is usually guaranteed by an assumption that consumption will be the same in each life-stage and that $w^o < w^y$, so that the individual must save while young to provide for extra consumption in the second period

Intertemporal budget constraint of the young

- In the young life-stage, the representative individual can either consume c^{y} or hold money m out of his endowments of commodities.
- The budget constraint for the first/young life-stage is:

$$p_t c^y_t + m^y_t = p_t w^y_t \quad c^y_t < w^y_t \tag{1}$$

At the beginning of period $\boldsymbol{t+1}$, the individual has the carryover money balances of $\boldsymbol{m_t}$ (which do not pay interest) and receives gratuitously the (real) endowment of commodities $\boldsymbol{W^o_{t+1}}$, so that his second/old life-stage constraint is:

$$p_{t+1} c^o_{t+1} = p_{t+1} w^o_{t+1} + m^o_{t+1} \tag{2}$$

where the money balances purchased when young, $\boldsymbol{m^y_t}$, become the inheritance of the old as $\boldsymbol{m^o_{t+1}}$, so that $\boldsymbol{m^y_t = m^o_{t+1} = m_t}$.

- NB: The only asset in the model is money, which does not pay interest, so that the interest rate does not enter (2).
- Note also that the individuals are assumed to have perfect foresight over the future values of the variables. From (2),

$$m^{o}_{t} = p_{t+1}c^{o}_{t+1} - p_{t+1}w^{o}_{t+1} \qquad \textbf{(2')}$$

Noting that $\boldsymbol{m^{o}_{t+1} = m^{y}_{t}}$, substitution of (2') in (1) gives the individual's lifetime budget constraint as:

$$p_t c^{y}_{t} + p_{t+1}c^{o}_{t+1} = p_t w^{y}_{t} + p_{t+1}w^{o}_{t+1}$$

Define the individual's real lifetime wealth W_t as:

$$W_t = w^{y}_{t} + (p_{t+1}/p_t)w^{o}_{t+1}$$

Description of symbols used

c^{y}_{t}	consumption of the young in period t
c^{o}_{t}	consumption of the old in period t
p_t	price of goods in period t
w^{y}_{t}	exogenous real income of the young in period t
w^{o}_{t}	exogenous real income of the old in period t
W_t	lifetime wealth in period t
N_t	number of persons born in period t
$N_{t-1} + N_t$	population in period t
m^{y}_{t}	*per capita* demand for *nominal* balances by the young in period t
m^{o}_{t}	money endowment of each old individual in period t
M_t	total amount of fiat money in period $t (= N^{o}_{t} m^{o}_{t})$.

- *Utility maximization by the young*

The individual born in period *t* has an intertemporal utility function:

- $U(c^{y}_{t}, c^{o}_{t+1})$

Where $U(.)$ is assumed to be an ordinal utility function with continuous first- and second-order partial derivatives.

- The young maximize this intertemporal/lifetime utility function subject to the lifetime budget constraint (3). That is, the young's optimization problem is:

$$\text{Maximize} \qquad U(c^{y}_{t}, c^{o}_{t+1}) \tag{4}$$

$$\text{subject to:} \qquad p_t c^{y}_{t} + p_{t+1} c^{o}_{t+1} = p_t w^{y}_{t} + p_{t+1} w^{o}_{t+1} \tag{3}$$

Implying the optimal consumption amounts c^y_t , c^o_{t+1} as:

$$c^y_t = c^y_t(p_{t+1}/p_t, w^y_t, w^o_{t+1})$$

$$c^o_{t+1} = c^o_{t+1}(p_{t+1}/p_t, w^y_t, w^o_{t+1})$$

By assumption, with $w^y_t > w^o_{t+1}$,

$$c^y_t < w^y_t$$

$$c^o_{t+1} > w^o_{t+1}$$

The net dissaving in the old life-stage is accomplished by spending the money balances carried over from the young life-stage. Optimal saving s^y_t in period t is given by:

$$s^y_t = w^y_t - c^y_t$$

$$= s^y_t(p_{t+1}/p_t, w^y_t, w^o_{t+1})$$

The demand for money, identical with that for nominal saving, is:

$$m^{y}_{t} = p_t s^{y}_{t} = p_t s^{y}_{t}(p_{t+1}/p_t, w^{y}_{t}, w^{o}_{t+1})$$

Intuitively, in period *t*, the young individual receives more of the consumption good than he wants to consume but cannot store the excess since the consumption good is perishable.

He sells it to the initial old for fiat money, provided that he expects to be able to exchange his fiat money holdings for the consumption good in period $t+1$.

- ***Utility maximization by the initial old***

- From the perspective of the initial old in the initial period *t*, they receive some of the consumption good.
- Further, while they received fiat money, its utility in commodity is zero so that they are willing to exchange it for some amount of the consumption good.
- Formally, the utility function and budget constraint, respectively, of the initial old are:

$$U^o_t = U(c^o_t)$$

$$p_t c^o_t = p_t w^o_t + m^o_t$$

Each member of the initial old maximizes his utility by maximizing c^o_t , which implies that he will try to trade m^o_t for the maximum amount that he can get of the consumption good.

Macroeconomic analysis: the price level and the value of money

- For the economy in period t, the aggregate demand for nominal balances M^{d}_{t} equals the nominal value of the commodities the young want to sell, so that it is given by:

$$M^{d}_{t} = N_t[p_t(w^{y}_{t} - c^{y}_{t})] \tag{10}$$

The money supply M_t in the economy is given by the money balances held by the old (born in $t-1$ with their number as N_{t-1}). The old want to trade it for commodities. This amount equals:

$$M_t = N_{t-1}[m^{o}_{t}] \tag{11}$$

so that money market clearance, with money demand equal to money supply, implies that:

$$N_t[p_t(w^{y}_{t} - c^{y}_{t})] = M_t \tag{12}$$

$$p_t = M_t/[N_t(w^{y}{}_t - c^{y}{}_t)] \tag{13}$$

From (5), $c^{y}{}_t$ on the right side of (12) depends on p_{t+1}/p_t, $w^{y}{}_t$ and $w^{o}{}_{t+1}$, so that:

$$p_t = M_t/[N_t(w^{y}{}_t - c^{y}{}_t(p_{t+1}/p_t, w^{y}{}_t, w^{o}{}_{t+1}))] \tag{13'}$$

Hence, *ceteris paribus*, the price level p_t varies proportionately with the money supply M_t, which is a quantity theory result. Further, note that p_t depends on the intertemporal price ratio p_{t+1}/p_t.

From (13), the value v_t per unit of money, which is equal to $1/p_t$, is given by:

$$\begin{aligned} v_t &= [(w^{y}{}_t - c^{y}{}_t)]N_t/(N_{t-1}m^{o}{}_t) \\ &= [(w^{y}{}_t - c^{y}{}_t)N_t]/M_t \end{aligned} \tag{14}$$

where $c^{y}{}_t = c^{y}{}_t(p_{t+1}/p_t,\ w^{y}{}_t,\ w^{o}{}_{t+1})$. Hence, the value of money is positive and changes inversely with the money supply. It also varies proportionately with aggregate saving $[(w^{y}{}_t - c^{y}{}_t)N_t]$.

Cash-in-Advance Model (The Clower's Constraint)

- The **cash-in-advance constraint**, also known as the **Clower constraint** after American economist Robert W. Clower (1967)
- To be able to say anything about the money supply, inflation, monetary policy and so on, economists must therefore introduce additional assumptions into their models.
- One possibility, and the more popular one, is to introduce a **cash-in-advance constraint** i.e. a requirement that each consumer or firm must have sufficient cash available before they can buy goods
- **Assumption**
- Before a consumer can buy goods they must pay for them in cash. Therefore money is demanded because it is the only means of purchasing some goods.

CIA model

- Every period a consumer has to choose
  - (a) their consumption (denoted c)
  - (b) their money balances (denoted m) and
  - (c) their savings (denoted a, assets).
- However, all consumption goods have to be paid for by cash so there is a constraint the consumer faces, $\mathbf{P_t c_t \leq m_t}$.
- Assets deposited in the bank earn an interest rate **R > 0** but no interest is earned on assets held in the form of money. Instead, money earns a rate of return equal to $\mathbf{P_{t-1}/P_t}$, so if there is inflation money earns a negative return (it loses value).
- Because consumers earn interest on deposits but not on money they will always prefer to keep assets on deposit. Therefore they will hold only just enough cash to finance their consumption, e.g. $\mathbf{P_t c_t = m_t}$.

CIA model

- This implies that the velocity of money is constant.
- The velocity of money (V) is defined by the identity $MV = PY$, where M is the money supply, P is the price level and Y is the volume of transactions in the economy.
- Assuming no capital, the volume of transactions in this economy is just c, and because $m = Pc$ it must be that the velocity of money is always equal to 1.
- In reality, however, the velocity of money shows considerable variation and depends in particular on the interest rate.
- Svensson (1985) proposes a simple amendment to Lucas' basic model. Like Lucas' article, Svensson's main concern is how to price assets when you have a cash in advance constraint.
- Svensson assumes that consumers have to choose how much cash to hold before they know the current state of the world (i.e. they are ignorant of the current money supply or productivity shock).
- As a result of this uncertainty the velocity of money is no longer constant. Agents will usually choose to hold $m > Pc$ for precautionary reason.

CIA

- In a very good state of the world, agents know they would like their consumption to be high and they can only achieve this if they have high money balances.
- Therefore, agents tend to hold more money than they otherwise would need as a precaution in case they find themselves wanting to consume large amounts in a surprisingly good state of the world.
- The greater the uncertainty facing the consumer (e.g. the higher the probability of wanting to spend a lot on average) the larger these precautionary balances.
- However, the higher is the interest rate the lower the level of precautionary balances held by the consumer.

- Consumers have to trade the benefits of higher money balances (increased insurance against a good state of the world) against the costs (loss of interest).

- As a result the velocity of money becomes time-varying and depends on the interest rate.

Cash-credit models

- Another version of the CIA model is the so called cash-credit model of Lucas and Stokey (1987).

- In this model agents gain utility from two goods, c_1 and c_2, where c_1 can only be purchased using cash but c_2 can be purchased on credit. The timing of the model is as follows. Agents observe the state of the world, decide on c_1 and c_2 and m, they then go and purchase cash goods paying for them with their money balances and

- also purchase credit goods, and then at the end of the period all credit bills are settled.

- This is another way of making the velocity of money variable.

- In this model, agents get utility from two goods, but on one good they have to pay cash and so lose R on any assets held in the form of cash.

- Therefore, when the interest rate is high they will tend to lower c_1 and increase c_2 to compensate, because they consume less of the cash good they also hold fewer money.

- Therefore the velocity of money $((c_1 + c_2)/m)$ varies positively with the interest rate - the higher the interest rate, the lower are money balances and the harder money has to work.

Exercise

- Let the consumer's utility function be $U(c, l) = \alpha \ln c_1 t + (1-\alpha) \ln c_{2t} - \gamma h_t$, where h denotes hours worked, c_1 is a good which can only be purchased with cash and c_2 denotes a good which can be purchased using credit.
- Households can hold two assets: money (m) or government bonds (b), the latter earn the return R.
- The household seeks to maximise utility subject to two constraints:

(i) a cash in advance constraint

$$p_t c_{1t} \leq m_t + (1 + R_{t-1}) b_t - b_{t+1}$$

(ii) a resource constraint

$$c_{1t} + c_{2t} + \frac{m_{t+1}}{p_t} + \frac{b_{t+1}}{p_t} \leq w_t h_t + \frac{m_t}{p_t} + \frac{(1 + R_{t-1}) b_t}{p_t}$$

Question

- (a) Write down an expression for the share of cash goods in total consumption as a function of the
- interest rate
- (b) Write down an expression for the velocity of money. Is this a plausible model?

MONEY SUPPLY

Lecture 3

Money Supply

Big Concepts

- Understanding items on the Balance Sheet for Commercial banks and the Fed
- The Bank Lending Channel of Monetary Policy
- How changes in the instruments affects the supply of money
  - Emphasis on Open Market Operations
- Deposit Creation
- Money Multiplier Process
- Non Borrowed Monetary Base and Discount Loans

Note: These lecture notes are incomplete without having attended lectures

The Four Players in the Money Supply Process

1. Central bank: the Fed
2. Banks
3. Depositors
4. Borrowers from banks

Banks' role in the money supply

- The money supply equals currency plus demand (checking account) deposits:

$$M = C + D$$

- Since the money supply includes demand deposits, the banking system plays an important role.

Central Bank's Policy Tools

- Recall the Fed uses following monetary policy tools:

1. Required reserve ratios
2. The discount rate
3. Open market operations

The Federal Reserve System

- The Fed sets required reserve ratios, which are the minimum percentages of deposits that depository institutions must hold as reserves.
- The Fed does not change these ratios very often.
- The discount rate is the interest rate at which the Fed stands ready to lend reserves to depository institutions.
- An open market operation is the purchase or sale of government securities—U.S. Treasury bills and bonds—by the Federal Reserve System in the open market.

The Fed's Balance Sheet

- On the Fed's balance sheet, the largest and most important asset is U.S. government securities.

- The most important liabilities are Federal Reserve notes in circulation and banks' deposits.

- The sum of Federal Reserve notes, coins, and banks' deposits at the Fed is the monetary base.

Key Elements of The Fed's Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities Discount loans	Currency in circulation (C) Reserves (R)

Monetary Base, $MB = C + R$

A few preliminaries

- **Reserves** (R): the portion of deposits that banks have not lent out.

- A bank's liabilities include deposits, assets include reserves and outstanding loans.

- **100-percent-reserve banking**: a system in which banks hold all deposits as reserves.

- **Fractional-reserve banking**: a system in which banks hold a fraction of their deposits as reserves.

Key Elements of a Commercial Bank's Balance Sheet

Commercial Bank

Assets	Liabilities
Reserves (R)	Deposits (D)
Outstanding loans	…
…	

Controlling the Quantity of Money

- How Required Reserve Ratios Work
  - An increase in the required reserve ratio boosts the reserves that banks must hold, decreases their lending, and decreases the quantity of money.

- How the Discount Rate Works
  - An increase in the discount rate raises the cost of borrowing reserves from the Fed and decreases banks' reserves, which decreases their lending and decreases the quantity of money.

Bank Reserves, the Monetary Base, and the Money Multiplier

- The **money multiplier** is the amount by which a change in the monetary base is multiplied to calculate the final change in the money supply.

- An increase in currency held outside the banks is called a **currency drain**.

- Such a drain reduces the amount of banks' reserves, thereby decreasing the amount that banks can loan and reducing the money multiplier.

Deposit Creation: Single Bank

Suppose the Fed bought $100 securities from Manhattan Commercial Bank via an open market purchase.

- What does Manhattan Commercial do with excess reserves?

Assets		Liabilities	
Securities	-$100	Deposits	+$100
Reserves	+$100		
Loans	+$100		

Deposit Creation: Banking System

What happens next at other banks…

Fleet Bank

Assets		Liabilities	
Reserves	+$10	Deposits	+$100
Loans	+$90		

Bank One

Assets		Liabilities	
Reserves	+$9	Deposits	+$90
Loans	+$81		

Deposit Creation

Creation of Deposits (assuming 10% Reserve Requirement and $100 increase in reserves)

Bank	Increase in Deposits	Increase in Loans	Increase in Reserves
Manhattan Commercial	0.00	100.00	0.00
Fleet Bank	100.00	90.00	10.00
Bank One	90.00	81.00	9.00
Bank A	81.00	72.90	8.10
Bank B	72.90	65.61	7.29
Bank C	65.61	59.05	6.56
Bank D	59.05	53.14	5.91
.	.	.	.
.	.	.	.
.	.	.	.
Total For All Banks	1000.00	1000.00	100.00

Deposit Creation

If Fleet Bank buys securities with $90 check

Fleet Bank

Assets		Liabilities	
Reserves	+ $10	Deposits	+ $100
Securities	+ $90		

Seller deposits $90 at Bank One and process is same

Whether bank makes loans or buys securities, get same deposit expansion

Deposit Multiplier

Simple Deposit Multiplier

$$\Delta D = \frac{1}{r} \times \Delta R$$

i.e. the change in reserves that arises is a multiple of the change in deposits.

Deriving the formular

- As you can see, we can easily put the above process in a geometric series as follows:

GHc 100 (=$\Delta R \times 1$) + GHc 90 [=$\Delta R \times (1 - r)$]+ GHc 81 [=$\Delta R \times (1 - r)^2$], and so on :

- This gives a general model as:

$\Delta D = \quad \Delta R \times [1 + (1 - r)] + (1 - r)^2 + (1 - r)^3 + \ldots\ldots\ldots\ldots\ldots\ldots (1 - r)^n]$

- This gives the formula for infinite series as

$$\Delta D = \Delta R \times \frac{1}{1-(1-r)} = \frac{1}{r} \times \Delta R$$

Cont

- Substituting $\Delta R = 100$(representing change in reserves); $r = 0.1$ (representing the required reserve ratio of 10%), we have:

$\Delta D = 100[1+ (1-0.1) + (1-0.1)^2 + ...+ (1-0.1)^n]$

$$\Delta D = \Delta R \times \frac{1}{1-(1-r)} = \frac{1}{0.1} \times 1000 = 10{,}000$$

- The actual money created = 1000 – 100 = 900

Derivation of the Simple Deposit Multiplier

- Total Reserves = Required Reserves + Excess Reserves, i.e. R = RR+ER
- Assume that banks hold no excess reserves, i.e ER=0
- Then: $R = RR = r \times D$

$$\Rightarrow D = \frac{1}{r} \times R$$

$$\Rightarrow \Delta D = \left(\frac{1}{r}\right) \times \Delta R$$

Deposit Creation: Banking System as a Whole

Banking System

Assets		Liabilities	
Securities	– $100	Deposits	+ $1000
Reserves	+ $100		
Loans	+ $1000		

Critique of Simple Model

From our simple model, deposit creation stops if:

1. Proceeds from loan kept in cash

2. Bank holds excess reserves, ER

The Multiplier Effect of an Open Market Operation

- When the Fed conducts an open market operation, the ultimate change in the money supply is larger than the initiating open market operation.

- Banks use excess reserves from the open market operation to make loans so that the banks where the loans are deposited acquire excess reserves which they, in turn, then loan.

Extending the model

What happens if:

- People convert loans to currency and hold cash? (Currency drain)

- Banks hold additional reserves beyond what they need to hold in the form of required reserves, i.e. they hold ***excess reserves***.

Deriving The Money Multiplier

Money Multiplier:

$M = m \times MB$; $MB = Monetary\ Base$

- Assume: ratio of currency to checkable deposits and ratio of excess reserves to checkable deposits are constant in equilibrium

  i.e. $c=C/D$ and $e = ER/D$

- Implication: Desired level of currency and excess reserves grow proportionately with checkable deposits

Deriving the Money Multiplier (cont.)

Examining the equation for reserves:

$R = RR + ER$; R = Reserves, RR = Required Reserves

$RR = r \times D$; D = Deposits

$R = (r \times D) + ER$; ER = Excess Reserves

- Note: $r<1$

Adding C to both sides

$$R + C = MB = (r \times D) + ER + C$$

$$R + C = MB = (r \times D) + ER + C$$

Equation above tells us three things:

1. Tells us amount of *MB* needed support *D*, *ER* and *C*

2. An increase of $1 of MB in C, does not get multiplied, whilst those that go into supporting deposits (e.g. Reserves) does get multiplied.

3. An increase of $1 of *MB* in *ER*, does not support *D* or *C*

$$\begin{aligned} MB &= (r \times D) + (e \times D) + (c \times D) \\ &= (r + e + c) \times D \end{aligned}$$

Deriving the Money Multiplier (cont.)

$$D = \frac{1}{r + e + c} \times MB$$

$$M = D + (c \times D) = (1 + c) \times D$$

$$\Rightarrow M = \frac{1 + c}{r + e + c} \times MB$$

where $m = \dfrac{1 + c}{r + e + c}$

Exercise 1…

- *Suppose: r=0.2, M=$1500 billion, C=$500 billion, D=$1000 billion, ER=$1.2 billion*

- What is the money multiplier?
  - Answer:

- What is the value of the monetary base?
  - Answer:

Exercise 2…

$$M = m \times B \quad \text{where } m = \frac{1+c}{r+e+c}$$

Question: Suppose households decide to hold more of their money as currency and less in the form of demand deposits.

1. Determine impact on money supply.
2. Explain the intuition for your result.

What factors influence bank's holdings of Excess Reserves?

The banking system's excess reserve ratio e is:

- *negatively* related to the market interest rate, i
- *positively* related to expected deposit outflows

Additional Factors that Determine money supply

- BM_n = MB-BR

BMn = nonborrowed monetary base

BR = borrowed reserve fund

M= m (BMn + BR)

Assignment

- The Bank of Ghana provided the following data for a particular year:
- Required Reserve Ratio (RRr) = 20%
- Excess Reserve Ratio (Er) = 0.25%
- Currency Ratio (Cr) = 70%
- Money Stock (M) = GH¢25,000 million
-
- Derive the money multiplier, calculate its value given the data above and interpret your results.
- Calculate the High Powered Money (H), the level of Banks Deposits, Currency in circulation and the Total Reserves.
- What is the net effect of an increase in the currency ratio (Cr) on the money supply given the monetary base? Give reasons in support of your answer.
- Determine the ratio of banks' interest yielding assets (loans/securities) to deposits.
-

Determination of the money supply

- Participants involved in the money supply determination

1. The central bank, which, among its other policies, determines the monetary base and the reserve requirements for the commercial banks, and sets its discount rate.

2. The public, which determines its currency holdings relative to its demand deposits

3. The commercial banks, which, for a given required reserve ratio, determine their actual demand for reserves as against their demand deposit liabilities.

Determination of the money supply

- *Demand for currency by the public*
- Fluctuations in the public's demand for currency relative to its holdings of demand deposits are a significant source of fluctuations in the money supply.
- Most studies on the issue examine the determinants of the ratio C/D, or of the ratio of currency to the total money stock (C/M1), rather than directly the determinants of the demand for currency alone.
- The desired C/D ratio depends upon the individual's preferences in the light of the costs and benefits of holding currency relative to demand deposits.
- Some of these costs and benefits are monetary and non-monetary
- The demand function for currency is specified below:

Determination of the money supply cont'd

$$C/D = c(\gamma_D, R^h, R_D, R_T, Y; \text{payments technology})$$

Where:

c = currency-demand deposit ratio

γ_D = charges on demand deposits

R^h = average yield on the public's investments in bonds, etc.

R_D = interest rate on demand deposits

R_T = interest rate on time deposits

Y = nominal national income

Determination of the money supply cont'd

$\partial c/\partial \gamma_D > 0$

$\partial c/\partial R_D < 0$

$\partial c/\partial Y > 0$

$\partial c/\partial R^h > 0$

$\partial c/\partial T_T > 0$

Determination of the money supply cont’d

- *Commercial banks: the demand for reserves*
- Commercial banks hold reserves against their deposits
- Technically this is known as the reserve ratio- the ratio of reserves held to deposits
- The central bank often requires the commercial banks to meet a certain minimum ratio of their reserves to their deposit liabilities, called the required reserve ratio.
- Banks usually hold reserves in excess of those required to meet the required reserve ratio. They also borrow from other banks or the central bank.
- Reserves held in excess of the sum of required and borrowed reserves are referred to as **free reserves.**

Determination of the money supply cont'd

- The demand function for desired free reserves, FR, can be expressed as:

$$FR/D = f(R, R_{BR}, R_{CB})$$

where:

R = average interest rate on banks' assets

R_{BR} = average return on banks' reserves

R_{CB} = central bank's discount rate (for loans to the commercial banks)

$\partial f/\partial R < 0$, $\partial f/\partial R_{BR} > 0$ and $\partial f/\partial R_{CB} > 0$.

The Monetary Base Model of Money Supply

- The Monetary Base Model, also known as the Base-Multiplier Approach to money supply determination is an alternative approach to the Flow of Funds approach of money supply which we will treat in detail in the next section.

- The first characteristic of the base-multiplier (B-M) approach is that it focuses upon stocks. The stocks in question are the stock of monetary base (M0) and the stock of money (e.g. M4).

- It points out that the latter is a multiple of the former and that this multiple is likely to be stable because of two underlying behavioural relationships.

- Since the components of the monetary base are liabilities of the central bank, the quantity can be varied at the bank's discretion and, given the stable relationship between M0 and M4, central bank action on M0 will produce a corresponding (multiple) reaction in M4.

Cont.

- We can also see from this simple summary that this insight depends upon some crucial **assumptions** about the underlying system.
- Firstly, it assumes the stability of two behavioural relationships: indeed, in its simplest version the B-M approach is sometimes presented as though these relationships are fixed. But this is an empirical question which needs to be examined.
- Secondly, while it is true that the monetary base consists of central bank liabilities, it does not automatically follow that the central bank either can or even desires to control these liabilities.
- Finally, there is a question about whether concentrating on stock equilibrium is very useful when the underlying variables are subject to continuous change. Put briefly, a monetary system in which the money supply changes only as the result of the central bank's deliberate adjustment of the monetary base, is a system in which the money supply is exogenous — exogenous at least with respect to the preferences of other agents in the economic system.

Monetary base

We turn now to a more formal examination of the base multiplier approach. We begin by defining the two stocks:

- M ≡ Cp + Dp……………………3.1 and

  B ≡ Cp + Cb + Db………………3.2

- M is (broad) money and consists of notes and coin in circulation with the non-bank public (Cp) plus their holdings of bank deposits (Dp). In practice, M corresponds to the broad money measures, the monetary base, consists of those same notes and coin plus also now notes and coin held by banks (Cb) and banks' own deposits at the central bank (Db). In practice, B corresponds to M0. If we now refer to Cb + Db as bank reserves and denote them R, then 3.2 can be rewritten as:

- B ≡ Cp + R ……………………………………..3.3

- At any particular time, there will be a monetary base of given value and similarly a given quantity of broad money and it is a simple task to create a ratio of money to base:

of money to base:

$$\frac{M}{B} \equiv \frac{Cp + Dp}{Cp + R} \qquad \text{...3.4}$$

The first insight comes when we divide through by the non-bank public's holdings of deposits.

$$\frac{M}{B} \equiv \frac{\dfrac{C_p}{D_p} + \dfrac{D_p}{D_p}}{\dfrac{C_p}{D_p} + \dfrac{R}{D_p}} \qquad \text{...3.5}$$

For convenience, let $Cp/Dp = \alpha$, and let $R/Dp = \beta$, then we can rewrite 3.5 as:

$$\frac{M}{B} \equiv \frac{\alpha + 1}{\alpha + \beta} \qquad \text{...3.6}$$

- The insight is that the volume of broad money, in relation to the base, depends upon the two ratios α, which is the public's cash ratio, and β which is the banks' reserve ratio. Let us suppose for a moment that these ratios are stable (not necessarily fixed) then we can predict that:

$$M = B.\frac{\alpha + 1}{\alpha + \beta} \qquad ...3.7$$

and

$$\Delta M = \Delta B.\frac{\alpha + 1}{\alpha + \beta} \qquad ...3.8$$

- Notice that in a fractional reserve system, β will have a value less than one and the term (α + 1)/(α + β), let us call it m, will be a multiplier.

- Recall that the base consists of liabilities of the central bank then, if we assume that the central bank is both willing and able to manipulate these liabilities at its discretion, then we get a second, more dramatic, insight, namely that the size of the money stock is determined by the central bank's willingness to supply assets comprising the monetary base.
-

MB cont.

- In an unrealistically simple world, α and β might be treated as fixed.
- But they are both portfolio decisions about which the public and banks respectively are likely to have preferences depending upon relative prices and other constraints.
- We cannot throw away the standard economic axioms of maximising behaviour just because we are dealing with money.
- That said, we do not promise an exhaustive account of how maximisation might be achieved, but we can offer some illustration of relevant factors which will bear upon preferences.
- If we take α, the public's cash ratio, we can say firstly that the decision to divide money holdings between notes and coin ('cash') and bank deposits must surely depend upon any rate of interest paid on deposits, money's 'own rate', which we might denote im.
- The higher the rate paid on deposits (and the wider the range of deposits on which it is paid), the less willing, ceteris paribus, people will be to hold cash.

The role of technology

- Technology has almost certainly affected the cash/deposit split through other routes.
- For a given level of money’s own rate and a given level of ‘services’ from deposits, the decision about how much cash to hold must depend to some extent upon the difficulties of switching between cash and deposits, the so-called ‘shoe leather costs’ based on the idea that replenishing cash balances involved walking to the bank and standing in a queue.
- But one of the many achievements of banking technology has been the development of the cash machine or automated teller machine (‘ATM’) to give it its proper name.
- These machines now allow a wide range of routine banking transactions to be carried out at remote sites like supermarkets, filling stations, shopping malls and even educational institutions. Given that these facilities make cash replenishment easier, they encourage people to hold smaller cash balances.
- The effect is likely to be more marked in periods
- of rapid inflation and high nominal interest rates when the protection of purchasing power offered by interest-bearing deposits will be greatest.

- The two examples of technological change we have given, both tend to reduce the public's cash ratio: α gets smaller. This need not be the case a priori.
- It is conceivable that future technological changes will push in the opposite direction.
- This means that we cannot give a definite sign to the partial derivative of technology (as we could with money's own rate, for example).
- In practice, however, it is very likely that technological changes have acted over the years towards a reduction in the public's need to hold cash.
- As regards influences upon the public's cash ratio, therefore, we can surmise

that α will depend to some extent upon at least two factors, money's own rate and technological conditions.

$$\alpha \equiv \frac{Cp}{Dp} = f(\underset{-}{i_m}, \underset{?}{T}) \qquad \ldots 3.9$$

- When it comes to banks' decisions about their reserve ratios, therefore, there are numerous influences at work.

- Remember that banks are profit-seeking firms, that the cash element of reserves yields no interest and that, in most systems deposits at the central bank are also non-interest bearing.

- This means that holding reserves acts like a tax on banking.

- Banks' decisions to hold reserves will depend firstly upon their cost.

- Where reserves pay no interest then the cost can be proxied by the return on alternative liquid assets, which might be proxied by the bond rate, ib.
- Where reserves do pay interest, then the cost will be the return on reserves, ir relative to the bond rate.
- The quantity of reserves held will depend also on the cost of being short, that is upon the rediscount rate charged for lender of last resort facilities, id.

- This is the rate of interest announced periodically, usually monthly, by the central bank.

In summary, then:

$$\beta \equiv \frac{R}{Dp} = f(\underset{+}{i_r}, \underset{-}{i_b}, \underset{+}{i_d}, \underset{+}{RR}, \underset{+}{\sigma}) \qquad \text{...3.10}$$

- Given that we now have some idea of the sorts of influences, and the direction of their effect, upon the ratios α and β, the next obvious question is what effect will changes in α and β have upon the size of the multiplier expression in 3.7 and 3.8.
- From there, we can see their effect on the money supply.

- The answer to the first question lies in the value ‘1’. Because the values of α and β are fractions (in practice, very small fractions) it is the ‘1’ which gives the expression a multiplier value:
- the numerator is bound to be larger than the denominator. Consider now what happens if we change α and β.
- If we increase (for example) α, we increase the numerator and denominator simultaneously and the outcome may therefore appear indeterminate at first glance.

- If we are looking at an increase, therefore, a given change in α must have a bigger effect upon the denominator than the numerator and the value of the multiplier will fall.
- With β, the effect is obvious since it appears only in the denominator.

- Any change in β must lead to an inverse change in the value of the multiplier.
- Since the money supply depends upon both the base and the multiplier we can write:

$$M = f(\underset{+}{B}, \underset{-}{\alpha}, \underset{-}{\beta}) \qquad \text{...3.11}$$

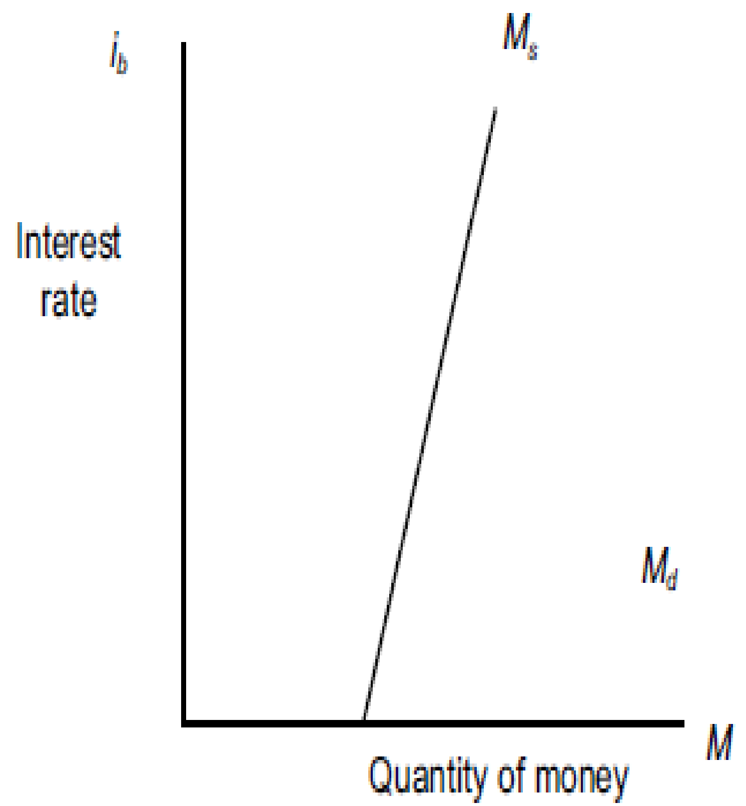
- and since we know (from 3.9 and 3.10) how α and β are likely to respond to a number of influences, we can substitute into (3.11), to yield a money supply determined as follows:

$$M = f(\underset{+}{B}, \underset{+}{i_m}, \underset{?}{T}, \underset{-}{i_r}, \underset{+}{i_b}, \underset{-}{i_d}, \underset{-}{RR}, \underset{-}{\sigma}) \qquad \text{...3.12}$$

- A change in B is a change in the multiplicand; changes in all other variables cause a change in the size of the multiplier itself.

- The horizontal axis depicts the quantity of money as a stock. In this space, a money supply curve intersects the horizontal (money) axis at a point where M = m.B (where m is the multiplier).
- A change in B changes the point of intersection (the supply curve shifts). The same results from a change in any of RR, id ir, im, σ, T since these cause a change in the value of the multiplier.
- With a downward sloping demand curve in the diagram, the rate on the vertical axis must be the opportunity cost of holding money.

Figure 3.1: The money supply curve



Flow of Funds Approach to Money Supply

- Traditionally, it has been shown controversially that money supply is determined using the base multiplier approach, as we have just seen.

- ‘The multiplier model of the money supply originally developed by Brunner (1961) and Brunner and Meltzer (1964) has become the standard model to explain how the policy actions of the Central Bank influence the money stock’.

- However, there is more than sufficient evidence to suggest that monetary authorities do not determine the money supply and that the flow of funds approach makes more sense.

- Consequently, I will compare and contrast the base multiplier and the flow of funds approaches to the determination of money supply and determine which occurs in reality in view of the present economic climate.
- As we have just gone through the base-multiplier approach we will now focus on the flow of funds approach to money supply and later reconcile the two.

Flow Fund cont

- Where the base-multiplier approach focused upon stocks, the flow of funds (FoF) approach concentrates upon changes in stocks, i.e. on flows.
- There is a connection with the B-M approach in that one of the flows is the change in money stock; but the other flow which dominates the FoF approach is the flow of bank lending to the non-bank public.
- This is strictly speaking the net change in the stock of bank loans — the difference over time in the stock of loans taking account of both new loans made and loans repaid.
- The flow of money is shown as ΔM, the flow of new loans is shown as ΔLp (for new lending to the non-bank private sector) and ΔLg (for new lending to the
- public sector).1 Because it focuses upon flows of new lending and their ability to create deposits, the FoF approach is sometimes known as the 'credit-counterparts' approach.

- As with the B-M approach, we begin with the money supply identity:

$M \equiv Cp + Dp$ ……………………….3.13

and then rewrite it in flows:

$\Delta M \equiv \Delta Cp + \Delta Dp$…………..3.14

FoF cont.

- We next concentrate on the deposit element and use the bank balance sheet identity to remind ourselves that since deposits (liabilities) must be matched by loans (assets) then the same must be true about changes. On the asset side, loans can be decomposed into loans to the private and to the public sector.

$\Delta Dp \equiv \Delta Lp + \Delta Lg$……………………………………….3.15

- Concentrate now on bank loans to the public sector. These are just one way of financing the public sector and, because of its monetary implications and short-term nature, it tends to be a residual source of financing — something to be resorted to after all other forms of finance.
- So it follows that we can locate the flow of new bank lending to the public sector (PSBR) within the public sector's total borrowing requirement:

$\Delta Lg \equiv PSBR - \Delta Gp - \Delta Cp \pm \Delta ext$…………………………3.16

- where ΔGp represents net sales of government bonds to the general public. Notice that Δext can take a positive or negative value.
- Δext refers to the monetary implications of external flows. For example, if the public sector buys foreign currency assets with sterling (as it might if it were trying to hold a fixed exchange rate) this adds to the public sector's borrowing requirement.
- Selling foreign currency assets for sterling reduces the need for sterling borrowing.

- We can then substitute 3.16 into 3.15 to show all the sources of change

in deposits:

$\Delta Dp \equiv \Delta Lp + PSBR - \Delta Gp - \Delta Cp \pm \Delta ext$ 3.17

- and then substitute 3.17 into 3.14 to show all sources of monetary change. In making the substitution we have tidied up (notice that ΔCp cancels because it enters twice, with opposite signs) and reordered the terms to give 3.18, which is often referred to as the 'flow of funds identity'.

$\Delta M \equiv PSBR - \Delta Gp \pm \Delta ext + \Delta Lp$..3.18

- What insights do we gain from the FoF approach? The explicit message is that changes in the money stock are inextricably linked to lending/borrowing behaviour.
- But behind this are three implications. The first of these is that changes themselves are what matters — one would not use the FoF approach to analyse a system where stocks dominate everyone's interest.
- It is an implication of the FoF approach that our interest in money supply is an interest in monetary growth.

FoF Approach

- The second implication is that the monetary base is of little interest.
- We shall see in the next section that we can rewrite the flow of funds identity so as to include changes in the monetary base, but the fact that the FoF identity is not normally written in that way is significant.
- One does not adopt a method of analysis which deliberately omits variables which one thinks are important.
- It points to flows as the important variables and by omitting references to the monetary base it hints that the authorities might need to find some non-base-orientated way of influencing these flows.
- Equally, one does not normally adopt a mode of analysis which gives a key position to variables of little interest.
- The third implication of the FoF analysis, therefore, is that if/when the authorities become interested in the magnitude of flows, they should pay attention to lending/borrowing.
- While the B-M approach creates the impression that bank lending is reserve (supply) constrained, the FoF creates the impression that it is (demand) constrained by the non bank private sector's desire for additional credit.

Determination of the money supply

- Participants involved in the money supply determination

1. The central bank, which, among its other policies, determines the monetary base and the reserve requirements for the commercial banks, and sets its discount rate.

2. The public, which determines its currency holdings relative to its demand deposits

3. The commercial banks, which, for a given required reserve ratio, determine their actual demand for reserves as against their demand deposit liabilities.

Determination of the money supply

- *Demand for currency by the public*
- Fluctuations in the public's demand for currency relative to its holdings of demand deposits are a significant source of fluctuations in the money supply.
- Most studies on the issue examine the determinants of the ratio C/D, or of the ratio of currency to the total money stock (C/M1), rather than directly the determinants of the demand for currency alone.
- The desired C/D ratio depends upon the individual's preferences in the light of the costs and benefits of holding currency relative to demand deposits.
- Some of these costs and benefits are monetary and non-monetary
- The demand function for currency is specified below:

Determination of the money supply cont'd

$$C/D = c(\gamma_D, R^h, R_D, R_T, Y; \text{payments technology})$$

Where:

c = currency-demand deposit ratio

γ_D = charges on demand deposits

R^h = average yield on the public's investments in bonds, etc.

R_D = interest rate on demand deposits

R_T = interest rate on time deposits

Y = nominal national income

Determination of the money supply cont'd

$\partial c / \partial \gamma_{\mathrm{D}} > 0$

$\partial c / \partial R_{\mathrm{D}} < 0$

$\partial c / \partial Y > 0$

$\partial c / \partial R^{\mathrm{h}} > 0$

$\partial c / \partial T_{\mathrm{T}} > 0$

Determination of the money supply cont'd

- *Commercial banks: the demand for reserves*
- Commercial banks hold reserves against their deposits
- Technically this is known as the reserve ratio- the ratio of reserves held to deposits
- The central bank often requires the commercial banks to meet a certain minimum ratio of their reserves to their deposit liabilities, called the required reserve ratio.
- Banks usually hold reserves in excess of those required to meet the required reserve ratio. They also borrow from other banks or the central bank.
- Reserves held in excess of the sum of required and borrowed reserves are referred to as **free reserves.**

Determination of the money supply cont'd

- The demand function for desired free reserves, FR, can be expressed a

$$\mathrm{FR}/D = f(R, R_{\mathrm{BR}}, R_{\mathrm{CB}})$$

where:

R = average interest rate on banks' assets

R_{BR} = average return on banks' reserves

R_{CB} = central bank's discount rate (for loans to the commercial banks)

$\partial f/\partial R < 0, \partial f/\partial R_{\mathrm{BR}} > 0$ and $\partial f/\partial R_{\mathrm{CB}} > 0.$

Mechanical theories of the money supply: money supply identities

- Mechanical theories of the money supply are so called because they use identities, rather than behavioral functions, to calculate the money supply

▪ *An elementary demand deposit equation*

This model assumes that the ratio of reserves held by the banks against dema $BR = \rho D$ is given by:

where:

BR = reserves held by banks

D = demand deposits in banks

ρ = reserve ratio

- Given this formulation, profit-maximizing banks will create the amount of d $D = (1/\rho)BR$

Mechanical theories of the money supply: money supply identities cont’d

- This equation is the elementary deposit creation formula for the creation of deposits by banks on the basis of the reserves held by them
- However, it fails to take note of the behavior of the banks and the public in the deposit expansion process.

▪ *Common money-supply formulae*

- Friedman and Schwartz (1963) extended the money supply model by $M = C + D$ to deposits desired by the public

$$M0 = BR + C$$

Mechanical theories of the money supply: money supply identities cont'd

- where:

  D = demand deposits

  BR = banks' reserves

  C = currency in the hands of the public

  $\mathrm{M0}$ = monetary base = $BR + C$.

- From the above two equations, the determinants of the money supply and monetary base multiplier are presented below:

Mechanical theories of the money supply: money supply identities cont'd

-

$$
\begin{aligned}
M &= \frac{M}{\mathrm{M0}}\mathrm{M0} \\
&= \frac{C+D}{BR+C}\mathrm{M0} \\
&= \frac{1+D/C}{BR/C+1}\mathrm{M0} \\
&= \frac{(1+D/C)(D/BR)}{(BR/C+1)(D/BR)}\mathrm{M0} \\
&= \frac{(1+D/C)(D/BR)}{(D/BR+D/C)}\mathrm{M0}
\end{aligned}
$$

Mechanical theories of the money supply: money supply identities cont'd

- Another version of the money supply formula is:

$$M = \frac{1}{\left(\frac{C}{M} + \frac{BR}{D} - \frac{C}{M} \cdot \frac{BR}{D}\right)} \mathrm{M0}$$

- Using this equation, Cagan (1965) examined the contributions of the three elements B, C/M and BR/D, to M2 over the business cycle and in the long term.
- It was found that growth in the monetary base highly influenced the long term growth in the money stock.
- However, for cyclical movements, changes in the C/M had a profound influence on the money stock

Mechanical theories of the money supply: money supply identities cont'd

- The preceding money-supply formula does not differentiate deposits into various types such as demand deposits, time and savings deposits, and government deposits nor does it differentiate between their reserve requirements
- The formula that does so is:

$$M = \left[\frac{1+c}{\rho_D + \rho_T t + \rho_G g + c} \right] \mathrm{M0}$$

- where t = T/D and g = G/D, T and G represent time/savings deposits and government deposits respectively in commercial banks.
- The above formulae are all identities. The one used depends on the rules and regulations about reserve ratios, the availability of statistical data and the further behavioral assumptions that are made

Behavioral theories of the money supply

- A behavioral theory of the money supply process takes into account the behavior of the different participants in this process in order to determine the economic and non-economic determinants of the variables being studied
- The theory makes use of the currency desired by the public, the reserves desired by the commercial banks, the amounts borrowed by them and the monetary base which the central bank wishes to provide.
- The money supply function is thus specified as:

Behavioral theories of the money supply

- $$M^s = M^s(R_D, R_T, R_S, R_L, R_d, R_O, R, Y, \text{M0})$$

where:

R_D = charges on demand deposits
R_T = interest rate on time deposits
R_S = short-term interest rate
R_L = long-term interest rate
R_d = discount rate (central bank rate for lending to the commercial banks)
R_O = overnight loan rate
RR = required reserve ratio.

Monetary base and interest rates as alternative policy instruments

- The central bank can use either the monetary base or the interest rate to control aggregate demand in the economy, or may have to use both
- Under certainty and known money supply and demand functions, it needs to use only one of them
- To ume that the money supply function is giv

$$M = \frac{\mathrm{M0}}{\left[\frac{C}{M} + \frac{BR}{D} - \frac{C}{M} \cdot \frac{BR}{D}\right]}$$

where:

$$\alpha = \frac{1}{\left[\frac{C}{M} + \frac{BR}{D} - \frac{C}{M} . \frac{BR}{D}\right]}$$

- This money supply function can be written simply as:

$$M = \alpha \mathrm{M0},$$

Monetary base and interest rates as alternative policy instruments cont'd

- Specifying the general form of the money demand as:
- $m^{\mathrm{d}} = m^{\mathrm{d}}(y, R)$
- The money market equilib $\alpha.\mathrm{M0} = P.m^{\mathrm{d}}(y, R)$
- Under certainty, given the policy targets for P at $P*$ and y at $y*$,
- The market condition can be solved for the relationship between M0 and R, so that the central bank can achieve its objectives by setting the monetary base M0 at M0∗ and letting the economy determine R, or by setting R at R∗ and letting the economy determine the money supply needed to support R∗.
- It does not have to pursue a policy of setting both M0 and *R*.

LECTURE 4: MONEY, PRICES AND EMPLOYMENT

Money and Theories of Inflation

Definition of Inflation

- The neo-classical school of thought initially regarded inflation as a galloping rise in prices as a result of excessive increase in the supply of money.
- They regarded inflation “as a destroying disease born out of lack of monetary control whose results undermined the rules of business, creating havoc in markets and financial ruin of even the prudent.”
- **The neo-classical school of thought believed that inflation is basically a monetary phenomenon.**
- Friedman pointed out that, “Inflation is always and everywhere a monetary phenomenon ……. and can be produced only by a more rapid increase in the quantity of money than output.”
- But Hicks noted that , “Our present troubles are not of a monetary character.”
- Economists, therefore, define inflation in terms of a continuous rise in prices. For example whilst Johnson defines “inflation as a sustained rise” in prices, Broman defines it as “a continuing increase in the general price level.
- Shapiro in a similar vein defines inflation “as a persistent and appreciable rise in the general level of prices.
- Denberg and McDougall however argued that ‘the term usually refers to a continuing rise in prices as measured by an index such as the consumer price index (CPI) or by the implicit price deflator for gross national product.’

Keynes

- But Keynes in his General Theory thought otherwise.
- He was of the view that the economy was not always at fill employment and so it was not possible for increases in the quantity of money to result in hyper-inflation.
- Rather, there is underemployment in the economy, and as such an increase in the money supply leads to increase in aggregate demand, output and employment.
- Starting from a depression, as the money supply increases, output and employment rise further, diminishing returns start and certain bottlenecks inflation or "semi-inflation" sets in.
- If the money supply increases beyond the full employment level, output ceases to rise and prices rise in proportion with the money supply.

- Keynes' perception of inflation is subjected to two main setbacks.
- First, it emphasizes on demand as the major cause of inflation, but neglects the cost side of inflation.
- Second, it ignores the possibility that a price rise may lead to further increase in aggregate demand which may, in turn, lead to further rise in prices.
- An attempt to provide a working definition for inflation has rather resulted in a prolonged debate on this subject matter.

Theories of Inflation

- ***The Cost-Push Theory of Inflations***
- The cost-push theory of inflation is the wage push or the profit-push theory of inflation. In every process of inflations wages and prices rise and they reinforce the rise in each other, whatever the cause of inflation.
- But if the cost-push theory is valid, then they both should not be the common result of some third force which may be a rise in total demand or money supply or what not and the initiation of inflation should have been made by an autonomous rise in wages or profits.

- The main cause of cost-push inflation is wage increases enforced by unions and profit increases by employers.
- That is to say that cost-push inflation is caused by wage-push and profit-push to prices. The primary cause of cost-push inflation is that money wages rise faster than the productivity of labour.
- In most countries where trade union activities are effective they are able to press employers to grant wage increases very much in excess of increases in the productivity of labour, thereby raising the cost of producing goods and serves. In turn, employers pass on the increase in the cost of production to consumers in the form of higher prices.
- Despite the increase in prices the higher wages enjoyed workers enable to buy as much as before.
- However, continuous increase in prices induces unions to make further demands for higher wages. In this way, the wage-cost spiral continues, thereby leading to cost-push or wage-push inflation.

- Related closely to the point above is that cost-push inflation can be also be caused by an increase in the price of domestically produced or imported raw materials. Since raw materials are used as inputs in the production of finished goods, they affect the cost of production. So then a continuous rise in the prices of raw materials tend to set off a cost-price-wage spiral.

- Cost-push inflation is further caused by profit-push inflation. Oligopolist and monopolist firms raise the price of their products to offset the rise in labour and production costs so as to earn higher profits. There being imperfect competition in the case of such firms, they are able to “administer price” of their products. Profit-push inflation is, therefore, also called administered-price theory of inflation or price-push inflation or sellers’ inflation or market-power inflation.

- Cost-push inflation is illustrated in Figure 4.1 (A) and (B). First consider diagram (B) of the figure where supply curves represented by the curves SS and SS1 and full employment income represented by YF.

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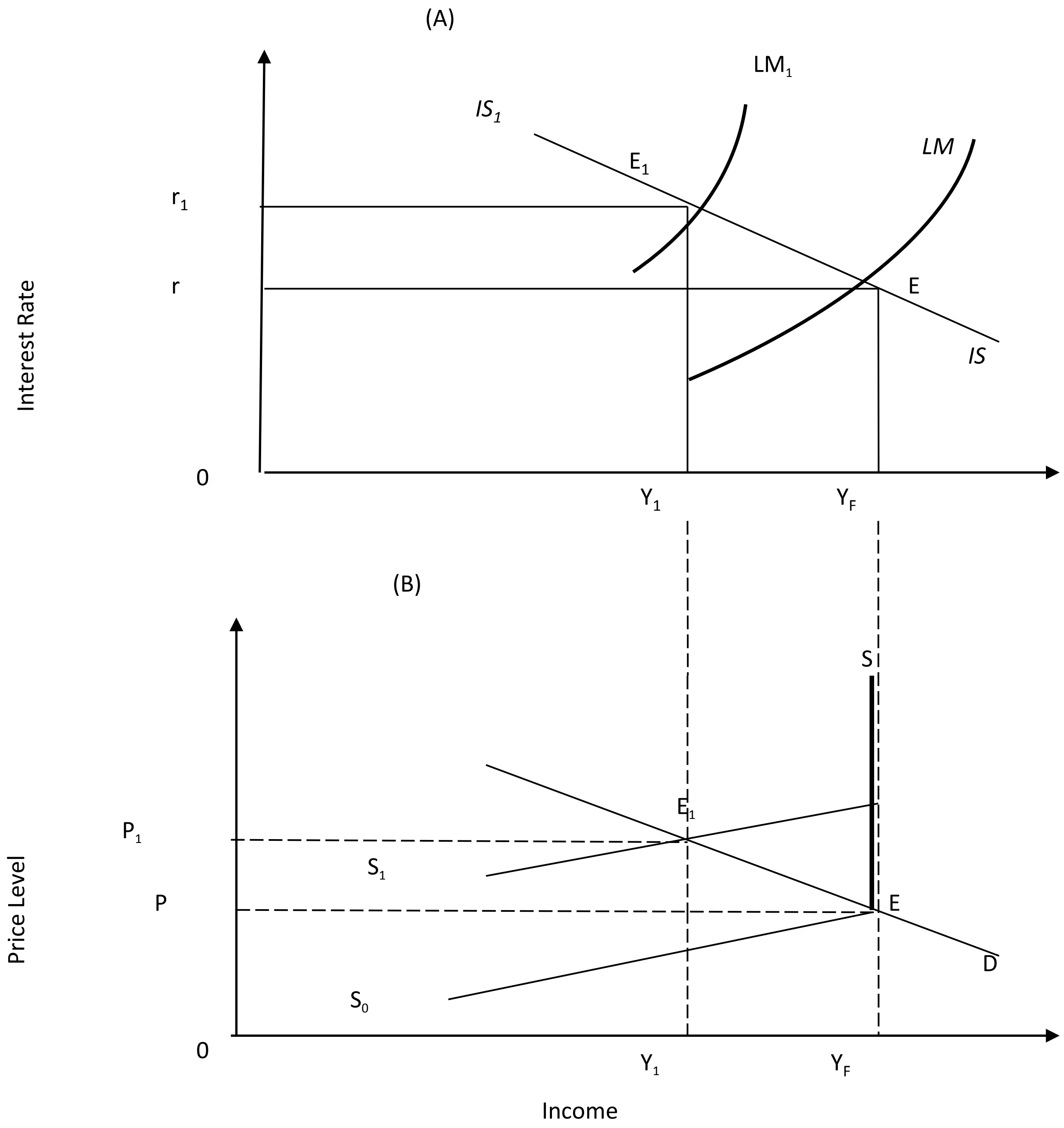
(A)
LM1
IS1
E1
LM
r1
r
E
IS
Interest Rate
0
Y1
YF
(B)
S
E1
P1
S1
P
E
D
Price Level
S0
0
Y1
YF
Income

Demand-Pull or Monetary Theory of Inflation

- According to this theory, it is not the push of cost from behind, but the pull of demand from the fore that causes inflation i.e. the wage-rise and the price rise - both are the results of rising total demand.
- Total demand for goods in the economy can rise either on account of the increase in the money stock or increase in the velocity of money.
- In the modern economy, liabilities of the non-bank financial intermediaries work as near moneys or near money substitutes and thereby reduce the demand for money that increases its velocity.
- This is also the thesis of Gurley and Shaw in their famous book – "Money in a Theory of Finance." Nov/ the rise in the velocity of money can be understood in two ways –
- (1) firstly, the growth of near money substitutes can lessen the demand for money and thereby can increase the velocity of money and secondly
- (2) money held up on account of pervasive controls, as for example, during war times, may begin to be spent when controls are relaxed or removed, thereby increasing the turnover of money or the velocity of money.
- Demand-pull inflation or excess demand inflation is the most commonly known type of inflation.
- It occurs when aggregate demand rises more than the supply of supply of goods and service. Goods may be in short supply either because resources are not fully utilized or production cannot be increased quickly to meet the increasing demand.
- We therefore experience a situation where “too much money chasing too few goods.”

Demand-Pull cont.

- Two principal theories attempt to explain the demand-pull inflation, namely the Monetarists and Keynesians theories.
- ***Monetarist View or Monetary Theory of Inflation***
- Monetarists emphasized the role of money as the principal cause of demand-pull inflation.They argued that inflation is always a monetary phenomenon.
- The formal explanation of the monetarist view was formulated as the simple quantity theory of money and was expressed the Fisher's equation of exchange which is of the form:

$$MV = PQ$$

- where M is the money supply, V is the velocity of money, P is the price level, and Q is the level of real output.

- Assuming V and Q as constant, the price level (P) varies proportionately with the supply of money (M). With flexible wages, the economy was believed to operate at full employment level.
- The labour force, the capital stock, and technology also changed only slowly over time.
- Consequently, the amount of money spent did not affect the level of real output so that a doubling of the quantity of money would result simply in doubling the price level.
- Until prices had risen by this proportion, individuals and firms would have excess cash which they would spend, leading to rise in prices.
- So inflation proceeds at the same rate at which the money supply expands. In this analysis the aggregate supply is assumed to be fixed and there is always full employment in the economy.
- Naturally, when the money supply increases if creates more demand for goods but the supply of goods cannot be increased due to the full employment of resources. This leads to rise in prices. But it is a continuous and prolonged rise in the money supply that will lead to true inflation.

- Friedman the renowned monetary economist however argued that “inflation is always and every where a monetary phenomenon that arises from a more rapid expansion in the quantity of money than in total output.”
- He argues that any time the quantity of money changes nominal income changes in the same direction.
- The rise in the general price level and thus inflation arise from the fact that the increase in income encourages everywhere to increase their demand for goods and services as they spend their cash balances.
- For the tact that demand for money is fairly stable, this excess spending is the outcome of a rise in the nominal quantity of money supplied to the economy.
- So inflation is always a monetary phenomenon.

- The quantity theory version of the demand-pull inflation is illustrated diagrammatically in Figure 4.3 (A) & (B).

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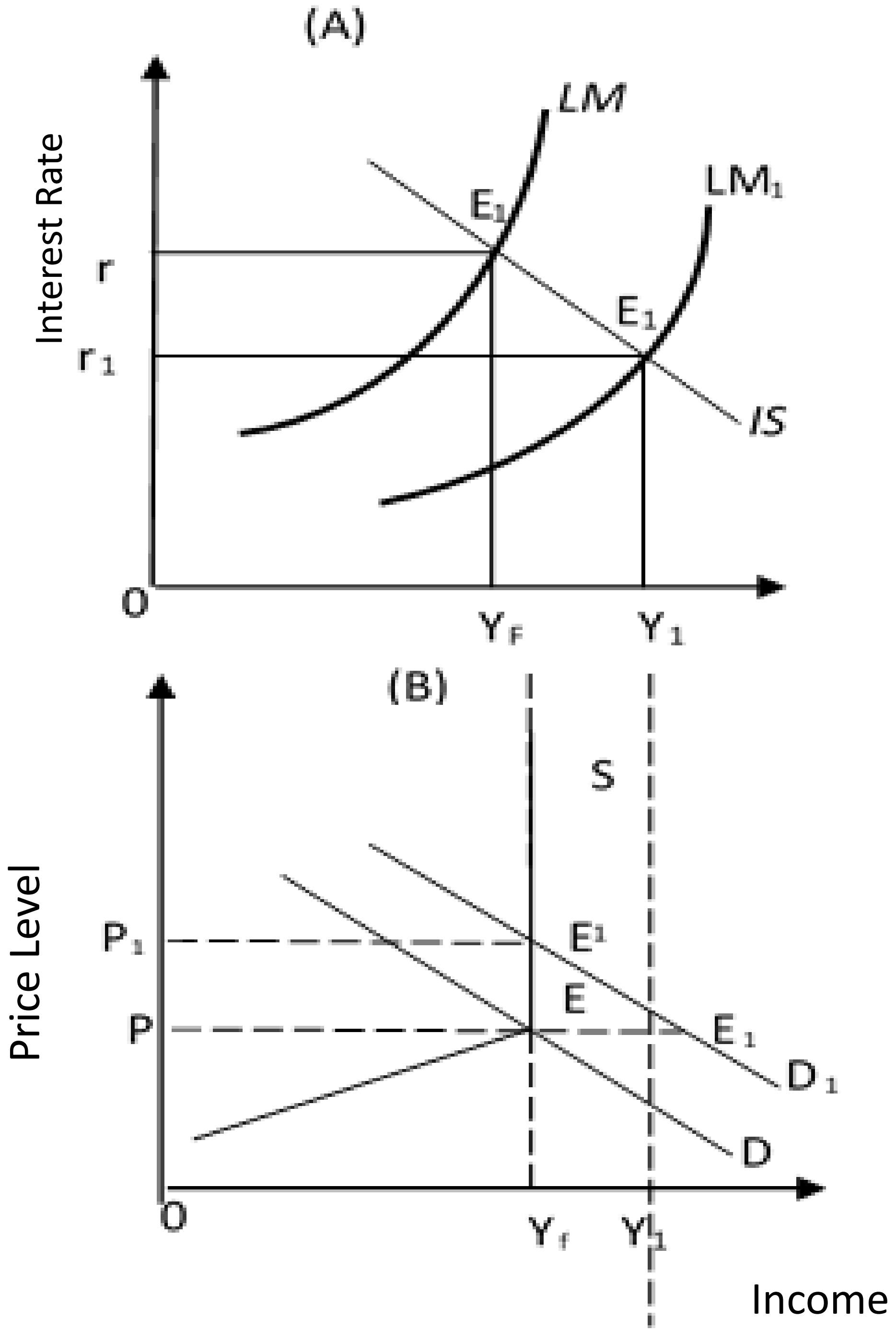

(A)
Interest Rate
LM
LM₁
E₁
E₁
r
r₁
IS
O
Y_F
Y₁
(B)
Price Level
S
P₁
E¹
E
P
E₁
D₁
D
O
Y_f
Y₁
Income

Mixed Demand-Pull and Cost-Push Inflation

- Most economists do not accept this dichotomy that inflation is either demand-pull or cost-push.
- Rather inflation is believed to be caused by inflationary process emanating from both source.
- Let's assume an inflationary process starts with excess demand with no cost-push forces at work.
- Excess demand will raise prices which will in due course pull up money wages.
- But the rise in money wages is not the result of cost-push forces. Such a mixed inflation will lead to sustained rise in prices.

- ,

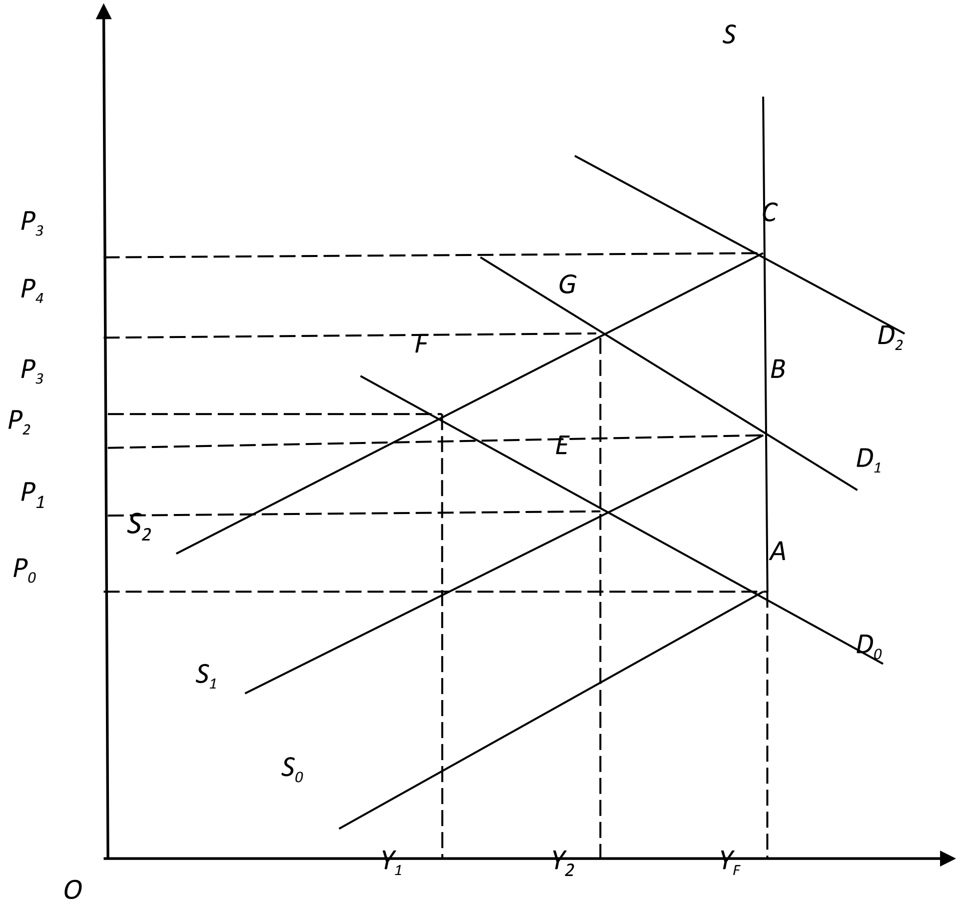


Fig 4. 3

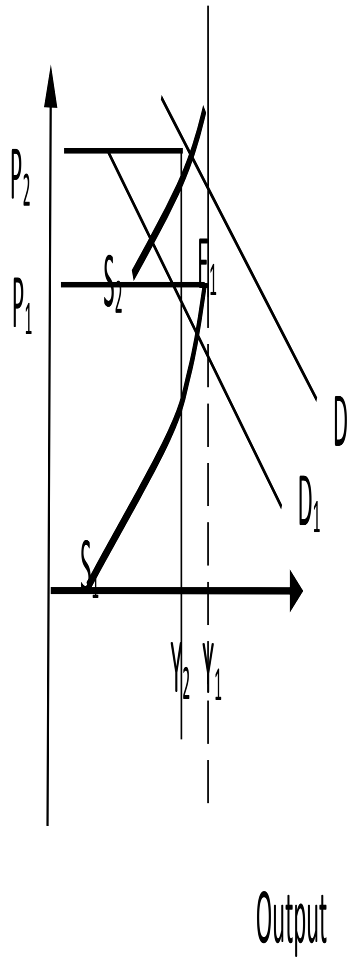
Keynesian Theory on Inflation

- Keynesian theory of inflation works through the investment-saving mechanism.
- It is little surprising to note that there are two Keynesian theories of inflation one is demand-pull theory and the other is the cost-push theory.
- It may be said that the demand-pull theory was expressed in the form of an ’inflationary gap* by Keynes in his book "How to Pay for War1’ (J .Keynes, 1940) and the cost-push theory was contained in his "General Theory."
- Keynesians believers in the quantity theory of money (implicitly or explicitly) are one in the belief that the immediate cause of inflation is excess demand, though they may disagree regarding the proximate and the ultimate causes of excess demand itself.
- Keynes did not emphasize the excess money supply as the cause of excess demand, he felt that the monetary policy cannot deliver the goods.
- He advocated that the fiscal policy should be activated and the Government should increase public expenditure and reduce taxes thereby ushering into budget deficits.
- Budget deficit implied the expansion of money supply, but he did not emphasize the growth in money supply which may take the place of hoarded inactive money and thus may help in reviving demand.
- He forced money and the monetary policy to take a backseat and put the fiscal policy in the forefront.
- He argued that the balancing of the economy was more important than the balancing of the budget. Balancing of the economy may require sometimes unbalanced budgets.

Structuralist View of Inflation

- According to the structuralist school of thought as an economy develops rising rigidities may give rise to structural inflation.
- Initially there is an increase in non-agricultural incomes accompanied by high growth rate of population that in turn causes an increase in the demand for goods and services.
- The increasing pressure from population growth and rising urban incomes would tend to rise through several channels, namely, prices of agricultural goods, the general price level and wages.
- With an initial increase in the demand for agricultural goods, their prices rise because their supply is inelastic rise emanating from a host of challenges including land tenure problems , lack of irrigation, finance, storage and marketing facilities, and bad harvests etc.
- To prevent the continuous rise in the price of agricultural products, especially food products, their supply is supplemented through. However large importation may not be possible because of foreign exchange constraint.
- Moreover, the prices of imported products are relatively higher than their domestic prices and thereby causing domestic prices within the economy to rise.

- As the prices of food products rise, wage earners agitate for higher wages to compensate for the rising cost of living.
- In fact wages may be increased whenever the cost of living index rises above an agreed point which further increases the demand for goods and a further rise in their prices.
- Figure6. 4 below illustrate the effect of an increase in wage rates on prices.
- In the diagram as wage rates rise, the aggregate demand for goods increases from D1 to D2.
- Aggregate supply however falls due to increase in labour costs which results in the shifting of aggregate supply curve from S1S to S2 S.
- Since the production of goods is inelastic due to structural rigidities after a point, the supply curve is shown as vertical from point E1 onwards.



Monetary Control and Inflation

- The principle that inflation and deflation are fundamentally monetary phenomena has been one of the best understood and empirically well-founded notions in monetary economics.
- Over history, whenever central banks have allowed money growth to systematically surpass the natural growth of the economy, sooner or later inflation inevitably followed.
- Likewise, serious deflationary episodes have invariably been associated with sustained shortfalls in money growth. Recognition of this fundamental principle over the years has led many central banks to place special emphasis on reigning in money growth in a continuing effort to pursue and maintain price stability over time.
- And consequently, monitoring the growth rate of money has long been part of the standard monetary practitioner's toolkit.

- Simple measures of money growth may not always reliably foreshadow subsequent movements in inflation. From this perspective, the benefits of close monitoring of the behavior of monetary aggregates as indicators of inflation over shorter horizons may not always appear very large.

Money growth and inflation

- Rewriting the equation of exchange in growth terms, approximated by logarithmic differences, allows restating this identity in terms of money growth and inflation.
- In this lecture, we use this well-known relationship to illustrate in a simple manner the significance of properly accounting for changes in equilibrium velocity in assessing the usefulness of money growth as an anchor for inflation.
- For notational convenience, we use lowercase letters to denote logarithms, and adopt the standard notation $\pi = \Delta p$ for inflation and $\mu = \Delta m$ for money growth. Writing the equation of exchange in logarithmic form,
- $m + v = p + q$, and taking differences gives:

- $\mu + \Delta v = \pi + \Delta q$ ……………………..1)

Money growth

- As with the equation of exchange, this relationship is an identity and holds for any horizon over which growth rates are computed.
- To allow for a more convenient interpretation, it is useful to decompose the growth of output and growth of velocity into their long-run equilibrium components and cyclical components.
- Defining Q* to denote the natural level of output (potential output), the cyclical component of output growth can be captured by the growth rate gap, $(\Delta q - \Delta q *)$. Likewise, the cyclical component of velocity growth can be captured by the velocity growth gap, $(\Delta \nu - \Delta \nu *)$. By definition, both of these gaps tend towards zero as the growth rates are computed over longer horizons.

- Equation (6) can be restated in terms of the cyclical and long-run components of
- output and velocity growth as follows:
-
- $\mu + \Delta \nu * + (\Delta \nu - \Delta \nu *)$=.$\pi + \Delta q *$+$(\Delta q - \Delta q *)$……………………..2)
-
- Rearranging terms to express this relationship in terms of inflation yields:

- $\pi = \mu - \Delta q * + \Delta \nu * - (\Delta q - \Delta q *) + (\Delta \nu - \Delta \nu *)$…………………………….3)

- This equation suggests a convenient decomposition of inflation into a cyclical component and a component determined by money growth adjusted both for the natural growth of output and changes in equilibrium velocity. Let m* reflect this adjusted money growth:

$\mu * \equiv \mu - \Delta q * + \Delta \nu *)$……………………………………….4)

- Collecting the two cyclical terms

$\eta = -(\Delta q - \Delta q *) + (\Delta \nu - \Delta \nu *)$……………………………………….5)

- And rewriting the equation, yields

$\pi = \mu * + \eta$ …………………………………….6)

- As this equation makes obvious, apart from cyclical effects that tend towards zero over medium- and long-term horizons, inflation should track adjusted money growth closely.
- Equation (6), of course, is simply a restatement of a relationship that is both fundamental and well understood.
- If the central bank's long-run objective is to achieve and maintain inflation at a low and stable level, π *, then this relationship indicates that the central bank must ensure that money growth is set such that $\pi * = \mu *$, over time.

How money growth produces inflation: Diagrammatic Approach

- let's look at the outcome of a continually growing money supply (M^s) (see Figure 2).

- Initially the economy is at point 1, with output at the natural rate level and the price level at P_1 (the intersection of the aggregate demand curve AD_1, and the short-run aggregate supply curve AS_1).

- If the m^s increases steadily over the course of the year, the aggregate demand curve shifts rightward to AD_2.

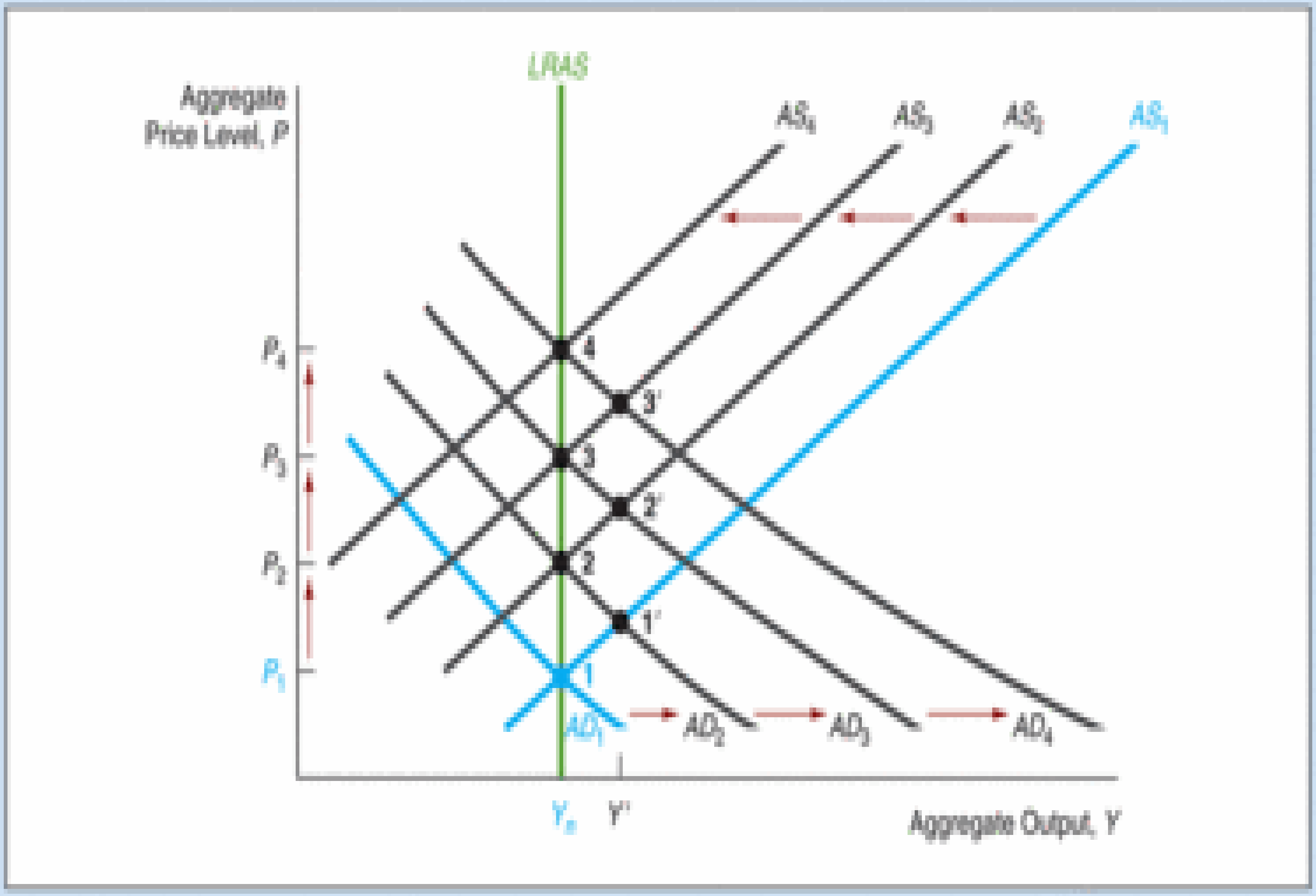


FIGURE 2 **Response to a Continually Rising Money Supply**

Money growth

- for a very brief time, the economy may move to point 1' and output may increase above the natural rate level to Y',
- but the resulting decline in unemployment below the natural rate level will cause wages to rise, and the short-run aggregate supply curve will quickly begin to shift leftward.
- It will stop shifting only when it reaches AS_2, at which time the economy has returned to the natural rate level of output on the long-run aggregate supply curve.[1]
- At the new equilibrium, point 2, the price level has increased from P_1 to P_2.
- **High money growth produces high inflation**.

Can Fiscal Policy by Itself Produce Inflation?

- The increase in government expenditure shifts the AD to AD_2, and we move to point 1', where output is above the natural rate level at $Y_{1'}$.
- Because of this, the short-run AS curve will begin to shift leftward,
- eventually reaching AS_2, where it intersects the aggregate demand curve AD_2, at point 2, at which output is again at the natural rate level and the price level has risen to P_2.
- The net result of a one-shot permanent increase in government expenditure is a one-shot permanent increase in the price level.
- High inflation cannot be driven by fiscal policy alone

Can Fiscal Policy by Itself Produce Inflation?

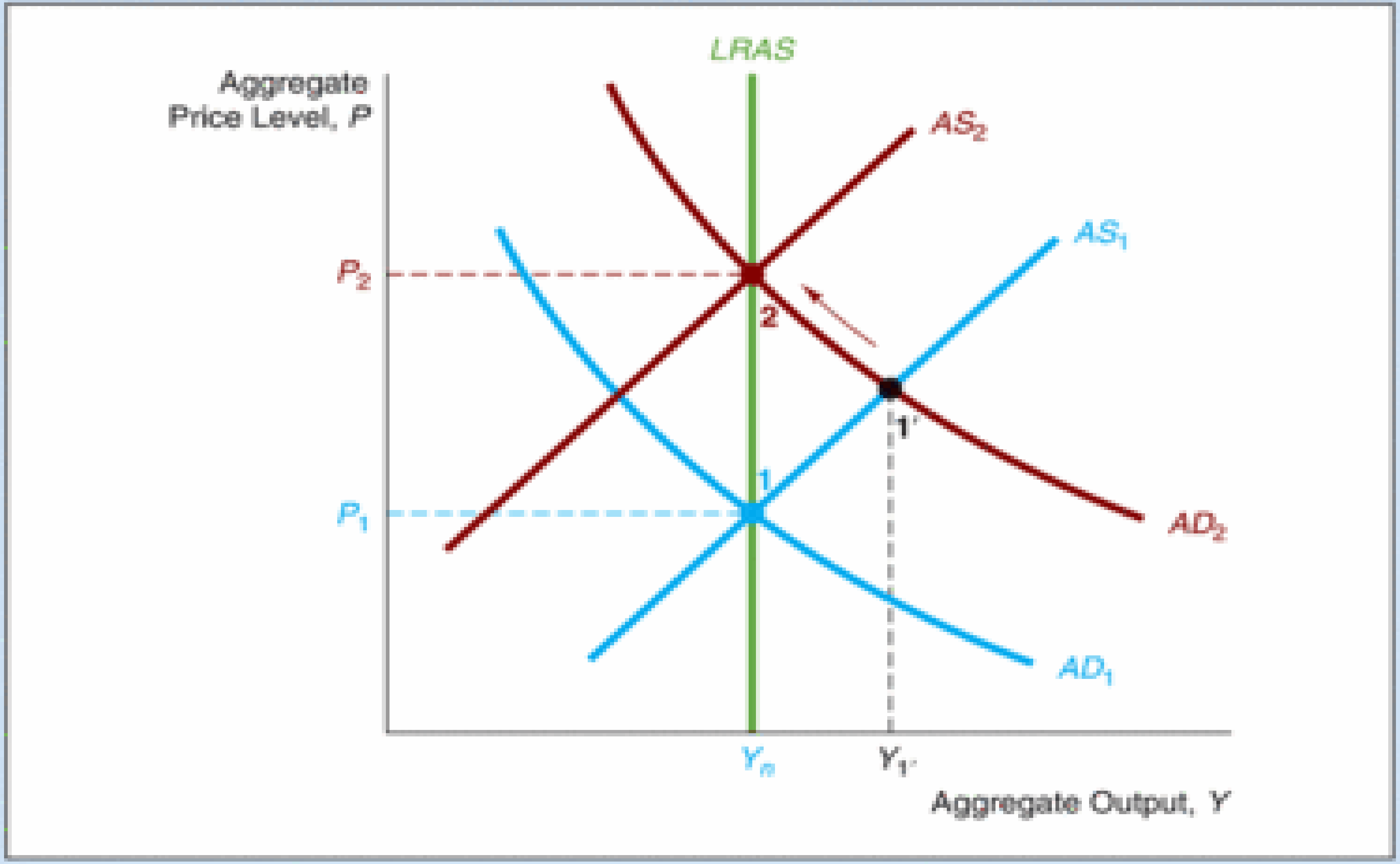


FIGURE 3 **Response to a One-Shot Permanent Increase in Government Expenditure**

Supply-Side Phenomena by Themselves Produce Inflation?

- "Because supply shocks and workers' attempts to increase their wages can shift the short-run AS curve leftward, you might suspect that these supply-side phenomena by themselves could stimulate inflation".

- Again, we can show that this suspicion is incorrect.

- Suppose that a negative supply shock -- for example, an oil embargo -- raises oil prices (or workers could have successfully pushed up their wages).
- As displayed in Figure 4, the negative supply shock shifts the short-run aggregate supply curve from AS_1 to AS_2.
- If the money supply remains unchanged, leaving the aggregate demand curve at AD_1, we move to point 1', where output $Y_{1'}$ is below the natural rate level and the price level $P_{1'}$ is higher.
- The short-run AS curve will now shift back to AS_1, because unemployment is above the natural rate, and the economy slides down AD_1 from point 1' to point 1. The net result of the supply shock is that we return to full employment at the initial price level, and there is no continuing inflation.

Supply-Side Phenomena by Themselves Produce Inflation?

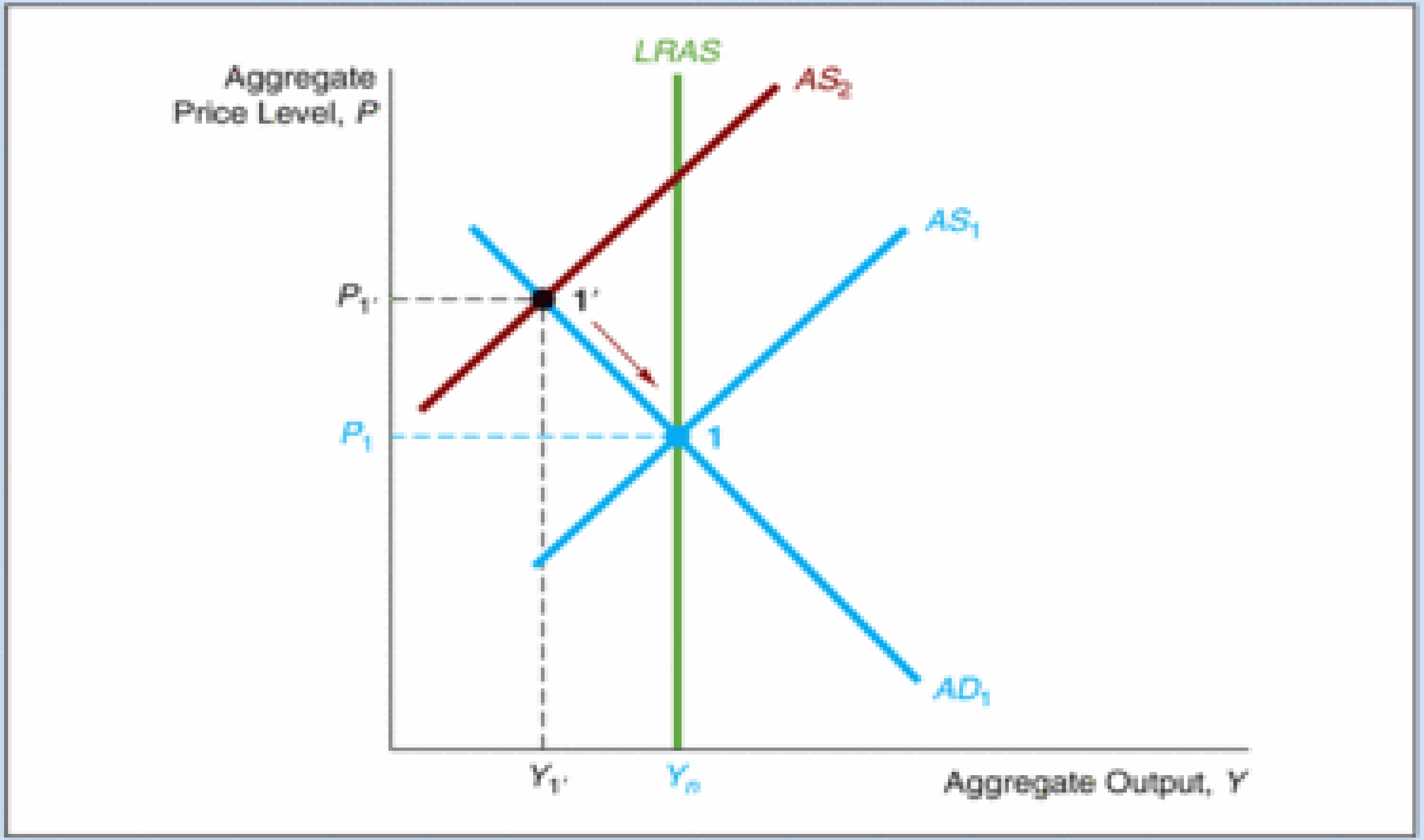


FIGURE 4 Response to a Supply Shock

Money Growth and Business Cycles

- As already implied, proponents of the money supply school have argued that the historical relationship between growth in money and cycles in general business activity provides major support for their views on the cause importance of money in the business cycle.

- For the most part, these economists have delineated cycles in the money supply in terms of peaks and troughs in the percentage rate of change of money (usually including time deposits) while cycles in business have been defined in terms peaks and troughs in the level of business activity marked off.

- They have argued that virtually without exception every cycle in the level of business activity over the past century can be associated with a cycle in the rate of growth of the money supply.

- According to Davis (1968), the exceptions that are observed occurred during and just after World War 1I—although the events of 1966-67 may also be interpreted as an exception, since an apparent cyclical decline in monetary growth was not followed by a recession but only by a very brief slowdown in the rate of business expansion.'

Cycle

- The money supply school also finds that cycles in business activity have lagged behind the corresponding cycles in the rate of growth of the money supply, with business peaks and troughs thus following peaks and troughs in the rate of monetary change.
- While the evidence supporting these generalizations is derived from about a century of United States data, the nature of the measurements and some of the problems
- The significance, if any, of these leads in assessing the • importance of cycles in money in causing cycles in business is highly problematical.
- In support of this, Davis (1968) puts out the following points:
- Firstly, chronological leads do not, of course, necessarily imply causation.

➢ It is perfectly possible, for example, to construct models of the economy in which money has no influence on business but which generate a consistent lead of peaks and troughs in the rate of growth of the money supply relative to peaks and troughs in general business activity.

Money and Cycles

- Secondly, the extreme variability of the length of the leads would seem to suggest, if anything, (he existence of factors other than money that can also exert an important influence on the timing of business peaks and troughs.
- *Certainly even if a peak or trough in the rate of growth of the money supply could be identified around the time it occurred, this would be of very little, if any, help in predicting the timing of a subsequent peak or trough in business activity.*
- Thirdly, there is in real question as to whether anything at all can be inferred from the historical record about the influence of money on business if, as is argued in the next section, there is an important reverse influence exerted by the business cycle on the monetary cycle itself.
-

Historical perspectives

- An old monetary theory of business cycles was put forward by Hawtrey. His monetary theory of business cycles relates to the economy which is under gold standard.
- It will be remembered that economy is said be under gold standard when either money in circulation consists of gold coins or when paper notes are fully backed by gold reserves in the banking system.
- According to Hawtrey, increases in the quantity of money raises the availability of bank credit for investment.
- Thus, by increasing the supply of credit expansion in money supply causes rate of interest to fall.
- The lower rate of interest induces businessmen to borrow more for investment in capital goods and also for investment in keeping more inventories of goods.
-
- Hawtrey, regards trade cycle as a purely monetary phenomenon.
- According to him, non-monetary factors like wars, strikes, earthquakes, crop failures, etc., may cause partial and temporary depression in particular sectors of the economy, but they cannot cause a full permanent depression involving general unemployment of the factors of production in the form of a business cycle.
- Purely Monetary Theory of Trade Cycle: by Ralph.G. Hawtrey (1926): (1879-1971

- Business cycles are caused by the expansion and contraction of bank credit. Hawtrey's business cycle theory is based on three important factors:

➢ 1. Traders play an important role in the economy. They are very sensitive to the change of rate of interest.

➢ 2. Money supply in the economy is affected by the level of consumer spending.

➢ 3. At the sudden crash of boom, banks suspend credit and call on the borrowers to return the loans.

- According to Arthur F. Burns and W. C. Mitchell, a typical or standard trade cycle consists of four closely interrelated phases of revival, expansion, recession, and contraction.
- The peak and trough the critical mark-off point in the cycle. According to Schumpeter, a trade cycle involves the four phase cycle consisting of the prosperity, recession, depression, and recovery.
- The trade cycle is divided in two parts the upper half and the lower half. The upper part of the cycle above trend or equilibrium line is divided into prosperity and recession while the lower part of the cycle below the trend line is divided into depression and recovery.
- Figure 4.8 below illustrates the four phases of a trade cycle:

Business cycle

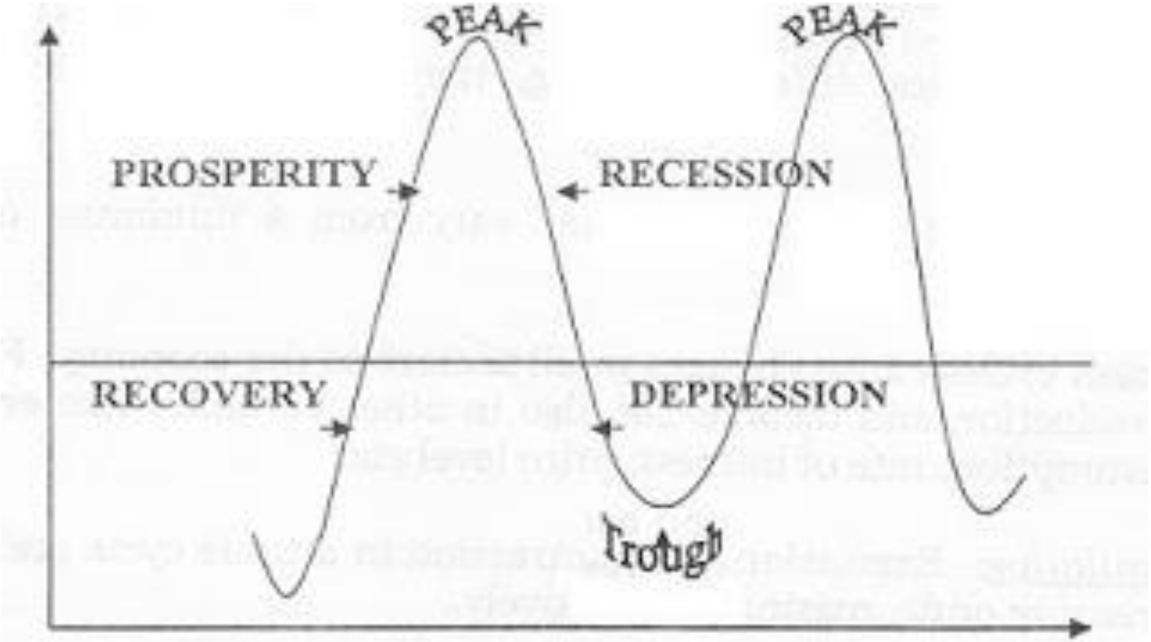
- It is important for any theory of trade cycle to answer two important questions as to how boom conditions are created. And why the boom crashes and depression starts?

The Upswing or Boom:

- According to Hawtrey the upward phase of the business cycle is brought about by an expansion of bank credit and also by an increase in the velocity of circulation of money.

The downswing or Depression:

- How the depression does develops according to this theory? As said above, the banks suddenly suspend their policy of credit expansion which they were following.



Four Phases of Business Cycle

Critical Appraisal

- Specific Criticism of the Theory:

1. The theory is criticized for not furnishing a comprehensive explanation of the trade cycle.
2. The rate of interest alone may not affect business decisions.
3. It is also incorrect to say that business fluctuations are caused by the actions of the banks
4. It ignores non-monetary factors, several non-monetary factors, such as new investment demands, cost structure, and expectations of businessmen, can also produce changes in economic activities.
5. Hawtrey’s theory that businessmen are more sensitive to the interest rates that is true but they are influenced by future opportunities to earn profit. Thus bank credit alone cannot explain the conditions of boom and depression.

Expectations of the Real Business Cycle and Expected Inflation

- During the years following the seminal papers of Kydland and Prescott (1982) and Prescott (1986), RBC theory provided the main reference framework for the analysis of economic fluctuations and became to a large extent the core of macroeconomic theory.
- The impact of the RBC revolution had both a methodological and a conceptual dimension.
- From a methodological point of view, RBC theory firmly established the use of dynamic stochastic general equilibrium (DSGE) models as a central tool for macroeconomic analysis.
- Behavioral equations describing aggregate variables were thus replaced by first-order conditions of intertemporal problems facing consumers and firms.
- Ad hoc assumptions on the formation of expectations gave way to rational expectations. In addition, RBC economists stressed the importance of the quantitative aspects of modelling, as reflected in the central role given to the calibration, simulation, and evaluation of their models.
- The most striking dimension of the RBC revolution was, however, conceptual

REAL BUSINESS CYCLES

- It rested on three basic claims:

1. The efficiency of business cycles.

The bulk of economic fluctuations observed in industrialized countries could be interpreted as an equilibrium outcome resulting from the economy’s response to exogenous variations in real forces (most importantly, technology), in an environment characterized by perfect competition and frictionless markets. According to that view, cyclical fluctuations did not necessarily signal an inefficient allocation of resources (in fact, the fluctuations generated by the standard RBC model were fully optimal).

2. The importance of technology shocks as a source of economic fluctuations.

That claim derived from the ability of the basic RBC model to generate “realistic” fluctuations in output and other macroeconomic variables, even when variations in total factor productivity—calibrated to match the properties of the Solow residual—are assumed to be the only exogenous driving force

3. The limited role of monetary factors.

Most important, given the subject of the present monograph, RBC theory sought to explain economic fluctuations with no reference to monetary factors, even abstracting from the existence of a monetary sector. Its strong influence among academic researchers notwithstanding, the RBC approach had a very limited impact (if any) on central banks and other policy institutions.

Real business cycle theory and monetary policy

- Business cycles are cyclical fluctuations in the economy's output and employment in real, not analytical, time.
- Their explanation relates to the short term, which is a chronological concept of time, rather than the analytical short run or long run.
- Real business cycle theory is an offshoot of the modern classical model and asserts that business fluctuations occur only in response to shocks to the fundamental determinants of long-run output and employment (e.g. see Prescott, 1986; Christiano and Eichenbaum, 1992; Romer, 1996, Ch. 4).
- These determinants are technology, which determines the production function and the demand for inputs, and the supply of factor inputs.
- Among the determinants of the latter are preferences, including those on labor supply, which depends on the labor– leisure choice and the stock of resources.
- Shifts in the production function or input supplies alter long-run equilibrium output, as well as being a source of cyclical fluctuations in output.

- The real business cycle theory derives the fundamental determinants of business cycles from the general macroeconomic models of the classical paradigm.

Real Business Cycles and Monetary Policy

- Explicitly, or by omission, real business cycle theory also holds that shifts in aggregate demand, no matter what their source, do not cause changes in output and employment and therefore do not cause business cycle fluctuations.

- Therefore, changes in consumption, investment, exports, money supply and demand (or the central bank's interest rate policy) or fiscal deficits cannot change output and employment.
- This exclusionary proposition is derived from the properties of the long-run equilibrium of the modern classical model.

- To be valid, it requires perfectly competitive markets and also that long-run equilibrium is continuously maintained in the economy.

- The policy implication of real business cycle theory, as of the modern classical model of which it is an elaboration, is that systematic monetary (and fiscal) policies cannot affect output and employment, so that they cannot be used to moderate the business cycle.

- The critical elements for this implication are the Friedman–Lucas supply equation and rational expectations, according to which anticipated changes in prices, inflation and monetary policy cannot affect output.

- Therefore, the Taylor rule, under which systematic monetary policy manipulates aggregate demand by changing the interest rate in response to the output gap and the deviation of inflation from its target rate, can only be useful in controlling inflation but not in moderating the output gap.
- According to the modern classical school, while random monetary policy can change aggregate demand, the central bank cannot predict and therefore cannot offset the random fluctuations in the private components of aggregate demand.
- In short, in the new classical model, monetary policy and the Taylor rule have no legitimate role in moderating or reducing the duration of business cycles.
-
- Intuitively, the problem with the real business cycle theory is most evident in its explanation of recessions.
- It attributes recessions to a fall in labor productivity and/or an increase in the preference for leisure.
- The objections to these explanations are succinctly stated by the quip: recessions occur because "workers forget how to do things" ("lose some of their knowledge") and/or because they decide to become lazier for some time, thereby causing the recessionary fall in output!
- Neither of these explanations is plausible, so the validity of the real business cycle theory is highly doubtful. Looking at upturns in business cycles, the real business cycle theory attributes upturns to increases in productivity and/or increases in the preference for work over leisure.
- The latter is hardly plausible over the length of upturns in the economy, while the former is highly plausible.
- Here, however, it is the plausibility of the assertion of real business cycle theory that aggregate demand increases cannot also be a source of upturns that is highly doubtful.

Money and Employment

- Before Keynes, real income (output) was assumed to be determined by the real forces of saving (thrift) and productivity and not by monetary factors.
- As we have seen, this required a stable demand for money and hence a stable income velocity of money.
- There was thus, effectively, no transmission mechanism between changes in the money supply and output. Long run real interest rates could not be influenced by monetary policy.
- Classical theory argued that they were determined by the behaviour of savers and investors, as set out in the loanable funds theory of the determination of interest rates.
- Both saving and investment decisions, and hence the real rate of interest, depended on long-term considerations.
- The monetary authorities could influence nominal interest rates, but these were of no long-run significance for the real economy.
- This picture was disturbed by Keynes's General Theory and by the interpretations made by Keynesians of this theory.
- In this view, the nominal interest rate was determined by the demand for and supply of money and provided a vital link between the real and monetary sectors of the economy.

Money and employment

- Changes in nominal interest rates could bring about changes in real interest rates and have an effect on the real variables of output and employment.

- Further, the demand for money was held not to be stable and hence control of the money supply would not have a predictable effect on nominal income.

- The interest rate became the accepted monetary policy instrument but, monetary policy was thought to have only a weak effect on nominal income, especially when the economy was in recession.

- However, whenever the economy was operating at less than full employment, any impact on nominal income implied also an impact on output since inadequate demand was argued to be a major cause of unemployment.

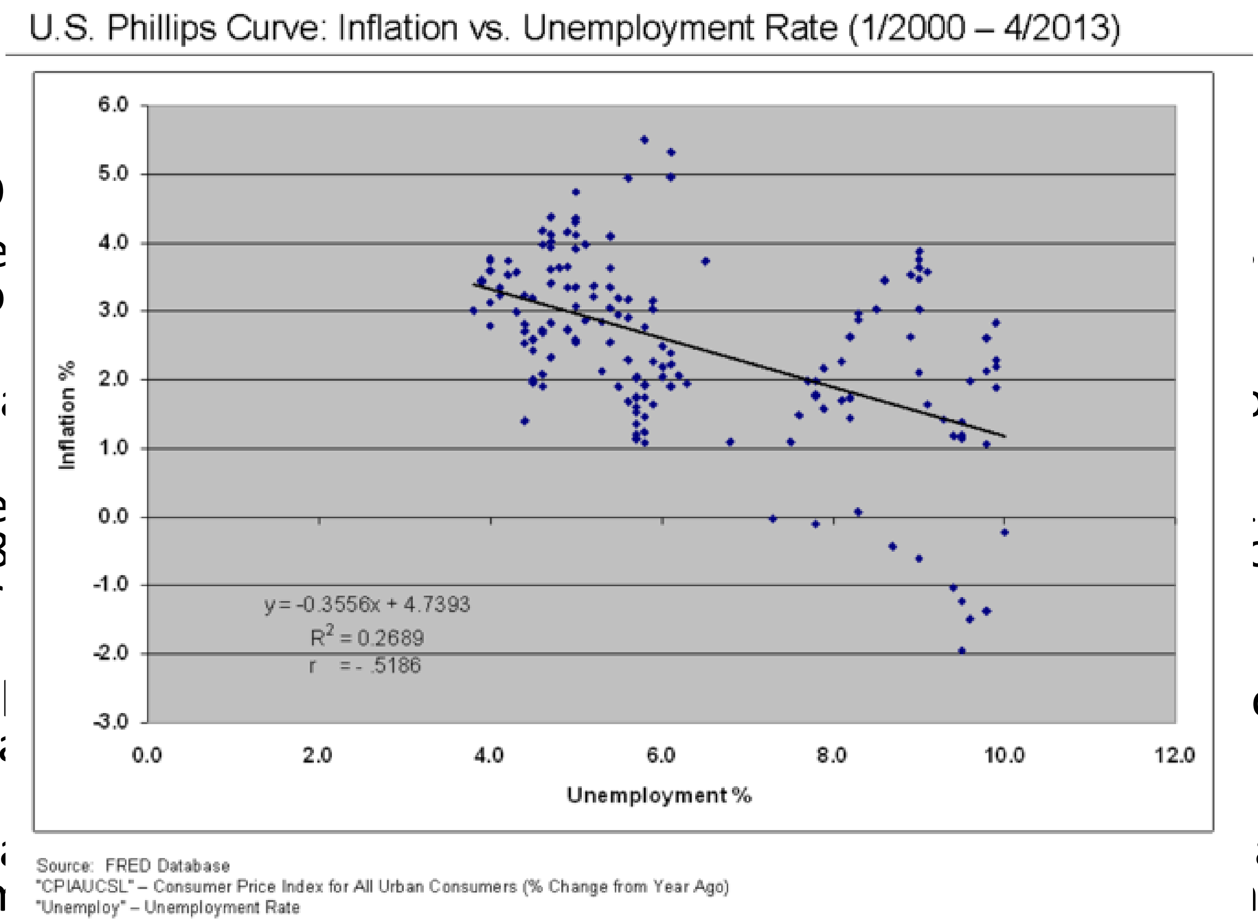
- This approach explained the standard Keynesian models in which the general price level was assumed to be constant and hence no distinction was made between nominal income and output.

- An increase in demand implied an increase in output and employment. It was always acknowledged that excess demand would cause prices to increase when the economy was at full employment as inflationary gaps (the gap between aggregate demand and aggregate supply at the existing price level) developed.

Exceptions:

- **1970s stagflation and, to some extent, 1990s boom**
- In the 1970s the U.S. economy experienced a rise in unemployment and a rise in inflation (see historical examples section below).
-
- The opposite occurred in the 1990s. Technological improvements made possible a reduction in production costs even with low unemployment. Inflation fell modestly from 3 to 4 percent in the early 1990s to about 2 percent by the late 1990s

Inflation and Unemployment: The Phillip Curve



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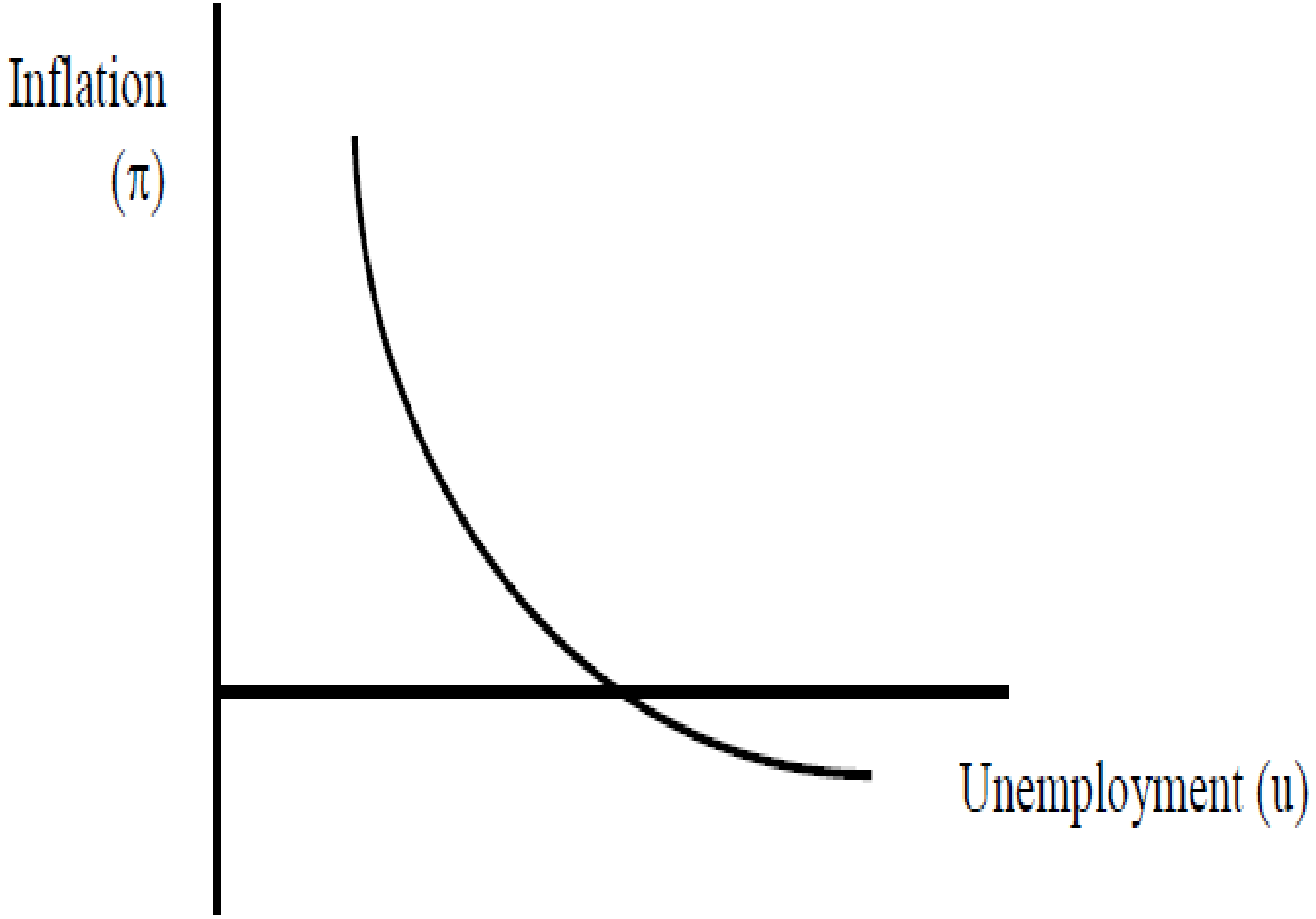
Explanations of procyclical

- **Labor Market**
- If the economy is strong and it is difficult to find workers, competition among firms will likely bid up wages. When there is lots of unemployment, wages will rise more slowly due to the competition among workers looking for jobs. Wages may even fall if things get really bad.
  - Changes in wage costs are likely to be passed through to prices. (Firms set prices as a "mark up" over costs.) Thus, faster wage growth in a strong economy is likely to lead to higher price inflation and slower growth of wages in a weak economy will reduce price inflation.

- **b) Product Market**
- If firms perceive strong demand for their products they are more likely to raise prices, creating more inflation. Alternatively, if the demand for a firm's products is weak, the firm will probably not raise prices much, if at all. Firms might even cut prices in very weak markets. If this weakness appears across much of the economy, inflation will decline.


Inflation
(π)
Unemployment (u)

Inverse relation between inflation and unemployment

- The graph above shows an "inverse relation" between inflation and unemployment.
- When the economy is weak and unemployment is high, inflation is low. When the economy is strong and unemployment is low, inflation is high.
  - This relationship was first studied in England by an economist named Phillips.
  - The inflation-unemployment graph is therefore called the "Phillips Curve."
  - We will use the Greek letter pi (π) to represent the inflation rate.
- **a) Slope of Phillips Curve**
- Economists typically draw the graph with some "curvature," that is, the slope of the Phillips Curve changes at different levels of unemployment.

Possibility of deflation

- Note that the Phillips Curve cuts through zero on the inflation axis. This captures the fact that deflation can happen, although it will normally be associated with high unemployment.

- **c) Steeper Phillips Curve at very low unemployment**
- We know from our earlier discussion that unemployment cannot really get to zero. Thus, the Phillips Curve gets very steep as u gets very low. This means that prices can begin to rise very fast in an overheated economy.

- **d) Flatter Phillips Curve at very high unemployment**
- At high levels of unemployment, further increases in u may have little effect on π, so the Phillips Curve gets flat.

Friedman’s View

- Criticism: The PC relates to the short-run and does not remain stable:
- According the Friedman, there is no need to assume a stable downward slopping PC to explain the trade-off between inflation and unemployment
- So long as there’s a discrepancy, between expected and actual inflation this trade-off will be found

- Natural Rate of Unemployment: It represents the rate of unemployment at which the economy normally settles – there’s no tendency for inflation rate to increase or decrease
- In the L-R, PC is a vertical line at the natural rate of unployment

Friedman/Phelps expectations augmented Phillips curve.

- When, in the late 1960s, inflation rates began to rise steadily and the points showing the unemployment/money wage inflation combinations began to appear well off to the right of the curve plotted by Phillips in 1958, Friedman and Phelps were separately able to exploit this approach to explaining the trade-off (Friedman, 1968; Phelps, 1967).
- The result was the Friedman/Phelps expectations augmented Phillips curve.

- By incorporating a theory of expectations formation into the model of worker behaviour, the Friedman/Phelps model allowed workers to take expected inflation into account.

- In so doing, it introduced the possibility of the money wage being different from the real wage. If, then, workers' estimate of the rate of inflation were correct, there would be no money illusion and the labour supply decisions of workers would be based on the true realwage rate.

- The Friedman/Phelps model assumed the use of adaptive expectations by workers, with workers basing their expectations of inflation on a weighted average of past inflation rates.

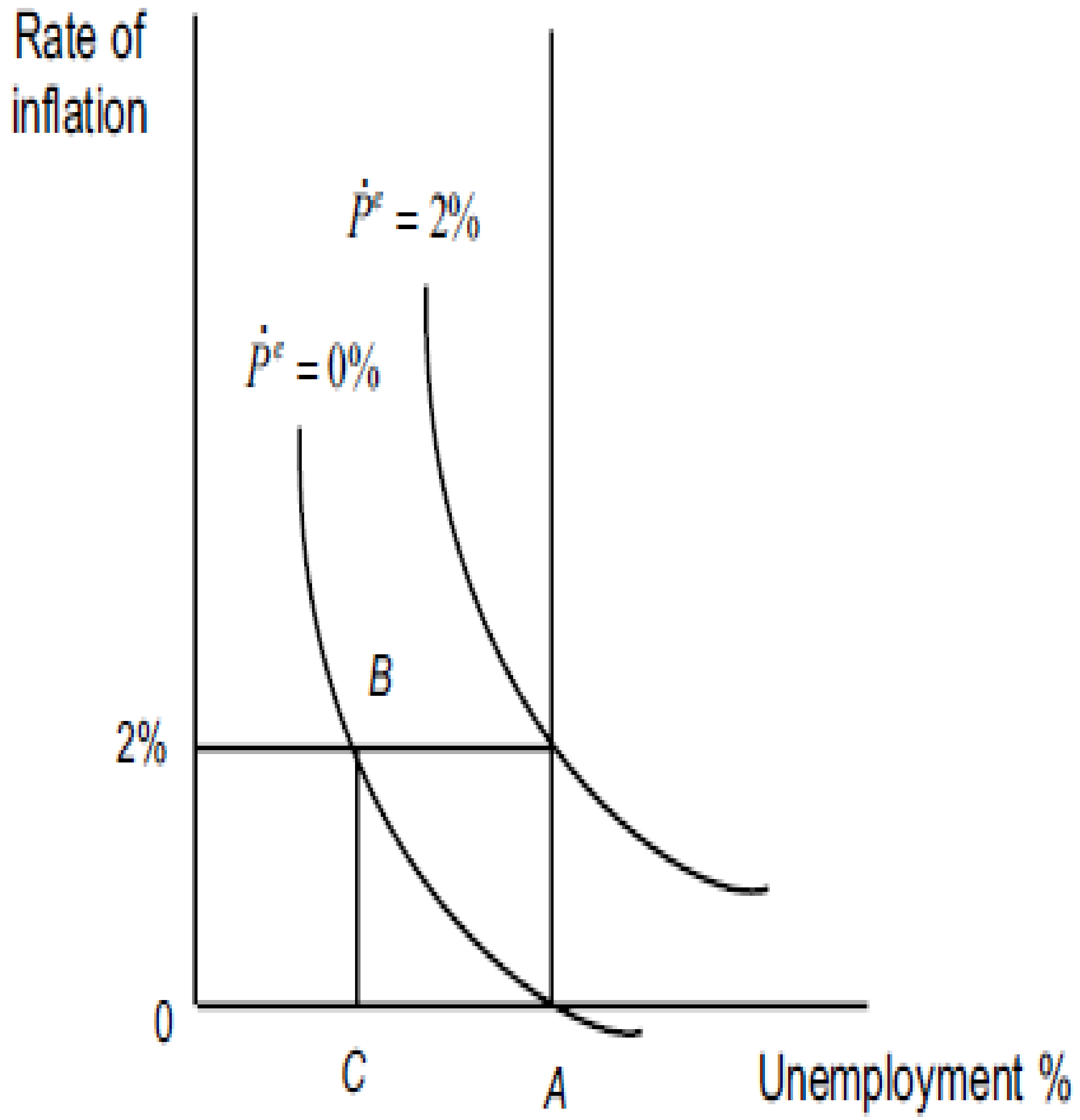
- Their expectations are said to be backward looking.

- This means that past errors are built into future forecasts (the errors are serially correlated).
- When inflation is increasing, workers systematically underestimate the rate of inflation and vice versa.
- Thus, if inflation were to increase steadily over a number of years, workers would expect higher and higher inflation rates and would push money wages up to reflect this.

- Consequently, the gap between the money wage rate and the equilibrium real wage rate would grow — workers would demand higher and higher money wage rates to supply the same quantity of labour as before.
- The combinations of unemployment and the rate of inflation experienced by the economy would appear above and to the right of the curve plotted by Phillips.
- Thus, according to Friedman/Phelps, there was a different short run Phillips curve for every expected rate of inflation.
- On each such short run curve, there would be one point at which workers' estimate of the real wage would be correct, and this would be the longrun position.
- Linking these long-run positions together provided the vertical long-run 'Phillips curve' at the level of unemployment that existed when the labour market was in equilibrium. This was called the 'natural rate of unemployment'.
- It extended the previously existing notion of 'voluntary' unemployment resulting from workers placing too high a value upon their leisure by allowing also for unemployment caused by structural factors (such as the level of economic development and the characteristics of the labour market).
- Crucially, however, it did not include unemployment caused by lack of aggregate demand — at the natural rate of unemployment, unemployment is balanced by job vacancies.
- Thus, government could only hope to reduce the natural rate of unemployment by microeconomic policies that affected the structural characteristics of markets or the incentives faced by economic agents in making their work/leisure choices, not by increasing aggregate demand.

Cont.

- Short-run trade-offs between unemployment and inflation could exist but only because the economy was out of equilibrium.
- We start at point A in Figure 4.5, with the rate of inflation having been at zero for some years and with workers expecting it to remain at zero.
- We assume, next, that the authorities increase the rate of growth of the money supply in the hope of reducing unemployment.
- Inflation unexpectedly increases to two per cent.
- The real wage falls but workers continue to offer labour to the market as if it had not done so.



Cont.

- Further attempts by the authorities to reduce unemployment by increasing the rate of growth of the money supply push inflation higher but, in the long run, produce no reduction in unemployment.
- It follows that any level of unemployment below the natural rate of unemployment is available only temporarily and is associated with accelerating inflation.
- For this reason, the natural rate of unemployment became widely known as the NAIRU (the non-accelerating-inflation rate of unemployment).

- The expectations-augmented Phillips curve was bad news for governments wishing to control unemployment by managing aggregate demand.
- It implied that increases in aggregate demand could reduce unemployment butoly in the short run and only at the expense of accelerating inflation.
- Each attempt by the government to lower unemployment below the NAIRU would ratchet up the rate of inflation.
- In fact, the news was even worse since it was also argued that increasing inflation interfered with the operation of the price mechanism and reduced the efficiency of the economy. This would cause the NAIRU to rise.
- This view assumed that higher rates of inflation meant more volatile inflation and hence an increased chance of incorrect inflationary expectations.

Shifts of the Phillips Curve

- **Flatter Phillips Curve at very high unemployment**
- At high levels of unemployment, further increases in u may have little effect on π, so the Phillips Curve gets flat.

- **2.**

- **a) Unfavorable supply shocks and stagflation**
- If firms' costs rise, they are likely to pass these costs on to their customers in the form of higher prices (again, this is the mark-up pricing idea). Therefore, a "cost shock" will cause higher inflation, at least for a while.
  - Higher costs will raise inflation for a given level of unemployment. Therefore, the Phillips Curve will shift upward.

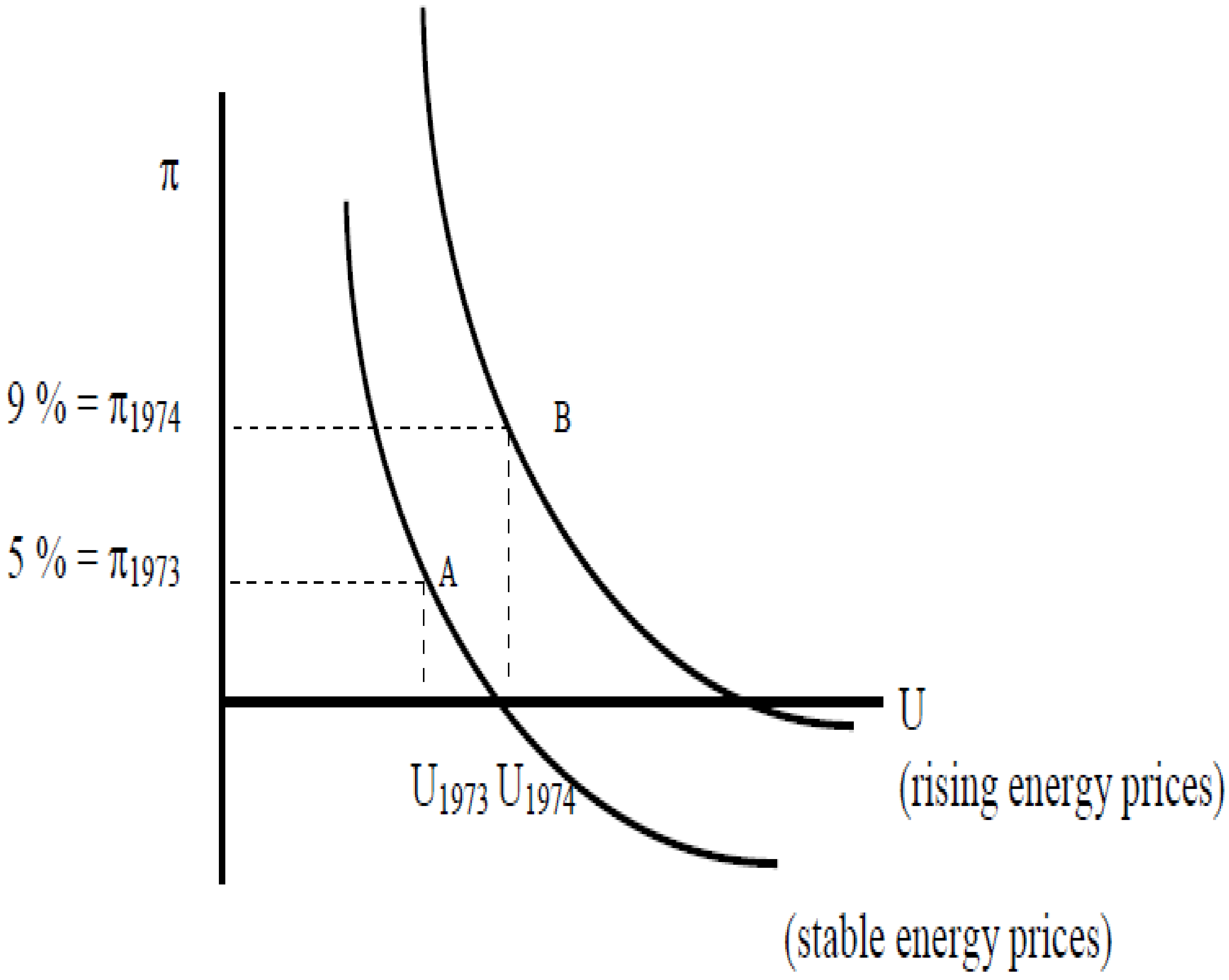
Shift in PC:

- Expected in Inflation: the extent the labor market correctly forecasts inflation and can adjust wages to the forecast.
- The acceleration hypothesis: Any reduction in unemployment below its natural rate will be associated with an accelerating and explosive inflation
- There's no trade-off between inflation and unemployment except in the short-run
- Adaptive expectation hypothesis: expected rate of inflation always lags behind the actual

Historical examples

- The classic example of this situation is the oil price increases of the 1970s.
- In the early 70s, war in the Middle East led OPEC (Organization of Petroleum Exporting Countries) to impose an oil embargo on the U.S. Oil prices rose dramatically. Because energy is used in so many industries, the higher oil prices caused big cost increases throughout the economy.
- There was a similar problem when oil imports from Iran were reduced by the revolution that deposed the Shah of Iran (who was supported by the U.S.) in the late 1970s.

- Because the Phillips Curve shifts upward, inflation is higher after the cost shock (or "supply shock"). During the early 70s in the U.S., there were also forces raising unemployment. Thus, the Phillips Curve diagram looked like this:



π
9 % = π1974
5 % = π1973
B
A
U
(rising energy prices)
U1973 U1974
(stable energy prices)

Stagflation

- The combination of a rise in unemployment and a rise of inflation was called "stagflation," that is, stagnation at the same time inflation was rising.

LECTURE 5:CENTRAL BANKING AND MONETARY POLICY

- Objectives and Functions of the Central Bank
- A central bank, which is sometimes referred to as a monetary authority or reserve bank, is a public institution that usually:

➢ issues currency (the nation's legal tender)

➢ regulates money supply using monetary policy instruments

➢ controls the interest rates in a country

➢ regulates the commercial banking system

➢ Lender of last resort to the banking sector

Objectives or Goals of Monetary Policy

- **Price Stability**: Price stability is "a state in which the general price level or the inflation rate is sufficiently low and stable, so that considerations concerning the nominal dimension of transactions cease to be a pertinent factor for economic decisions"
- A price stability policy is an essential action that keeps the value of a currency stable, eliminates cyclical fluctuations, helps in reducing inequalities of income and wealth, secures social justice and promotes economic welfare. Monetary policy can be used to achieve price stability in different ways.

Objectives or Goals of Monetary Policy cont'd

- **Full Employment:** Full employment, in the Keynesian paradigm, is one of maintaining adequate effective demand. It is a situation in which aggregate employment is inelastic in response to an increase in which aggregate employment is inelastic in response to an increase in the effective demand for its output

- The Keynesian concept of full employment, therefore, involves three things:

➢There should be a reduction in real wages

➢There should be an increase in effective demand

➢There should be an inelastic supply of output at the level of full employment

Objectives or Goals of Monetary Policy cont’d

- **Economic Growth**: Economic growth is one of the most important objectives of monetary policy. It is defined as the process whereby the real per capita income of a country increases over a long period of time. This is measured by the increase in the amount of goods and services produced in a country. Economic growth occurs when an economy’s productive capacity increases, which in turn, is used to produce more goods and services.
- Monetary policy can be used to achieve economic growth by altering real interest rate and its resultant impact on investment. Thus if monetary authorities opt for a cheap or easy credit policy by reducing interest rates, the investment level in an economy can be encouraged. This increased investment can speed up economic growth. Faster economic growth is possible if the monetary policy succeeds in maintaining income and price stability

Objectives or Goals of Monetary Policy cont'd

- **Balance of Payments Equilibrium**: A country's balance of payments is the net of its current and capital accounts.
- The current account measures the inflows and outflows of capital for the following: export and import of goods and services, transfers of private capital, and foreign governments
- A capital transaction involves the sale or purchase of real property, buildings, stocks, and bonds.
- Current account deficits are often balanced by capital account surpluses

- **Interest-Rate Stability**: Interest-rate stability is desirable because fluctuations in interest rates create uncertainty in the economy and make it harder to plan for the future. A central bank may also want to reduce upward movements in interest rates for the reasons such as upward movements in interest rates generate hostility toward central banks and lead to demands that their power be curtailed.
- **The stability of financial markets** is also fostered by interest-rate stability, because fluctuations in interest rates create great uncertainty for financial institutions. An increase in interest rates produces large capital losses on long-term bonds and mortgages, losses that can cause the failures of the financial institutions holding them.

Objectives or Goals of Monetary Policy cont'd

- **Price Stability and the Role of a Nominal Anchor**: A nominal anchor for monetary policy is a single variable which a central bank uses to pin down expectations of private agents about the nominal price level or its path or about what the bank might do with respect to achieving that path (Krugman, 2003). Mishkin (1999) defines a nominal anchor as 'a constraint on the value of domestic money' or more broadly as 'a constraint on discretionary policy that helps weaken the time-inconsistency problem'

- Generally there are two kinds of nominal anchors: quantity-based nominal anchor and price-based nominal anchor. The quantity based nominal anchor targets money while the price-based nominal anchor targets exchange rate or interest rates.

- A nominal anchor is necessary for monetary policy because it helps promote price stability, which most countries now view as the most important goal for monetary policy

The Time Inconsistency Problem

- According to Kydland and Prescott (1977), governments that are free from rules (pre-commitment) and can use discretionary policies will be unable to persuade rational agents that they will stick to low-inflation policies. Agents know that if they lower their inflation expectations, the government will have an incentive to cheat and by creating an inflation surprise increase employment temporarily.
- However, because rational agents are aware of the policy makers' incentives, the time-consistent policy involves an inflationary bias. If a government has discretion, low inflation declarations are time-inconsistent and are not credible. Therefore a credible policy announcement can be defined as one which is time-consistent.

The Time Inconsistency Problem cont’d

- The time-consistency problem of discretionary monetary policy arises because economic behavior is influenced by what firms and people expect the monetary authorities to do in the future.
- With firms’ and people’s expectations assumed to remain unchanged, policymakers think they can boost economic output (or lower unemployment) by pursuing discretionary monetary policy that is more expansionary than expected, and so they have incentives to pursue this policy.
- Discretionary monetary policy is time-consistent i.e. the policy is what policymakers are likely to want to pursue at any given point in time.
- The problem with timely consistent discretionary policies is that it leads to bad outcomes. Because decisions about wages and prices reflect expectations about policy, workers and firms will raise their expectations not only because of inflation but also of wages and prices. On the average, output will not be higher under such an expansionary strategy, but inflation will be.

Tools and Instruments of Monetary Policy

- **Reserve Requirements**: The Central Bank may require Deposit Money Banks (DMBs) to hold a fraction (or a combination) of their deposit liabilities (reserves) as cash and/or deposits with it. Fractional reserve banking limits the amount of loans banks can make to the domestic economy and thus limit supply of money. The assumption is that DMBs generally maintain a stable relationship between their reserve holdings and the amount of credit they extend to the public.

- When prices are rising, the central bank may raise the reserve requirements of DMBs to keep money within the central Bank. Hence, the reserves of DMBs are reduced; their lending is reduced; and the volume of investment, output and employment are adversely affected.

Tools and Instruments of Monetary Policy cont’d

- **Discount Rate (Bank Rate):** this is the rate at which the Central Bank lends to Commercial Banks.

- The discount sets the floor for the interest rate regime in the money market (the nominal anchor rate) and thereby affects the supply of credit, the supply of savings (which affects the supply of reserves and monetary aggregate) and the supply of investment (which affects full employment and GDP).

- Hence, when monetary authorities want to alter the level of money supply, they simply alter the minimum rediscount rate. This in turn affects the supply of credit, savings, investments and ultimately growth.

- In an inflationary situation, Central Banks raise the discount rate. In a recession, Central Banks reduce the discount rate

Tools and Instruments of Monetary Policy cont'd

- **Open Market Operations (OMO):** The Central Bank may alternatively buy or sell financial securities to the banking and non-banking public (on behalf of the Fiscal Authorities or the Treasury) to alter the level of money supply in an economy. One such security is the Treasury Bills.

- When the Central Bank sells securities, it reduces the supply of reserves and when it buys (back) securities – by redeeming them – it increases the supply of reserves to the Deposit Money Banks, thus affecting the supply of money. Thus when prices are rising and there is the need to control it, the central bank can decide to sell Treasury Bills. In that way, the reserves of DMBs are reduced, investment is discouraged and the rise in prices is checked. In a recession, Central Bank buys securities.

Tools and Instruments of Monetary Policy cont’d

- **Direct Credit Control:** The Central Bank can direct Deposit Money Banks on the maximum percentage or amount of loans’ (credit ceilings) they can allocate to different sectors of the economy, the interest rate caps, the liquid asset ratio and issue credit guarantee to preferred loans. In this way, available savings are allocated and investment directed in particular directions.
- If there is a brisk speculative activity in the economy or particular sectors in certain commodities and prices are rising, the central bank may decide to raise the margins of the above variables. The result is that borrowers are given less money as loans and against specified securities and economic imbalances are addressed.

Tools and Instruments of Monetary Policy cont'd

- **Moral Suasion**: The Central Bank, in an act of conducting monetary policy, also issues licenses or operating permits to Deposit Money Banks and also regulates the operation of the banking system. It can, from this advantage, persuade banks to follow certain paths such as credit restraint or expansion, increased savings mobilization and promotion of exports through financial support, which otherwise they may not do, on the basis of their risk/return assessment.

Tools and Instruments of Monetary Policy cont'd

- **Prudential Guidelines**: Central Banks may again in writing require Deposit Money Banks to exercise particular care in their operations in order that specified outcomes are realized. Key elements of prudential guidelines remove some discretion from bank management and replace it with precise rules for decision making.

- **Exchange Rate:** The balance of payments can be in deficit or in surplus and each of these affect the monetary base, and hence the money supply in one direction or the other. By selling or buying foreign exchange, the Central Bank ensures that the exchange rate is at levels that do not affect domestic money supply in an undesired direction, through the balance of payments and the real exchange rate. The real exchange rate when misaligned affects the current account balance because of its impact on external competitiveness.

- Several issues arise in the selection and use of goals, intermediate variables and operating targets or instruments by the monetary authorities. Among these are:

➢ Are the relationships between the ultimate goal variables, intermediate variables and operating targets stable and predictable?

➢ Can the central bank achieve the desired levels of the operating targets through the instruments at its disposal?

➢ What are the lags in these relationships, and, if they are long, can the future course of the economy be reasonably well predicted?

Interrelations Among Goals, Targets and Instruments of Monetary Policy

- Illustration of the relevant relationships:

$y = f\ (x;\Psi)$ (1)

$x = g(z;\ \theta)$ (2)

where:

y = (ultimate) goal variable

x = intermediate target

z = policy instrument or operating target

Ψ,θ = sets of exogenous variables

Interrelations Among Goals, Targets and Instruments of Monetary Policy Cont'd

- z can be used to achieve a desired value of y.
- However, this can be done reliably only if the functional forms f and g are known and these are stable functions.
- In practice, given the complex structure of the real-world economies, as well as the existence of uncertainty and lags in the actual relationships, the precise forms of f, g and h are often only imperfectly known at the time the decisions are made.
- Further, the coefficients in these relationships may be subject to stochastic changes. In addition, given the lags in the economy, the policy maker also needs to predict the future values of the coefficients and the exogenous variables, usually an imprecise art

Targets of Monetary Policy

- The two main operating targets for monetary policy:

➢ monetary aggregates

➢ interest rates.

- The two main targets of monetary policy:

➢ inflation rate (or the price level), or its deviation from a desired value

➢ output, or its deviation from the full-employment level.

Monetary Aggregates versus Interest Rates as Operating Targets

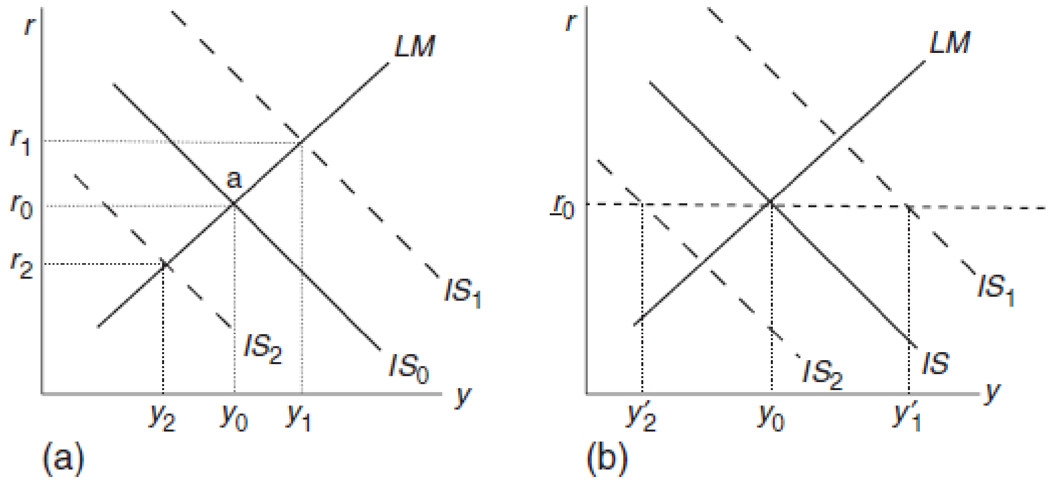
- Based on IS LM analysis
- **Shocks arising from the commodity market :** The IS equation and curve encompass the various components of expenditures, such as consumption, investment, exports, fiscal deficits, etc., in the economy. Several of these are volatile, with investment often being the most volatile component of expenditures. Shifts in any of these components shift the IS curve in the IS–LM diagram.

Monetary Aggregates versus Interest Rates as Operating Targets Cont’d

- Start with the initial equilibrium shown by point a, with coordinates (r0, y0), in Figure (a). Assume that the central bank targets money supply and holds it constant through open market operations or by the use of some other instruments. Shocks to the IS curve would then change both r and y. To illustrate, if a positive shock shifts the IS curve from IS0 to IS1, aggregate demand will increase from y0 to y1 and the interest rate rise from r0 to r1. Similarly, a negative shock, occurring, say, in the following period, which shifts the IS curve to IS2, will lower aggregate demand to y2 and the interest rate to r2.

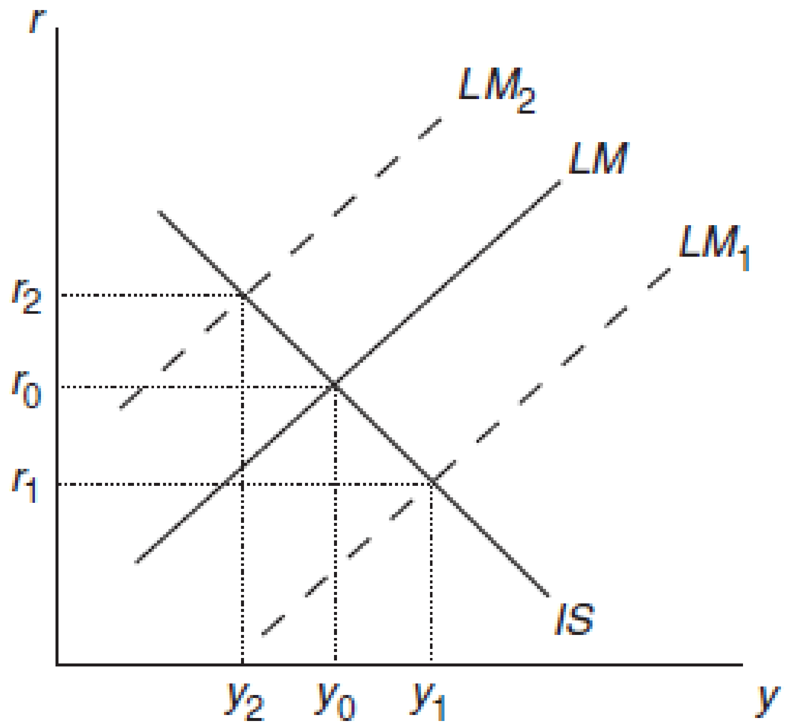
Monetary Aggregates versus Interest Rates as Operating Targets Cont'd

- Compare this result with the impact of the same shock if the interest rate had been targeted. This is where the interest rate is assumed to be held fixed by the authorities at the target rate r0, where the underline indicates that it is exogenously set by the central bank (Figure b). The shifts in the IS curve, first to IS1 and then to IS2, will produce movements in aggregate demand, first to y1 and then to y2. This fluctuation between y1 and y2 is clearly greater than between y1 and y2, so that targeting the interest rate produces greater fluctuations in aggregate demand than money supply targeting if the exogenous shocks emanate from the commodity market.


r
LM
r_1
a
r_0
r_2
IS_1
IS_2
IS_0
y
y_2
y_0
y_1
(a)
r
LM
r_0
IS_1
IS
IS_2
y
y'_2
y_0
y'_1
(b)

Monetary Aggregates versus Interest Rates as Operating Targets Cont'd

- **Shocks arising from the money market:**
- Now assume that the exogenous shocks arise only in the money market while there are no shocks in the commodity market, so that the IS curve does not shift. Such exogenous shocks in the money market can be to either money demand or money supply, and shift the LM curve.
- Money supply targeting would stabilize the money supply, so that disturbances to it do not have to be considered, but not the money demand
- If money demand decreases and given the targeted money supply, the decrease in the money demand will shift the LM curve to the right to LM1 and increase aggregate demand from y0 to y1
- Assume that the next period's shock to the money demand increases it and shifts the LM curve to LM2, so that aggregate demand falls to y2. The aggregate demand fluctuations are then from y1 to y2 and the interest rate fluctuations are from r1 to r2.

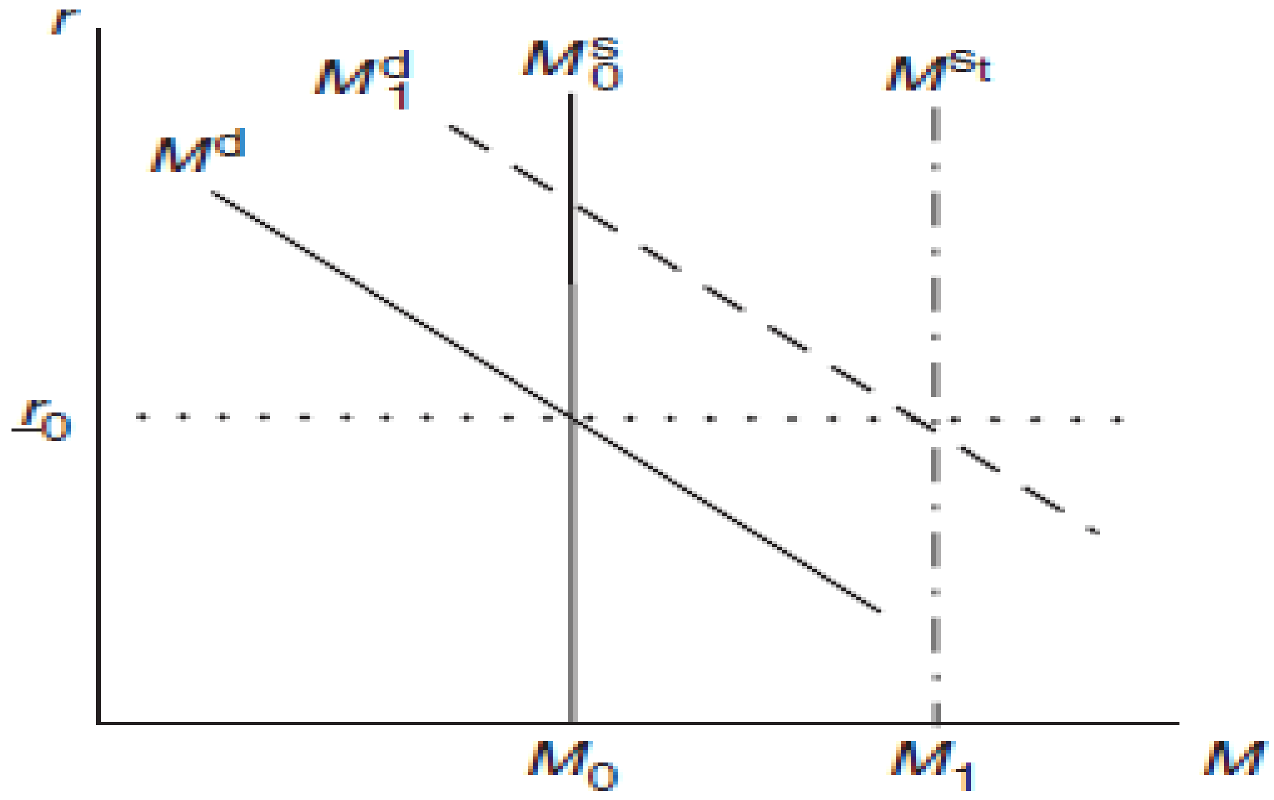

r
LM₂
LM
LM₁
r₂
r₀
r₁
IS
y₂
y₀
y₁
y

Monetary Aggregates versus Interest Rates as Operating Targets Cont'd

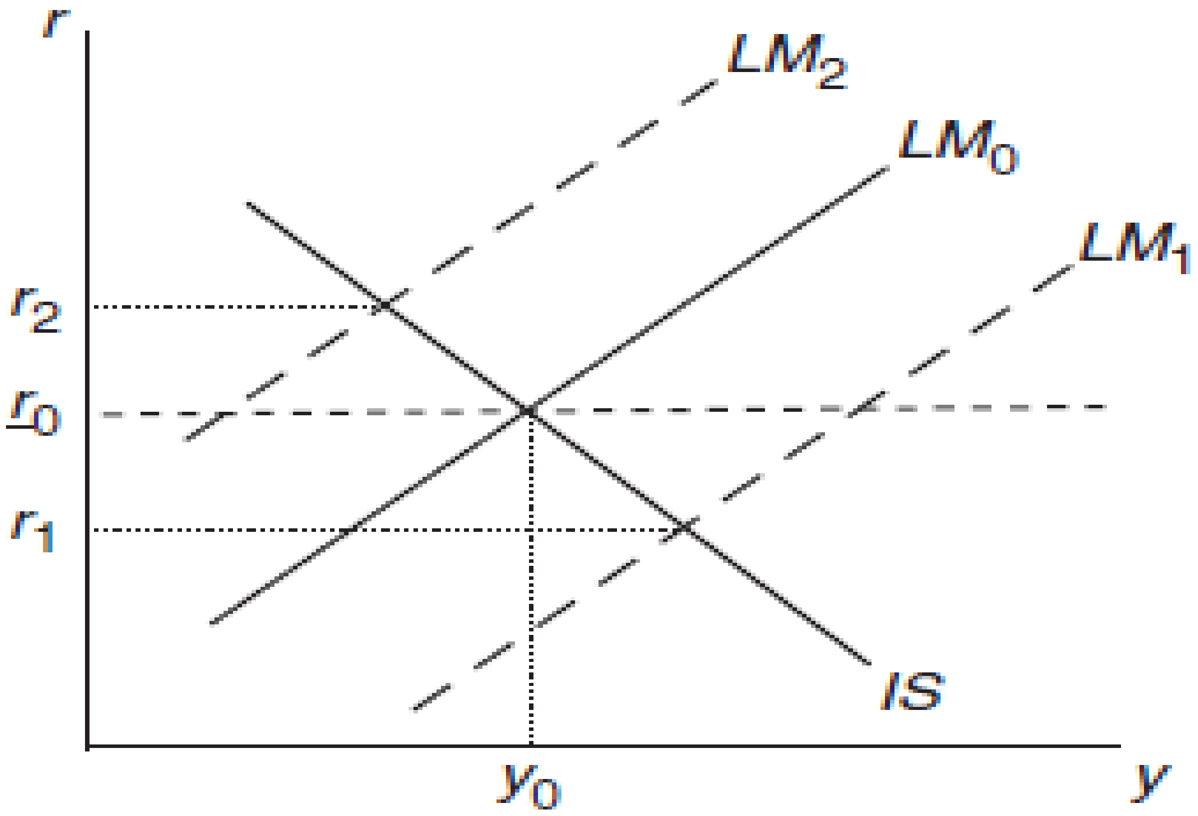
- For interest rate targeting, assume that the real interest rate had been set at r0. Assume the initial demand curve for nominal balances as Md and the initial supply curve as Ms, with the initial equilibrium interest rate as r0 and the initial money stock as M0. Now suppose that the money demand curve shifts from Md0 to Md1. Since the interest rate is being maintained by the monetary authority at r0, the monetary authority will have to increase the money supplied from M0 toM1. The money stock therefore adjusts endogenously through an accommodative monetary policy to the changes in money demand.

Monetary Aggregates versus Interest Rates as Operating Targets Cont'd

- A reduction in the money demand would shift the LM curve to the right from LM0 to LM1. However, given that the monetary authority maintains the interest rate at r0, the aggregate demand y0 will be determined by the intersection of the IS curve and a horizontal line at the target interest rate r0.



r
M^d_1
M^s_0
M^{St}
M^d
r_0
M_0
M_1
M



r
LM2
LM0
LM1
r2
r0
r1
IS
y0
y

Monetary Aggregates versus Interest Rates as Operating Targets Cont'd

- The exogenous shift in the LM curve from LM0 to LM1 leads the central bank to undertake an accommodative money supply decrease sufficient to shift this curve back to LM0.
- Monetary targeting will allow greater fluctuations in aggregate demand and interest rates than interest-rate targeting when the exogenous shifts arise from money demand.
- This poses a problem for the policy maker since both types of shocks occur in the real world. The monetary authority has to determine the potential source of the dominant shocks to the economy before making the choice between monetary and interest rate targeting.

Optimal choice of the operating target of monetary policy: The mathematical approach

- Assume that the IS and LM equations each have a disturbance term. Further, assume that the central bank can control the economy's interest rate r and money supply Ms except for uncontrollable disturbance terms and ηt , so that:

IS:

- LM: $({}^{M}/_{P})t = -m_1 R_r + m_2 y_t^d + \eta_t$

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

IS: ${y_t}^d = -\propto_r r_t - \mu_t$

LM: $\left({}^{\mathrm{M}}/_{\mathrm{P}}\right)\mathrm{t} = -\mathrm{m}_1\mathrm{R}_\mathrm{r} + \mathrm{m}_2\mathrm{y}_\mathrm{t}^\mathrm{d} + \eta_\mathrm{t}$

- where:

The demand for real balances md is a function of real income y and the nominal interest rate r snd assuming a linear relationship for simplification for the demand for real balances, specified by:

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

md = md (y, R, FW0) = myy+(FW0 −mRR)

m = real money balances

myy = real transactions balances

(FW0 −mRR) = speculative/portfolio demand for real balances

mRR = portfolio demand for bonds

R = nominal interest rate

- FW0 = real financial wealth

Optimal choice of the operating target of monetary policy: The mathematical approach cont’d

- This IS–LM model needs to be supplemented by a relationship between rt and Rt . This is provided, for an economy with perfect capital markets, by the Fisher equation:

- $R_t = r_t + \pi_t^e$

- where π_t^e is the expected inflation rate for period t. Holding these expectations constant as a simplifying analytical assumption, Rt and rt can be treated as identical in the IS–LM model.

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- Hence, replacing Rt by rt in the LM equation, the model becomes:

IS: $y_t^d = -\alpha_r + \mu_t$ ……………………………………………………..(1

LM: $(^M/_P)t = -m_1 r_r + m_2 y_t^d + \eta_t$ ……………………………………….(2

- The central bank observes the values of all terms, except those of the shocks, prior to setting its policy instrument, which is either Mt or rt . Its objective function is to minimize the expected variance of aggregate demand around its trend value, i.e.

- Minimize E$(y_t^d)^2$

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- Since y has been defined in terms of deviations from its trend, note that the equilibrium value of y_t^d in the absence of shocks (μ = η = 0) would be zero, so that its variance arises only by virtue of μ and η being different from zero.

- When the money stock is the policy instrument, we need to solve (1) and (2) to derive y_t^d which is given by:

- $IS - LM$: $y_t^d = \frac{(\alpha_r {}^M/_P) + m_1\mu_t \ - \alpha_r\eta_t}{\alpha_r m_2 + m_1}$……………………………(3)

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- Since Eμ = Eη = 0, E(yd) = $\frac{(\alpha_r {}^{M}/_{P})}{\alpha_r m_2 + m_1}$. Hence, noting that the variables in the current model are being defined in terms of deviations from their trend values, targeting M such that E(y_t^d) = 0 requires M/P = 0, which yields:

$$y_t^d = \frac{m_1 \mu_t \ \ - \alpha_r \eta_t}{\alpha_r m_2 + m_1} \text{ ....}(4)$$

- Therefore, under the assumption that μ and η are uncorrelated and the variance of αP is zero, the variance of aggregate demand under the money supply instrument is given by,

$$E^d(y^d)^2 = \frac{m_1^2 \sigma_\mu^2 + \alpha_r^2 \sigma_\eta^2}{(\alpha_r m_2 + m_1)^2} \text{.................................}(5)$$

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- where the superscript m on E indicates monetary targeting. When the real interest rate is the monetary policy instrument, the IS equation (1) alone needs to be solved for y_t^d. Under interest rate targeting, setting r such that E(y_t^d) = 0, its variance becomes:

- $E^r(y^d)^2 = \sigma_\mu^2$ ……………………………………..(6)

- where the superscript r on E indicates interest rate targeting. Monetary targeting is preferable to interest rate targeting if (5) is less than (6), and vice versa. The former requires:

$$\frac{m_1^2\sigma_\mu^2+\alpha_r^2\sigma_\eta^2}{(\alpha_r m_2+m_1)^2} < \sigma_\mu^2 \qquad (7)$$

- Which simplifies to:

- $\sigma_\eta^2 < \sigma_\mu^2(m_2^2 + \frac{2m_2m_1}{\alpha_r}$ (8)

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- Hence, if there are only money market shocks but no commodity market shocks (i.e.$\sigma\mu = 0$), then interest rate targeting is preferable since doing so perfectly stabilizes aggregate demand; the LM equation and its disturbance term become irrelevant to the determination of aggregate demand. But if there are only commodity market shocks but no money market shocks (i.e. $\sigma\eta = 0$), then monetary targeting is preferable since doing so reduces fluctuations in aggregate demand. In this case, with a given money supply, a positive commodity market shock raises the interest rate, which reduces interest-sensitive expenditures, thereby reducing commodity demand, so that the original shock to demand is partially offset.

Optimal choice of the operating target of monetary policy: The mathematical approach cont'd

- In the general case, the choice of the policy instrument will depend on the relative magnitudes of the shocks and the slope of the IS curve (whose slope is $-1/\alpha r$) relative to that of the LM curve (whose slope is $1/mr$). If, for simplification, the term in parentheses on the right-hand side of (8) were ignored, monetary targeting would be preferable to interest rate targeting if the stochastic disturbance in the money market were smaller than in the commodity market. For the money market, assuming that the central bank can precisely control the money supply but does not know the money demand because of the instability of this demand, $\sigma\eta$ occurs because of the volatility of money demand.

Inflation Targeting Monetary Policy Framework

- **Targeting the price level (or inflation)**

- A stable price level or a low inflation rate is argued as the ultimate goal of monetary policy.

- It is argued that money is neutral in the long run, so that the central bank cannot change the level and path of full-employment output, nor should it attempt to do so since such an attempt will only produce inflation. Under this neutrality argument, what the central bank can do is to ensure a stable value of money, so that its target should be in terms of the price level or the rate of inflation.

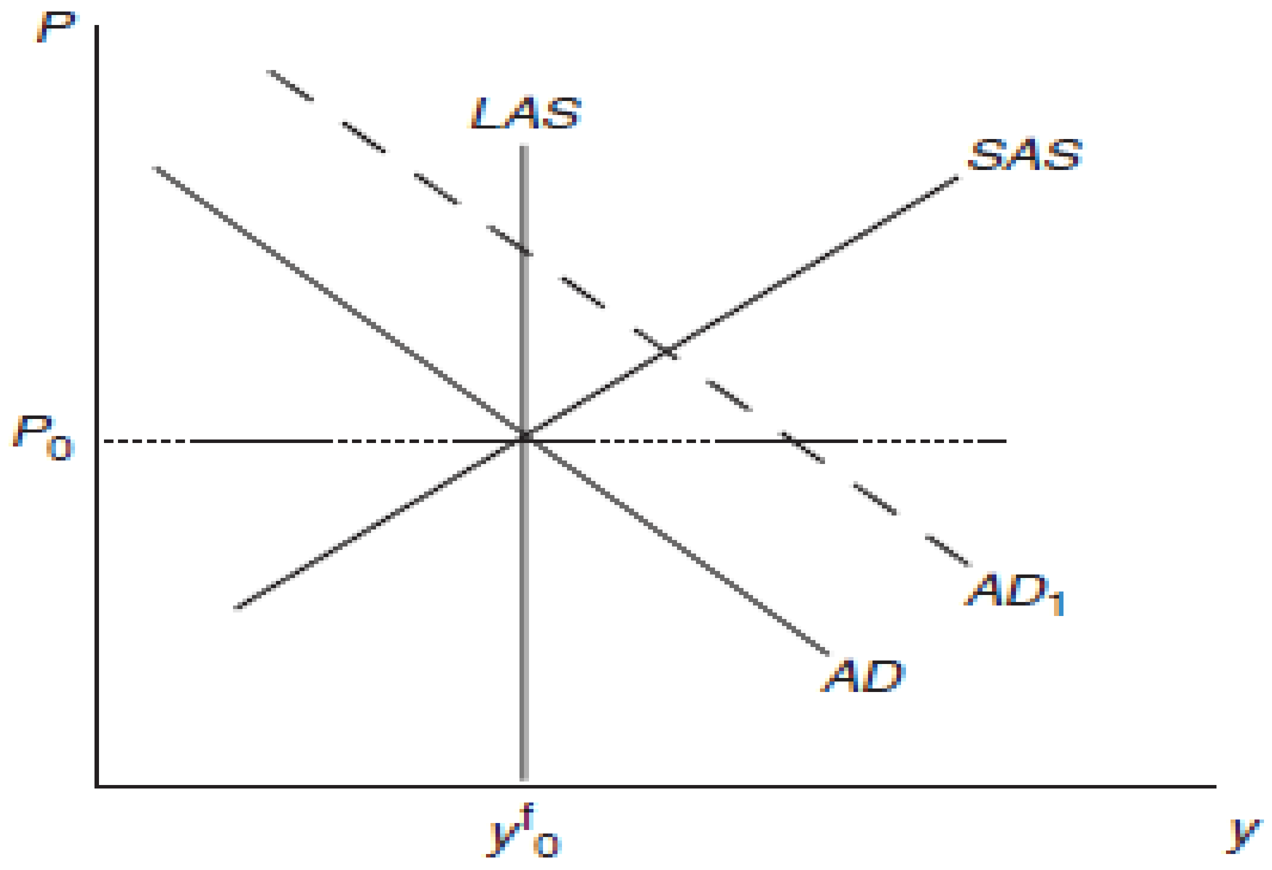
- A fairly stable price level reduces the risks in entering into long-term financial contracts and fixed real investments and promotes the formulation and realization of optimal saving and investment, which in turn increase output and employment. By comparison, high and variable inflation rates inhibit economic growth by introducing uncertainty into long-term financial contracts and investment.

Inflation Targeting Monetary Policy Framework Cont’d

- Assume the price level and the inflation rate as the monetary authorities’ target,
- Assume that the monetary authority will adopt the appropriate instrument to achieve the desired level of aggregate demand. In the short run, we use a positively sloping short-run aggregate supply curve rather than a vertical long-run one.

Inflation Targeting Monetary Policy Framework Cont'd

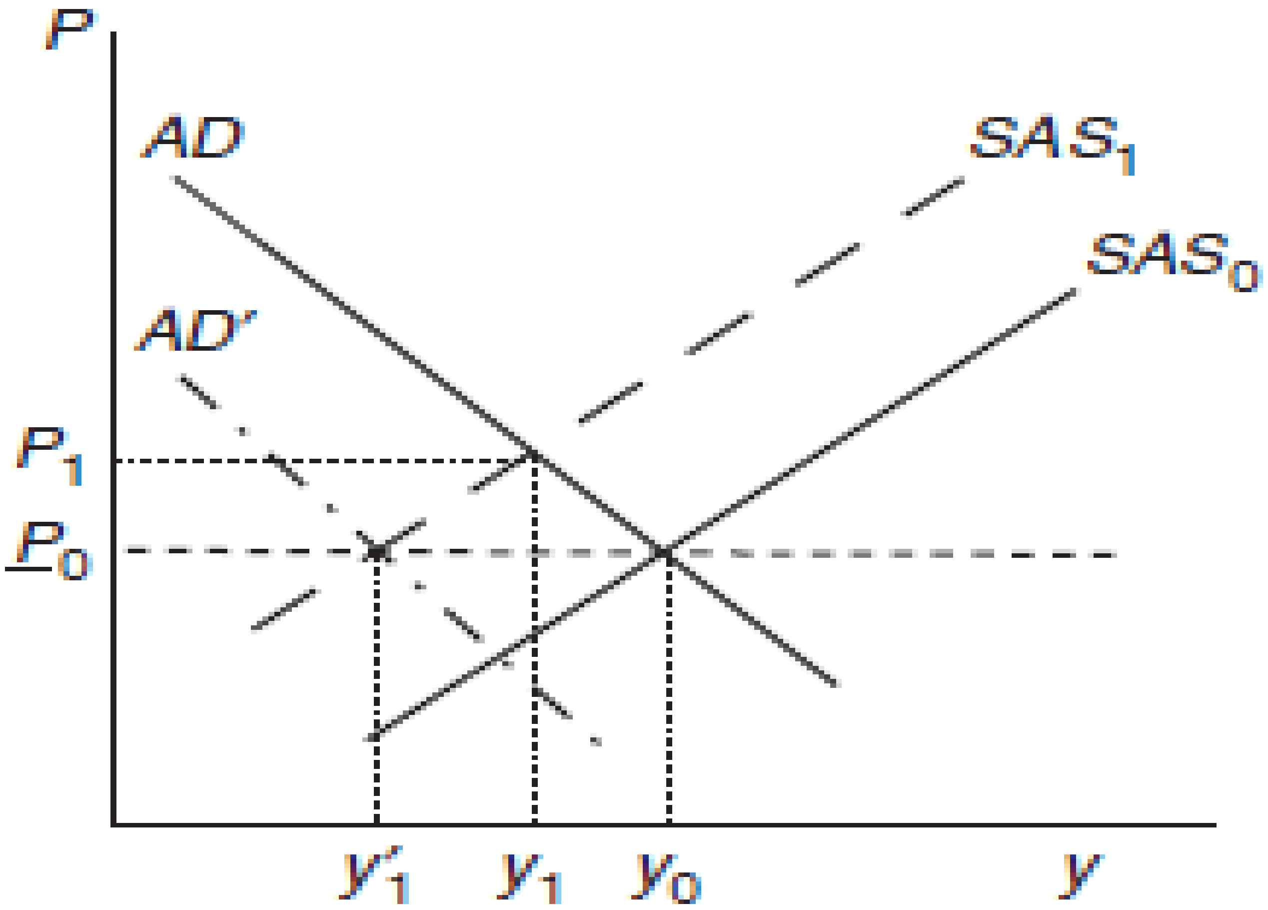
- Assume a positive demand shock such that the AD curve shifts to AD1. If the monetary authorities stabilized prices at P0, output would remain unchanged at y0.
- To achieve this under monetary targeting, the monetary authority would pursue a compensatory decrease in the money supply or an increase in the interest rate to shift aggregate demand back to AD.
- Under interest-rate targeting, they would raise the interest rate to achieve the same effect.
- The net effect of such a monetary policy would stabilize both the price level and output in the event of exogenous shocks from the money or commodity markets.



P
LAS
SAS
P_0
AD_1
AD
y^f_0
y

Inflation Targeting Monetary Policy Framework Cont'd

- Assume a negative supply shock such that the short-run aggregate supply curve SAS shifts from SAS0 to SAS1. This will produce an increase in the price level from P0 to P1 and a decrease in output from y0 to y1.
- Since the price level is not an operational variable under the direct control of the central bank, the bank would have to achieve price stability through a reduction in aggregate demand, which requires a contraction of the money supply or a rise in interest rates such that AD is made to shift to AD1. This will decrease output from y0 at P0 to y1 at P1 due to the supply shock and then to y1 due to the contractionary monetary policy and its implied shift of the AD curve to AD1.
- Hence, the contractionary monetary policy would have increased the fall in output over that which would have occurred if the monetary policy had not been pursued.

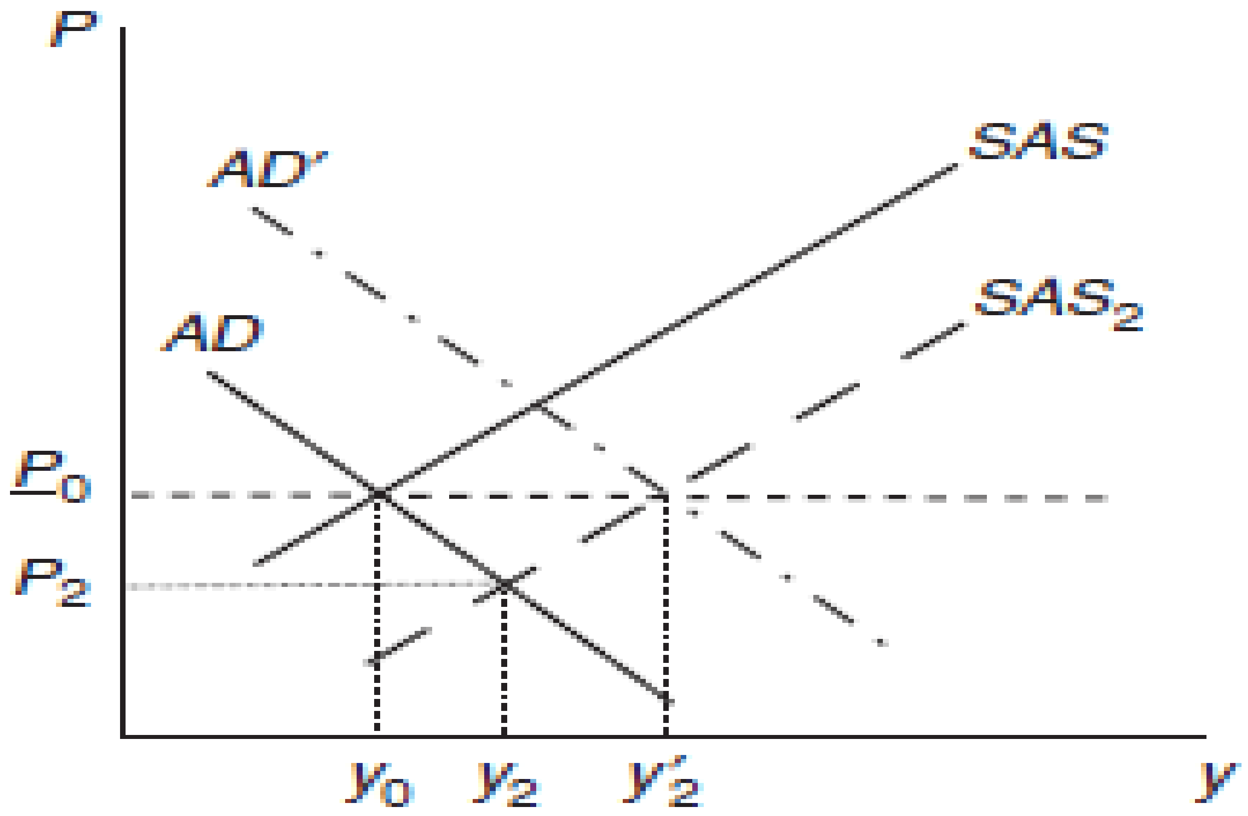


P
AD
SAS1
SAS0
AD′
P1
P0
y′1
y1
y0
y

Inflation Targeting Monetary Policy Framework Cont’d

- Similarly, suppose that the aggregate supply shock had been a positive one. This would shift the SAS curve to the right from SAS0 to SAS2, resulting in the increase in output from y0 to y2 and the decrease in prices from P0 to P2. The central bank could increase aggregate demand to stabilize the price level at P0, but this would mean an expansionary monetary policy which shifts the AD curve to AD1 and further increases output to y2. Price stabilization has, therefore, again increased the fluctuation in output.

- Therefore, given the aggregate supply curve as being positively sloped and short run, the pursuit of price stability in the face of supply-side fluctuations has the cost of.



P
AD′
AD
SAS
SAS2
P0
P2
y0
y2
y′2
y

Inflation Targeting Monetary Policy Framework Cont'd

- Inflation targeting, which involves a central bank raising or lowering interest rates to anchor inflation expectations in order to achieve a given inflation target, is argued as a more effective way of maintaining low and stable inflation.

Inflation Targeting Monetary Policy Framework Cont’d

- Inflation targeting involves several elements:

- public announcement of medium-term numerical objectives (targets) for inflation;

- an institutional commitment to price stability as the primary, long-run goal of monetary policy and a commitment to achieving the inflation goal;

- an information-inclusive approach in which many variables (not just monetary aggregates) are used in making decisions about monetary policy;

- increased transparency of the monetary policy strategy through communication with the public and the markets about the plans and objectives of monetary policymakers; and

- increased accountability of the central bank for attaining its inflation objectives.

Inflation Targeting Monetary Policy Framework Cont’d

- Inflation targeting framework requires that the central bank is given institutional independence and a clear mandate to pursue price stability.
- The central bank, (or the fiscal authority) announces an explicit inflation target (either as a point, a band or a ceiling) for a period; intermittent assessment of inflationary pressures over the relevant time horizon; and systematic adjustments in the monetary policy tool based on pressure within the operating environment.

Inflation Targeting Monetary Policy Framework Cont'd

- As inflation targeting is forward-looking, a prerequisite that underpins its success, is a well-functioning inflation forecasting framework and an efficient financial market that is responsive.
- Inflation targeting central banks maintain significant scope for applying discretion in the conduct of monetary policy. Thus, a good judgment on their part is a critical element for successful inflation targeting.

Inflation Targeting Monetary Policy Framework Cont’d

- Achieving the target is crucial to realizing policy credibility and anchoring expectations of economic agents about monetary policy.
- Having an autonomous central bank with an overt mandate and quantifiable inflation target is desirable
- The centrality of the central bank on aggressive inflation targeting is counterproductive in a country characterized with weak fiscal and productive fundamentals

Inflation Targeting Monetary Policy Framework Cont’d

- **Advantages of Inflation Targeting**

➢ **Reduction of the Time-Inconsistency Problem**: An explicit numerical inflation target increases the accountability of the central bank, inflation targeting can reduce the likelihood that the central bank will fall into the time-inconsistency trap of trying to expand output and employment in the short run by pursuing overly expansionary monetary policy. Inflation targeting can reduce political pressures on the central bank to pursue inflationary monetary policy and thereby reduce the likelihood of the time-inconsistency problem

Inflation Targeting Monetary Policy Framework Cont’d

- **Advantages of Inflation Targeting**

➢ **Increased Transparency:** Inflation targeting has the advantage that it is readily understood by the public and is thus highly transparent. Inflation-targeting regimes place great importance on transparency in policymaking and on regular communication with the public. Inflation-targeting central banks have frequent communications with the government, some mandated by law and some in response to informal inquiries, and their officials take every opportunity to make public speeches on their monetary policy strategy.

Inflation Targeting Monetary Policy Framework Cont’d

- **Increased Accountability**: Another key feature of inflation-targeting regimes is the tendency toward increased accountability of the central bank. Indeed, transparency and communication go hand in hand with increased accountability.
- **Consistency with Democratic Principles**: Accountability makes the institutional framework for the conduct of monetary policy more consistent with democratic principles. The inflation-targeting framework promotes the accountability of the central bank to elected officials, who are given some responsibility for setting the goals of monetary policy and then monitoring the economic outcomes.

Inflation Targeting Monetary Policy Framework Cont’d

- **Disadvantages of Inflation Targeting:**

➢ **Delayed Signaling**: Inflation is not easily controlled by the monetary authorities. Furthermore, because of the long lags in the effects of monetary policy, inflation outcomes are revealed only after a substantial lag. Thus an inflation target does not send immediate signals to the public and the markets about the stance of monetary policy.

➢ **Too Much Rigidity**: Some economists criticize inflation targeting because they believe it imposes a rigid rule on monetary policymakers and limits their ability to respond to unforeseen circumstances. However, useful policy strategies exist that are “rule-like” in that they involve forward-looking behavior that limits policymakers from systematically engaging in policies with undesirable long-run consequences.

Inflation Targeting Monetary Policy Framework Cont’d

- **Potential for Increased Output Fluctuations**: An important criticism of inflation targeting is that a sole focus on inflation may lead to monetary policy that is too tight when inflation is above target and thus may result in larger output fluctuations. Inflation targeting does not, however, require a sole focus on inflation—in fact, experience has shown that inflation targeters display substantial concern about output fluctuations.
- **Low Economic Growth**: Another common concern about inflation targeting is that it will lead to low growth in output and employment. Although inflation reduction has been associated with below-normal output during disinflationary phases in inflation targeting regimes, once low inflation levels were achieved, output and employment returned to levels at least as high as they were before.

Monetary Transmission Mechanism of Monetary Policy

- **Monetary policy transmission mechanism shows channels through which changes in monetary policy (money supply) affect real variables (output, prices and employment)**
- **Interest Rate Channels**: The interest rate control (endogenous money) approach to the transmission mechanism is in six steps (Goodhart, 2002):

➢ The central bank determines the short-term interest rate

➢ The private sector determines the volume of borrowing it wishes to undertake from the banking sector at the current set of interest rates.

➢ Banks adjust their own relative interest rates, marketable assets, and interbank and wholesale borrowing to meet the credit demands upon them

Monetary Transmission Mechanism of Monetary Policy Cont’d

- **Interest Rate Channels Cont’d**

➢ These bank actions determine the money stock and its various sub-components (e.g. demand, time and wholesale deposits). This determines the volume of bank reserves needed, taking into account any required reserve ratios

➢ This determines how much the banks need to borrow from, or pay back to, the central bank in order to meet their demand for reserves

➢ In order to sustain the level of interest rates, the central bank uses open market operations to satisfy the banks' demand for reserves established

Monetary Transmission Mechanism of Monetary Policy Cont’d

- **Interest Rate Channel Cont’d**
- An important feature of the interest-rate transmission mechanism is its emphasis on the real (rather than the nominal) interest rate as the rate that affects consumer and business decisions. In addition, it is often the real long-term interest rate (not the real short-term interest rate) that is viewed as having the major impact on spending.

$$\pi^e \uparrow \Rightarrow r_r \downarrow \Rightarrow I \uparrow \Rightarrow Y^{ad} \uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont’d

- **Interest Rate Channel Cont’d**
- A rise in expected inflation leads to a fall in real interest rates (r), which in turn lowers the real cost of borrowing, causing a rise in investment spending (I), thereby leading to an increase in aggregate demand (Yad)

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Other Asset Price Channels** – One drawback of the aggregate demand analysis is that it focuses on only one asset price, the interest rate, rather than on many asset prices. In addition to bond prices, two other asset prices are critical channels for monetary policy effects: foreign exchange rates and the prices of equities (stocks).

Monetary Transmission Mechanism of Monetary Policy Cont’d

- **Exchange Rate Effects Channel:** Monetary policy affects exchange rates, which in turn affect net exports and aggregate demand. The foreign exchange rate channel also involves interest-rate effects.

➢ When domestic real interest rates fall, domestic dollar assets become less attractive relative to assets denominated in foreign currencies. As a result, the value of dollar assets relative to other currency assets falls, and the dollar depreciates (denoted by E). The lower value of the domestic currency makes domestic goods cheaper than foreign goods, thereby causing a rise in net exports (NX) and hence in aggregate demand (Yad). The schematic for the monetary transmission mechanism that operates through the exchange rate is

Monetary Transmission Mechanism of Monetary Policy Cont'd

- The schematic for the monetary transmission mechanism that operates through the exchange rate is

$$r\downarrow \Rightarrow E\downarrow \Rightarrow NX\uparrow \Rightarrow Y^{ad}\uparrow$$

- **Tobin's q Theory:** Explains how monetary policy can affect the economy through its effects on the valuation of equities (stock). Tobin defines q as the market value of firms divided by the replacement cost of capital. If q is high, the market price of firms is high relative to the replacement cost of capital, and new plant and equipment capital is cheap relative to the market value of firms. Companies then can issue stock and get a high price for it relative to the cost of the facilities and equipment they are buying. Investment spending will rise because firms can buy a lot of new investment goods with only a small issue of stock.

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Tobin's q Theory**

➢ Monetary policy affect also stock prices. Lower real interest rates on bonds mean that the expected return on this alternative to stocks falls. This makes stocks more attractive relative to bonds, and so demand for them increases, which raises their price. By combining this result with the fact that higher stock prices (Ps) will lead to a higher q and thus higher investment spending I, we can write the following transmission mechanism of monetary policy

$$r\downarrow \Rightarrow P_s\uparrow \Rightarrow q\uparrow \Rightarrow I\uparrow \Rightarrow Y^{ad}\uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Wealth Effects Channel :**

➢ Modigliani's theory is that consumers smooth out their consumption over time. Therefore, consumption spending is determined by the lifetime resources of consumers, not just today's income

➢ An important component of consumers' lifetime resources is their financial wealth, a major part of which is common stocks. When stock prices rise, the value of financial wealth increases, thereby increasing the lifetime resources of consumers, which means that consumption should rise. Considering that monetary easing can lead to a rise in stock prices, we now have another monetary transmission mechanism

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Wealth Effects Cont'd**

$$r\downarrow \Rightarrow P_s\uparrow \Rightarrow \text{wealth}\uparrow \Rightarrow \text{consumption}\uparrow \Rightarrow Y^{ad}\uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Credit Channel**

➢ Expansionary monetary policy, which increases bank reserves and bank deposits, raises the quantity of bank loans available. Because many borrowers are dependent on bank loans to finance their activities, this increase in loans causes investment (and possibly consumer) spending to rise.

$$\text{Bank reserves}\uparrow \Rightarrow \text{bank deposits}\uparrow \Rightarrow \text{bank loans}\uparrow \Rightarrow I\uparrow \Rightarrow Y^{ad}\uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont’d

- Monetary policy can affect firms’ balance sheets in several ways. Easing of monetary policy, which causes a rise in stock prices (Ps), raises the net worth of firms and so leads to higher investment spending (I) and higher aggregate demand (Yad) because of the decrease in adverse selection and moral hazard problems.

$$r\downarrow \Rightarrow P_s\uparrow \Rightarrow \text{firms' net worth}\uparrow \Rightarrow \text{adverse selection}\downarrow,$$
$$\text{moral hazard}\downarrow \Rightarrow \text{lending}\uparrow \Rightarrow I\uparrow \Rightarrow Y^{ad}\uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont’d

- **Cash Flow Channel**:

➢ Another balance sheet channel operates by affecting cash flow, the difference between firms’ cash receipts and cash expenditures.

➢ An easing of monetary policy, which lowers nominal interest rates, also causes an improvement in firms’ balance sheets because it raises cash flow. The increase in cash flow increases the liquidity of the firm (or household) and thus makes it easier for lenders to know whether the firm (or household) will be able to pay its bills. The result is that adverse selection and moral hazard problems become less severe, leading to an increase in lending and economic activity.

Monetary Transmission Mechanism of Monetary Policy Cont'd

- **Cashflow Channel**:

$$i\downarrow \Rightarrow \text{firms' cash flow}\uparrow \Rightarrow \text{adverse selection}\downarrow,$$
$$\text{moral hazard}\downarrow \Rightarrow \text{lending}\uparrow \Rightarrow I\uparrow \Rightarrow Y^{ad}\uparrow$$

Monetary Transmission Mechanism of Monetary Policy Cont’d

- Monetary policy influences aggregate demand in a variety of ways:
  - ➢ The relationship between interest rate changes and changes in aggregate demand
  - ➢ The relationship between interest rates and aggregate demand is inverse — increases in interest rates reduce aggregate expenditure; reductions in interest rates cause aggregate expenditure to increase

Interest Rates and Monetary Policy (Taylor’s Rule)

- Many central banks use the interest rate, rather than the money supply, as the primary monetary policy instrument, while leaving the money supply endogenous to the economy.
- The central elements of this consensus [about the conduct of monetary policy] are that the instrument of monetary policy ought to be the short-term interest rate, that policy should be focused on the short-term interest rate, and that inflation can be reduced by increasing the short-term interest rate.

Interest Rates and Monetary Policy (Taylor's Rule)

- The use of the interest rate as the operating monetary policy instrument is stated in the form of a Taylor rule

$$r^{\mathrm{T}}{}_t = r_0 + \alpha(y_t - y^{\mathrm{f}}) + \beta(\pi_t - \pi^T) \qquad \alpha, \beta > 0$$

- where rT is the real interest rate target of the central banks for financial markets, y is real output, yf is full-employment output, π is the actual inflation rate, πT is the inflation rate desired by the central bank, and the subscript t refers to period t. πT is called the target inflation rate. Similarly, yf is the target output level. (yt –yf) is (minus of) the output gap.

Interest Rates and Monetary Policy (Taylor's Rule)

- The Taylor rule is a feedback rule according to which changes in two indicators (inflation and output) of the actual performance of the economy cause the central bank to change its real interest rate target.
- Under this feedback rule, the central bank would increase its target real interest rate if actual output (or the demand for it) were too high or if inflation were too high, relative to their long-run or desired levels.

Interest Rates and Monetary Policy (Taylor's Rule)

- Since central banks set the nominal rather than the real interest rate, the Taylor rule is also often written as:

$$R^{T}_{t} = \pi_t + r_0 + \alpha(y_t - y^{f}) + \beta(\pi_t - \pi^{T}) \quad \alpha, \beta > 0$$

- which specifies the nominal interest rate R set by the central bank. The objective of the manipulation of the interest rate by the Taylor rule is to engineer inflation and output back to their target levels and to do so through a gradual adjustment pattern.

Interest Rates and Monetary Policy (Taylor's Rule)

- Under the Taylor rule, if π rises above πT the increase in the target real rate will require that the nominal rate has to rise more than the inflation rate

- If π falls below πT, a cut in the target real rate will require that the nominal rate has to fall more than the inflation rate.

- For any given inflation rate, the greater the value of β, the larger will be the change in the real and nominal rates and the stronger the movement to stabilize the economy at the target inflation rate.

Interest Rates and Monetary Policy (Taylor's Rule)

- **Integration of the interest rate as the operating monetary target into the macroeconomic model**

➢The assumption made on monetary policy is that the central bank successfully targets and sets the economy's real interest rate r at r0 (constant). That is, under this simple targeting policy

$$r = r^T_0$$

Interest Rates and Monetary Policy (Taylor's Rule)

- An alternative to the above assumption of a simple fixed interest rate rule is a simple feedback rule such as:

$$r = r_0 + \lambda_y y^d + \lambda_P P \quad \lambda_y, \lambda_P > 0$$

- This can also be modified to a Taylor-type rule but with targeting of price level, rather than inflation:

$$r^T{}_t = r_0 + \alpha(y_t - y^f) + \beta(P_t - P^T) \quad \alpha, \beta > 0$$

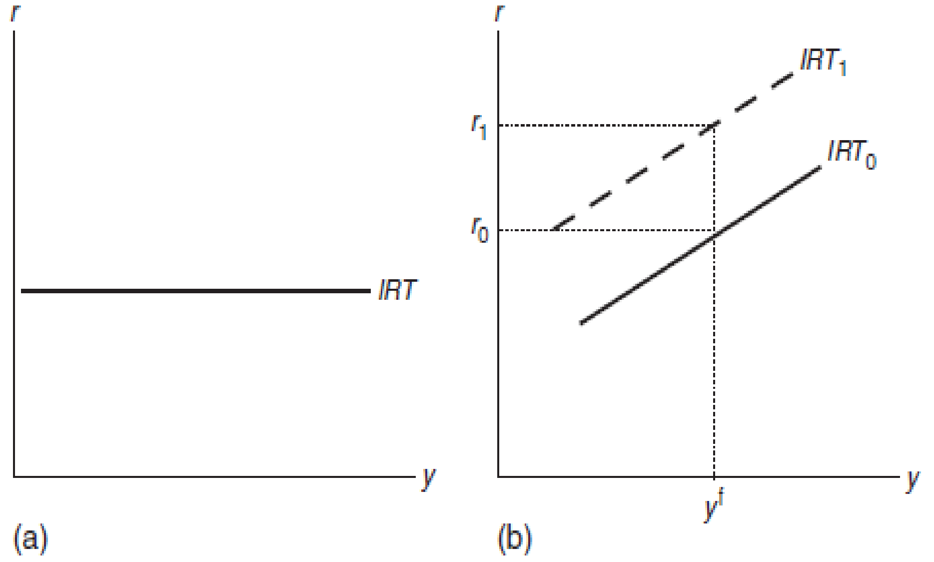
Interest Rates and Monetary Policy (Taylor's Rule)

- An increase in aggregate demand causes the central bank to raise the interest rate, so that r and yd are positively related, giving the IRT curve a positive slope. An increase in P would not shift the IRT curve but would shift upward, from IRT0 to IRT1, indicating an increase in r at any given level of yd.

Interest Rates and Monetary Policy (Taylor's Rule)

- An increase in aggregate demand causes the central bank to raise the interest rate, so that r and yd are positively related, giving the IRT curve a positive slope. An increase in P would not shift the IRT curve but would shift upward, from IRT0 to IRT1, indicating an increase in r at any given level of yd.
- Under interest rate targeting, money supply becomes endogenous to money demand, which the central bank accommodates by appropriate changes in the monetary base. Further, under the simple interest rate targeting, the LM curve becomes horizontal at the set interest rate because the central bank supplies money perfectly elastically to the economy.

Interest Rates and Monetary Policy (Taylor's Rule)



Theories of Central Bank Independence and Time Consistency of Policies

- The goal variables of many central banks include the rate of inflation and the unemployment rate, which can be a goal variable in its own right or a proxy for the output gap.
- Assume that the central bank’s preferences over these variables can be encompassed in an objective/utility function

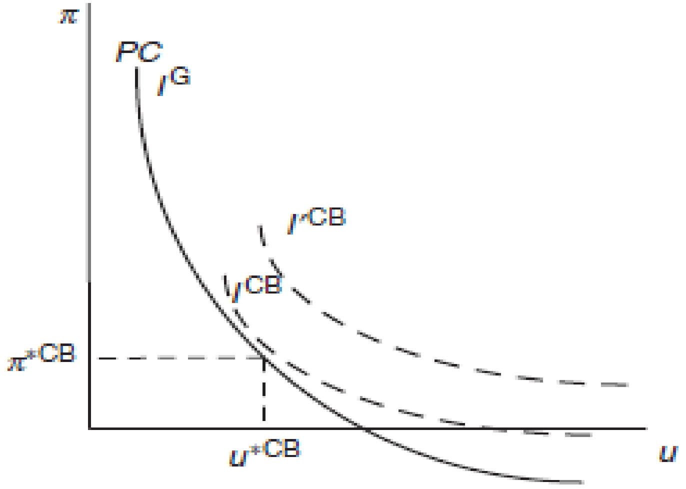
Theories of Central Bank Independence and Time Consistency of Policies

$U = U(\pi, u)$

- where π is the rate of inflation, u is the rate of unemployment, and $U_\pi, U_u < 0$. Hence, the indifference curves in the (π, u) space are negatively sloped. Further, it is reasonable to assume that the undesirability – that is, disutility – of each variable keeps on increasing, ceteris paribus, with higher levels of it, so that $U_{\pi\pi}, U_{uu} < 0$.

- Hence, as the rate of inflation rises, the central bank is willing to accept a higher marginal increase in the unemployment rate in order to prevent a further rise in the rate of inflation, so that the indifference or tradeoff curves between the rates of inflation have the usual convex shape.

Theories of Central Bank Independence and Time Consistency of Policies



Theories of Central Bank Independence and Time Consistency of Policies

- A common variant of the above objective function is:

$U = U(\pi - \pi*\ , y - yf)$ $\qquad\qquad$ $U\pi\#, Uy\# < 0$

- where $\pi\# = \pi - \pi*$, $y\# = y - yf$, so that $\pi\#$ and $y\#$ are the respective gaps between the actual and the desired values of π and y. Since the central bank's choices are limited by constraints imposed by the economy on the values of π and u that can be attained, the central bank's decision problem is optimization of utility subject to these constraints

Theories of Central Bank Independence and Time Consistency of Policies

- General analysis of the choice among goals when the economy allows a tradeoff

- The utility function can be generalized to the case of n variables. The formal analysis of this general case assumes that the central bank has a utility function:

U = U(x1, . . ., xn)

Theories of Central Bank Independence and Time Consistency of Policies

- Asume that the central bank's choice is subject to only one constraint, which has the form:

$f\ (x1, \ldots, xn;\ z, \Psi\ ) = 0$

where:

xi = ith goal variable

z = vector of instruments available to the central bank

Ψ = vector of exogenous variables.

Theories of Central Bank Independence and Time Consistency of Policies

- The goal variables can be levels of variables, their growth rates or even such variables as the output gap and the "inflation gap," where the gaps are deviations from their desired levels. U(.) represents the central bank's preferences over its goals. These depend upon the organizational structure of the central bank, the interactions between the policy makers, their perceptions of society's goals, the structure of the economy and of what is achievable, political pressures.

Theories of Central Bank Independence and Time Consistency of Policies

- The central bank maximizes the utility function subject to the constraint in order to determine its optimal choices among the goals.

- **Choices under the economy's supply constraint**

➢ There are several forms of the economy's supply constraint relating unemployment (u) and inflation (π).

$u = f(\pi) \qquad f' < 0$

➢ This constraint allows the central bank to trade between higher inflation and lower unemployment. Optimization of the utility function subject to the constraint yields the optimal values of π and u, with higher inflation rates yielding lower unemployment.

Theories of Central Bank Independence and Time Consistency of Policies

- The constraint, under the assumption of rational expectations, is of the form

$(u - un) = f(\pi - E\pi)$ $\qquad f' < 0$

- where $du/dE\pi = 0$ and the use of a systematic monetary policy by the central bank changes both π and $E\pi$ by the same extent, so that $(\pi - E\pi)$ would not change. According to this, unemployment can only be made to deviate from its natural rate through unanticipated inflation, which, given rational expectations, requires a random monetary policy.

Theories of Central Bank Independence and Time Consistency of Policies

- Therefore, there is no tradeoff between these variables which systematic monetary policy by the central bank can exploit, so that the recommendation is that the central bank should adopt the target of price stability
- Given the objective function

$U = U(\pi - \pi_* , y - y_f) \qquad U_{\pi\#}, U_{y\#} < 0$

where $\pi\# = \pi - \pi_*$, $y\# = y - y_f$, so that $\pi\#$ and $y\#$ are the respective gaps between the actual and the desired values of π and y.

Theories of Central Bank Independence and Time Consistency of Policies

- Given this objective function, maintaining the expectations-augmented Phillips curve as the constraint, as well as assuming that the central bank does not want to or cannot fool the public by causing unanticipated inflation, implies that the optimal values of inflation and output are $\pi*$ and yf, of which the former can be achieved through systematic monetary policy. The latter is not affected by monetary policy but is determined by the long-run performance of the economy

Theories of Central Bank Independence and Time Consistency of Policies

- **Conflicts among policy makers: theoretical analysis**

➢ Different policy-making bodies in the economy are likely to have different preference functions and hence different indifference curves between any given pair of variables. Therefore, the formal optimization analysis for two policy makers A and B would be:

Theories of Central Bank Independence and Time Consistency of Policies

- For policy maker A:

Maximize $UA = UA(x1, \ldots, xn)$

subject to A's perceived constraint:

$f A(x1, \ldots, xn; z, \Psi) = 0$

- For policy maker B:

Maximize $UB = UB(x1, \ldots, xn)$

subject to B's perceived constraint:

$f B(x1, \ldots, xn; z, \Psi) = 0$

Theories of Central Bank Independence and Time Consistency of Policies

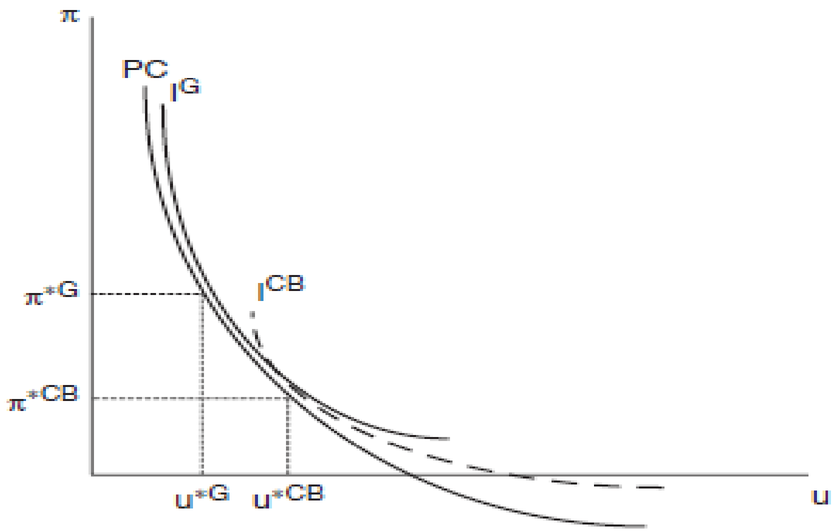
- The superscripts A and B refer to the policy maker. Since both the utility functions and the perceived constraints can differ, the optimal values of the goals for x1A , . . ., xnA will differ from x1B , . . ., xnB , so that working at cross purposes can be a common phenomenon, rather than a rare occurrence, among policy makers in the economy. This possibility depends upon the differences in the utility functions, becoming reinforced by any differences in the policy makers' perceptions of the actual present and expected course of the economy. In most cases, such conflicts in the understanding of the economy and desirable tradeoffs among objectives by the fiscal and monetary authorities of a given country tend to be mild. However, they can erupt into open and sometimes acrimonious public debate in times of radical economic and political change and of differences in ideology.

Theories of Central Bank Independence and Time Consistency of Policies

- The two principal tools for the control of aggregate demand are monetary and fiscal policies. In a country with an independent central bank, monetary policy is in the control of the central bank whereas fiscal policy is in the hands of the legislature and the government.
- Formally, in terms of the marginal rates of substitution of the two policy makers, $\partial\pi/\partial u CB < (\partial\pi/\partial u) G$, where CB stands for the central bank and G for the government, implying that the indifference curves of the central bank are steeper than those of the government. This implies that for a given constraint $f(\pi, u) = 0$, the central bank would adopt a monetary policy aimed at achieving a lower rate of inflation than the government.

Theories of Central Bank Independence and Time Consistency of Policies

- There a conflict between the central bank and the government on the desired rates of inflation and unemployment for the economy.



Theories of Central Bank Independence and Time Consistency of Policies

- **Independence of the Central Bank**

➢ Potential conflicts are inherent in a situation where the central bank is free to formulate monetary policy independently of the government, which is in charge of the fiscal policies and the management of the public debt. This conflict can be about the ultimate goals of full employment and price stability

➢The Case for Independence:

Theories of Central Bank Independence and Time Consistency of Policies

- **The Case for Independence**

➢ The strongest argument for an independent central bank rests on the view that subjecting it to more political pressures would impart an inflationary bias to monetary policy.

➢ Politicians in a democratic society are shortsighted because they are driven by the need to win their next election. With this as their primary goal, they are unlikely to focus on long-run objectives such as promoting a stable price level. Instead, they will seek short-run solutions to problems such as high unemployment and high interest rates, even if the short-run solutions have undesirable long-run consequences.

Theories of Central Bank Independence and Time Consistency of Policies

- Another argument for central bank independence is that control of monetary policy is too important to be left to politicians, a group that lacks of expertise at making hard decisions on issues of great economic importance, such as reducing the budget deficit or reforming the banking system

- **The Case Against Independence**

- It is undemocratic to have monetary policy (which affects almost everyone in the economy) controlled by an elite group responsible to no one.

Theories of Central Bank Independence and Time Consistency of Policies

- The public holds the president responsible for the economic well-being of the country, yet it lacks control over the government agency that may well be the most important factor in determining the health of the economy.

- In addition, to achieve a cohesive program that will promote economic stability, monetary policy must be coordinated with fiscal policy (the management of government spending and taxation). Only by placing monetary policy under the control of the politicians who also control fiscal policy can these two policies be prevented from working at cross-purposes.

Theories of Central Bank Independence and Time Consistency of Policies

- Another argument against central bank independence is that an independent central bank may not always used its freedom well.

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- This theoretical model is based on the simple New Keynesian in its 3-equation structure and its modelling of a forward-looking optimizing central bank
- The 3 equations are the IS equation $y1 = A - \alpha r0$ in which real income y is a positive function of autonomous expenditure A and a negative function of the real interest rate r; the Phillips curve

$$\pi 1 = \pi 0 + \alpha\ (y1 - ye),$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

where π is the rate of inflation and ye, equilibrium output; and the central bank's Monetary Rule. Equilibrium output is the level of output associated with constant inflation. In a world of imperfect competition, it reflects the mark-up and structural features of the labour market and welfare state.

- The central bank minimizes a loss function, where the government requires it to keep next period's inflation close to the target whilst avoiding large output fluctuations:

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

$$L = (y_1 - y_e)^2 + \beta(\pi_1 - \pi^T)^2.$$

- Any deviation in output from equilibrium or inflation from target — in either direction — produces a loss in utility for the central bank. The lag structure of the model explains why it is π1 and y1 that feature in the central bank's loss function: by choosing r0, the central bank determines y1, and y1 in turn determines π1

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- The central bank optimizes by minimizing its loss function subject to the Phillips curve:

$\pi 1 = \pi 0 + \alpha(y1 - ye)$

- By substituting the Phillips curve equation into the loss function and differentiating with respect to y1 we have:

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

$$\frac{\partial L}{\partial y_1} = (y_1 - y_e) + \alpha\beta(\pi_0 + \alpha(y_1 - y_e) - \pi^T) = 0.$$

- Substituting the Phillips curve back into this equation gives:

$(y_1 - y_e) = -\alpha\beta(\pi_1 - \pi^T)$ (Monetary rule: MR-AD equation)

- This equation is the ‘optimal’ equilibrium relationship in period 1 between the inflation rate chosen indirectly and the level of output chosen directly by the central bank in the current period 0 to maximize its utility given its preferences and the constraints it faces.

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- The logic of the central bank's position in period 0: it knows $\pi 0$ and hence it can work out via the Phillips curve (since $\pi 1 = \pi 0 + \alpha(y1 - ye)$) what level of y1 it has to get to — by setting the appropriate r0 in the current period — for this equilibrium relation to hold.
- The Monetary Rule or the Interest Rate Rule (sometimes called the optimal Taylor Rule), which shows the short term real interest rate relative to the 'stabilizing' or 'natural' real rate of interest, rS, that the central bank should set now in response to a deviation of the current inflation rate from target.

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- The central bank can set the nominal short-term interest rate directly, but since the expected rate of inflation is given in the short run, the central bank is assumed to be able to control the real interest rate indirectly. We assume the Fisher equation, i ≈ r + πE.
- The IS equation incorporates the lagged effect of the interest rate on output:

As a simple case, let $a = \alpha = \beta = 1$, so that

$$(r_0 - r_S) = 0.5\left(\pi_0 - \pi^T\right).$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

$$y_1 = A - ar_0. \qquad (IS \text{ equation})$$

A key concept is the stabilising interest rate r_S, which is the interest rate that produces equilibrium output. This is defined by

$$y_e = A - ar_S.$$

So subtracting this from the IS equation we can rewrite the IS equation in output gap form as:

$$y_1 - y_e = -a(r_0 - r_S). \qquad (IS \text{ equation, output gap form})$$

If we substitute for π_1 using the Phillips curve in the MR-AD equation, we get

$$\begin{aligned} \pi_0 + \alpha(y_1 - y_e) - \pi^T &= -\frac{1}{\alpha\beta}(y_1 - y_e) \\ \pi_0 - \pi^T &= -\left(\alpha + \frac{1}{\alpha\beta}\right)(y_1 - y_e) \end{aligned}$$

and if we now substitute for $(y_1 - y_e)$ using the IS equation, we get

$$(r_0 - r_S) = \frac{1}{a\left(\alpha + \frac{1}{\alpha\beta}\right)}\left(\pi_0 - \pi^T\right). \qquad (\text{Interest-rate rule, } IR \text{ equation})$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

As a simple case, let $a = \alpha = \beta = 1$, so that

$$(r_0 - r_S) = 0.5\left(\pi_0 - \pi^T\right).$$

- This tells the central bank how to adjust the interest rate (relative to the stabilizing interest rate) in response to a deviation of inflation from its target. By setting out the central bank's problem in this way, we have identified the key role of forecasting: the central bank must forecast the Phillips curve and the IS curve it will face next period. Although the central bank observes the shock in period zero and calculates its impact on current output and next period's inflation, it cannot offset the shock in the current period because of the lagged effect of the interest rate on aggregate demand

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- **Lags and the Taylor Rule**

➢ An optimal Taylor Rule is a policy rule that tells the central bank how to set the current interest rate in response to shocks that result in deviations of inflation from target or output from equilibrium or both in order to achieve its objectives. In other words, $(r0 - rS)$ responds to $(\pi 0 - \pi T)$ and $(y0 - ye)$:

$$r0 - rS = 0.5* (\pi 0 - \pi T) + 0.5*(y0 - ye) \qquad \text{(Taylor rule)}$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- We have already derived the optimal Taylor-type rule for the 3-equation C–Smodel:

$$(r_0 - r_S) = \frac{1}{a\left(\alpha + \frac{1}{\alpha\beta}\right)}\left(\pi_0 - \pi^T\right), \qquad (IR \text{ equation, C–S model})$$

- which with a = α = β = 1, gives r0 − rS = 0.5 · (π0 − πT). Two things are immediately apparent: first, only the inflation and not the output deviation is present in the rule and second, all the parameters of the three equation model matter for the central bank's response to a rise in inflation. If each parameter is equal to one, the weight on the inflation deviation is one half. For a given deviation of inflation from target, and in each case, comparing the situation with that in which a = α = β = 1, we have a more inflation averse central bank (β > 1) will raise the interest rate by more; when the IS is flatter (a > 1), the central bank will raise the interest rate by less; when the Phillips curve is steeper (α > 1), the central bank will raise the interest rate by less.

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- Given the double lag, the central bank's loss function contains y1 and π2 since it is these two variables it can choose through its interest rate decision

$$L = (y_1 - y_e)^2 + \beta(\pi_2 - \pi^T)^2$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

and the three equations are:

$$\begin{aligned} \pi_1 &= \pi_0 + \alpha(y_0 - y_e) && \text{(Phillips curve)} \\ y_1 - y_e &= -a(r_0 - r_S) && (IS) \\ \pi_2 - \pi^T &= -\frac{1}{\alpha\beta}(y_1 - y_e). && (MR\text{-}AD) \end{aligned}$$

By repeating the same steps as we used to derive the interest rate rule in section 2, we can derive a Taylor rule:

$$(r_0 - r_S) = \frac{1}{a\left(\alpha + \frac{1}{\alpha\beta}\right)}\left[\left(\pi_0 - \pi^T\right) + \alpha(y_0 - y_e)\right].$$

(Interest rate (Taylor) rule in 3-equation (double lag) model)

If $a = \alpha = \beta = 1$, then

$$(r_0 - r_S) = 0.5\left(\pi_0 - \pi^T\right) + 0.5(y_0 - y_e).$$

Theoretical modelling of the role of Central Banks and monetary policy: The Three Equation Model of Monetary Policy

- Implicitly the Taylor Rule incorporates changes in the interest rate that are required as a result of a change in the stabilizing interest rate (in the case of a permanent shift in the IS or of a supply-side shift): rS in the rule should therefore be interpreted as the post-shock stabilizing interest rate.

Theory of Interest Rates

- **Interest Rate Determination, Theory of Portfolio Choice, the Risk and Term Structure of Interest Rates**

➢ The interest rate may be defined as the compensation that a borrower of capital pays to a lender of capital for its use

➢ Interest rate is also a return on bonds (all non-monetary financial assets). A simple relationship between the nominal bond price pb and the nominal interest rate R, the (homogeneous) bond is assumed to be a consol (perpetuity), which promises a constant coupon payment of $1 in perpetuity. For this consol, pb =1/R.

Theory of Interest Rates

- **Nominal and real rates of interest**

➢The Fisher equation on the interest rate:

$$(1+R) = (1+r)(1+\pi e)$$

where R is the nominal interest rate, r is the real interest rate, re is the expected real interest rate and πe is the expected inflation rate.

Theory of Interest Rates

- If there exist both real bonds (i.e. promising a real rate of return r per period) and nominal bonds (i.e. promising a nominal rate of return R per period), the relationship between them in perfect markets would be:

$$(1+R) = (1+r)(1+\pi e)$$

- At low values of re and πe, reπe$\rightarrow$0, so that the Fisher equation is often simplified to:

$$re = R - \pi e$$

Theory of Interest Rates

- **Some of the Concepts of the Rate of Interest**

➢ The short-term markets for bonds have spot, forward and long rates of interest.

➢ *The (current) spot rate of interest rt*, is the annualized rate of return on a loan for the current period t, with the loan being made at the beginning of period t.

Theory of Interest Rates

- *The future spot rate of interest* is the return on a one-period loan in a future period (t +i), i >0, with the loan made at the beginning of that period. It will be designated rt+i, so that the left-hand subscript will be implicit. Since rt+i is a future spot rate, its expected value will be designated rt+ie. Its rational expectation in period t will be written as E rt+i , or as Et t+i rt+i i.

- *The future short rate of interest* is the return on a one-period loan in a future period (t +i), i > 0, with the contract for the loan entered into at the beginning of period t + j, j ≤ i, which could be the current period. It will be designated t+j rt+i.

Theory of Interest Rates

- *The forward short rate of interest* rft+i is the annualized rate of interest on a one-period loan for the (t+i)th period only, with the contract for the loan being made in the current period t. The forward rate differs from the future short rate rt+i, where the one-period loan for the period (t +i) is contracted at the beginning of period t +i. In incomplete financial markets, rft+i may not exist but rft+i would do so as long as there are spot markets. However, rft+i, if it exists, will be known in the current period t, whereas rft+i is not likely to be known in t, though expectations on its value can be formed in t.

Theory of Interest Rates

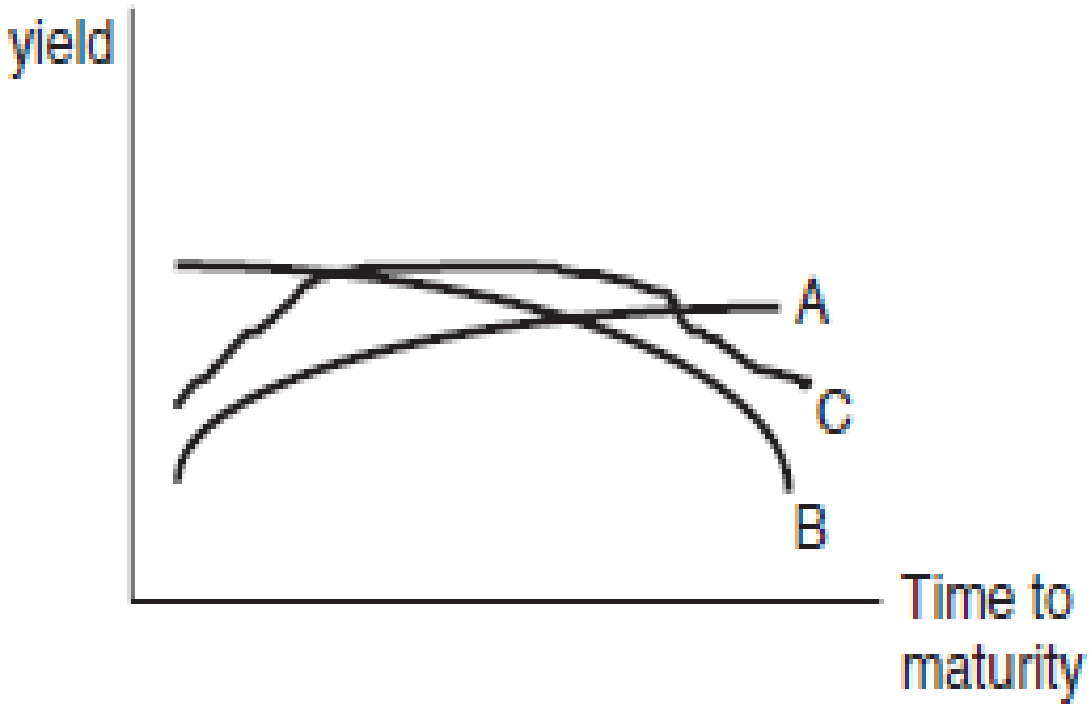
- *The long rate of interest* R_{t+i}, $i=0,1,...,n$, is the rate of return per period on a loan for $(i+1)$ periods, the loan being made in period t, with repayment of the principal and accumulated interest after $(i+1)$ periods. The current spot rate of interest r_t and the one-period long rate of interest R_t are identical. For simplicity of notation, r_{t+i} will sometimes be written as r_i and R_{t+i} will be written as R_i, with the subscript t being implicit or with the current period being treated as 0.

Theory of Interest Rates

- *The Yield Curve*: The variation in yields on assets of different maturities (redemption dates) is known as the term structure of interest rates, with the assets being assumed to be identical in all respects except for their maturity. This requirement is generally fulfilled only by the bonds issued by the government, so that the yields on government bonds are examined to show the variation in yield with increasing maturity.

Theory of Interest Rates

- The yield curve normally slopes upward from left to right, with the yield rising with term to maturity (curve A)
- In times of monetary stringency, short-term interest rates can rise and move above the long-term rates (curve B). This can also happen when inflation is rampant in the economy but is expected to be a short-term problem so that the inflationary premium in nominal yields is greater for the shorter term than for the longer-term bonds.
- In some cases, the curve may have a hump (curve C)


yield
A
C
B
Time to maturity

Theory of Interest Rates

- The two main determinants of the shape of the yield curve in practice are the time structure of the expected inflation rates and the current stage of the business cycle.
- Fisher's relationship between the nominal yields and the expected inflation rate is:

$$(1+r_t)=(1+r^r{}_t)+(1+\pi^e{}_t)$$

where r is the nominal short yield, rr is the real short yield and πe is the expected inflation rate. The higher the expected rate of inflation, the more will the time structure of expected inflation determine the shape of the yield curve.

Theory of Interest Rates

- The yield curve changes its shape over the business cycle. Long-term yields are usually higher than short-term yields mainly because long-term debt is less liquid and is subject to greater price uncertainty than short-term debt.
- The short-term yields are more volatile, rising faster and extending further than long yields during business expansions and falling more rapidly during recessions. Large swings in short-term rates, and to a lesser extent in intermediate rates, together with relatively narrow movements in long-term rates, cause a change in the shape of the yield curve over the course of a business cycle.

Theory of Interest Rates

- A sharp increase in short-term rates frequently occurs near the peak of a business expansion because of a combination of factors, most often including a strong demand for short-term credit, restrictive effects of monetary policies on the supply of credit, and changing investor expectations. Depending upon the intensity of these forces, the yield curve will be relatively flat, have a slight downward slope, or show a steep negative slope. As short rates fall absolutely and relative to long yields during the ensuing economic slowdown, the yield curve tends to regain its positive slope, acquiring its steepest slope near the cyclical trough. As the economy recovers and economic activity picks up, short rates again rise faster than long yields, and the yield curve tends to acquire a more moderate slope. Since the yield curve plots the nominal rather than the real rate of interest, and the nominal rate includes the expected rate of inflation, the dominant element of the shape and shifts in the yield curve is often the term structure of the expected rate of inflation.

Theory of Interest Rates

- **Three main theories on the term structure of interest rates**:

➢ The expectations hypothesis (by Irving Fisher)

➢ The segmented markets theory (by Culbertson)

➢ The preferred habitat hypothesis

Theory of Interest Rates

- **Expectations Hypothesis**

Assumptions:

- All borrowers and lenders have perfect foresight and know future interest rates and asset prices with certainty, so that there is no risk
- While there is uncertainty of yields, the borrowers and lenders are risk neutral and form rational expectations about the future short rates
- There are no transactions costs in switching from money into securities and vice versa.
- Financial markets are efficient. A market is said to be efficient if it clears (i.e. demand equals supply) instantly and prices reflect all available information.

Theory of Interest Rates

- Investors are assumed to maximize their expected utility, subject to the relevant constraints

- With all investors exhibiting this behavior, efficient markets under certainty ensure that:

$$(1 + {}_tR_{t+i})^{i+1} = (1 + {}_tr_t)(1 + {}_tr^{\mathrm{f}}{}_{t+1})(1 + {}_tr^{\mathrm{f}}{}_{t+2}) \ \ldots \ (1 + {}_tr^{\mathrm{f}}{}_{t+i}) \qquad (1)$$

This formula will hold for every $i, i = 0, \ldots, n$, where $n + 1$ is the longest maturity in the market, so that:

$$(1 + {}_tR_t) = (1 + {}_tr_t)$$

$$(1 + {}_tR_{t+1})^2 = (1 + {}_tr_t)(1 + {}_tr^{\mathrm{f}}{}_{t+1})$$

$$(1 + {}_tR_{t+2})^3 = (1 + {}_tr_t)(1 + {}_tr^{\mathrm{f}}{}_{t+1})(1 + {}_tr^{\mathrm{f}}{}_{t+2})$$

....

$$(1 + {}_tR_{t+n})^{n+1} = (1 + {}_tr_t)(1 + {}_tr^{\mathrm{f}}{}_{t+1})(1 + {}_tr^{\mathrm{f}}{}_{t+2}) \ \ldots \ (1 + {}_tr^{\mathrm{f}}{}_{t+n}) \qquad (2)$$

Theory of Interest Rates

- Under our assumption of complete markets, the forward rates are known, rather than merely expected, in period t

- **Expectations Hypothesis and Expected Future Spot Rates**

- In terms of the expected future rates, the expectations hypothesis becomes:

$$(1+{}_tR_{t+i})^{i+1} = (1+{}_tr_t)(1+{}_tr^e{}_{t+1})(1+{}_tr^e{}_{t+2})\ldots(1+{}_tr^e{}_{t+i}) \qquad (3)$$

Theory of Interest Rates

- Note that (3) differs from (1) since (3) involves expected future spot rates while (1) involves the corresponding forward rates, which are known in period t. For many investors, though ones with relatively small portfolios, the assumptions of the expectations hypothesis can be somewhat unrealistic. There is often both a transfer cost in and out of securities and a lack of perfect foresight (or risk indifference) about the future. The former implies that n one-period loans will involve much greater expense and inconvenience than a single n-period loan. The latter implies that loans of different maturities involve different risks and, for risk averters, a higher risk has to be compensated for by a higher yield. For very many large transactors, usually financial institutions, the transactions costs tend to be negligible, so that (3) should hold approximately, if not accurately.

Theory of Interest Rates

- **Rational expectations hypothesis**

➢ re is replaced by Etr, so that (3) becomes:

$$(1+{}_tR_{t+i})^{i+1} = (1+{}_tr_t)(1+E_{t\,t}r_{t+1})(1+E_{t\,t}r_{t+2})\ldots(1+E_{t\,t}r_{t+i}) \qquad (3')$$

➢The long rates of interest are quoted on these securities, so that their values are known each period. These values can be used to calculate the expected short rates of interest by using the following iterative reformulation of (3):

Theory of Interest Rates

$$E_{t\,t}r_{t+1} = (1 + {}_tR_{t+1})^2 / (1 + {}_tr_t) - 1$$

$$E_{t\,t}r_{t+2} = (1 + {}_tR_{t+2})^3 / [(1 + {}_tr_t)(1 + E_{t\,t}r_{t+2})] - 1 \qquad (4)$$

- If the market forms its expectations in terms of the expected future short rates, the long rates will be determined from these short rates by the preceding equations. Some economists assume that the investors' expectations are formed in terms of a series of expected short rates for the future periods, while others assume that investors are concerned with the prices of the assets currently in the market and that these prices can be used to calculate the long rates.

Theory of Interest Rates

- **Long Rates as Geometric Averages of Short Rates**

This implies that:

- If the short interest rates are expected to be identical, the long rate will equal the short rate.
- If the short interest rates are expected to rise, the long rates will lie above the current short rates.
- If the short interest rates are expected to decline, the long rates will be less than the current short rate.
- The long rate, being an average of the short rates, will fluctuate less than the short rate.

Theory of Interest Rates

- **Liquidity Preference Version of the Expectations Hypothesis**

➢ Under uncertainty of future yields, they have to be compensated by a higher yield on longer term loans. Conversely, borrowers – generally firms borrowing for long-term investments – prefer borrowing for a longer term than for a shorter term, which makes them willing to pay a premium on longer term loans. Such risk avoidance behavior on the part of both lenders and borrowers implies that the longer term loans will carry a premium over shorter term loans. Hence, the yield on bonds will increase with the term to maturity, so that equation (3) will be modified to:

Theory of Interest Rates

$$(1+{}_tR_{t+n})^{n+1} > (1+{}_tr_t)(1+{}_tr^e{}_{t+1})\ldots(1+{}_tr^e{}_{t+n}) \qquad n \geq 1 \qquad (5)$$

- Equation (5) is known as the liquidity preference hypothesis of the yield curve. For a more specific hypothesis on liquidity preference, designating the liquidity premium as tγt+n, we have:

$$(1+{}_tR_{t+n})^{n+1} = (1+{}_tr_t)(1+{}_tr^e{}_{t+1})\ldots(1+{}_tr^e{}_{t+n})\,{}_t\gamma_{t+n}(n;\rho) \qquad n \geq 1 \qquad (6)$$

Theory of Interest Rates

- Where:

$\partial \gamma n / \partial n \geq 0$ by virtue of the liquidity premium

γ = liquidity premium

ρ = degree of risk aversion

n = periods to maturity.

Theory of Interest Rates

- We can distinguish between two versions of (6) on the basis of two alternative assumptions on the liquidity premium. These are that:

(i) The liquidity premium is constant at γ per period, so that $t\gamma t+i = i\gamma$. While there is no particular intuitive justification for making this assumption, it is analytically convenient. It reduces (6) to:

$$(1+{}_tR_{t+n})^{n+1} = (1+{}_tr_t)(1+{}_tr^{e}{}_{t+1})\ldots(1+{}_tr^{e}{}_{t+n})n\gamma \qquad n \geq 1 \qquad (7)$$

Theory of Interest Rates

Equation (7) with a constant per period risk premium is sometimes called the strong form of the expectations hypothesis with a liquidity premium

(ii) The per period liquidity premium varies with the term to maturity and may not be constant over time, e.g. over the business cycle, so that (6) does not simplify to (7). This is sometimes called the weak form of the expectations hypothesis with a liquidity premium.

Theory of Interest Rates

- **Segmented Markets Hypothesis**

➢ If the uncertainty in the loan market is extremely severe or if lenders and borrowers have extremely high-risk aversion, each lender will attempt to lend for the exact period for which he has spare funds and each borrower will borrow for the exact period for which he needs funds.

➢ In this extreme case, the overall credit market will be split into a series of segments or separate markets based on the maturity of loans, without any substitution by either borrowers or lenders among the different markets.

➢ Therefore, the yields in any one market for a given maturity cannot influence the yields in another market for another maturity. This is the basic element of the segmented markets theory: the market is segmented into a set of independent markets.

Theory of Interest Rates

- **Preferred Habitat Hypothesis**

➢ The preferred habitat hypothesis was proposed by Modigliani and Sutch (1966, 1967), and represents a compromise between the expectations hypothesis of perfect substitutability and the segmented markets hypothesis of zero substitution between loans of different maturities.

➢ Modigliani and Sutch argued that lenders would prefer to lend for periods for which they can spare the funds and borrowers would prefer to borrow the funds for periods for which they need the funds. However, each would be willing to substitute other maturities, depending upon their willingness to take risks and the opportunities provided by the market to transfer easily among different maturities. Bonds maturing close together would usually be fairly good substitutes and have similar risk premiums.

Theory of Interest Rates

- This would be especially so for bonds at the longer end of the maturity spectrum.
- In well-developed financial markets, a high degree of substitutability would exist among different maturities, but without these necessarily becoming perfect substitutes.
- While the yields on different maturities would be interrelated to a considerable extent, there would also continue to exist some variation in yields among the different maturities.

Theory of Interest Rates

- **Bond valuation or Financial Asset Prices**

➢ Financial assets are not generally held for their direct contribution to the individual's consumption. They are held for their yield, which is often uncertain, and the individual balances the expected yield against the risks involved. This is the basic approach of the theories of portfolio selection. These theories focus on the yields on assets rather than on the prices of assets. The price of any asset is uniquely related to its yield and can be calculated from the following relationship. In any period t, for an asset j,

Theory of Interest Rates

$$r_{jt} = ({}_{t}p^{e}{}_{jt+1} - p_{jt}) + x_{jt} \tag{8}$$

where:

r_{jt} = expected yield on the jth asset during period t
p_{jt} = jth asset's price in period t
${}_{t}p^{e}{}_{j\,t+1}$ = jth asset's (expected) price in period $t+1$, with expectations held in t
x_{jt} = jth asset's coupon rate in period t.

That is,

$${}_{t}p^{e}{}_{jt+1} = p_{jt} + r_{jt} - x_{jt} \tag{9}$$

Theory of Interest Rates

- Hence, a theory of the rate of interest is also a theory of the prices of financial assets.
- Alternatively, the yields on assets may be explained by a theory of asset prices. Such a theory at a microeconomic level would consider the market for each asset, and use the demand and supply functions for each asset to find the equilibrium price of the asset. At the macroeconomic level, the theory could focus on the average price of financial assets, with macroeconomic demand and supply functions. These demand and supply functions would have the prices of the assets as the relevant variables.

Basic VAR as Tool for Monetary Policy Analysis

- What is the effect of a 100-basis-point hike in the interest rate on the rate of inflation one year hence?
- How big an interest rate cut is needed to offset an expected half percentage point rise in the unemployment rate?
- How well does the Phillips curve predict inflation?
- What fraction of the variation in inflation in the past say 40 years is due to monetary policy as opposed to external shocks?

Basic VAR as Tool for Monetary Policy Analysis

- VARs come in three varieties: reduced form, recursive and structural.

➢ A reduced form VAR expresses each variable as a linear function of its own past values, the past values of all other variables being considered and a serially uncorrelated error term.

➢ A recursive VAR constructs the error terms in each regression equation to be uncorrelated with the error in the preceding equations

➢ A structural VAR uses economic theory to sort out the contemporaneous links among the variables (Bernanke, 1986; Blanchard and Watson, 1986; Sims, 1986). Structural VARs require "identifying assumptions" that allow correlations to be interpreted causally. These identifying assumptions can involve the entire VAR, so that all of the causal links in the model are spelled out, or just a single equation, so that only a specific causal link is identified. This produces instrumental variables that permit the contemporaneous links to be estimated using instrumental variables regression.

Basic VAR as Tool for Monetary Policy Analysis

- **Basic VAR Model**

➢ The empirical analysis of the impact of monetary policy on macroeconomic variables is conducted by using vector autoregressive models. In its basic form, a vector autoregressive model of order is described by:

$$x_t = \mu_t + \sum_{i=1}^{k} A_i x_{t-i} + u_t,$$

Basic VAR as Tool for Monetary Policy Analysis

where $x_t = (x_{1t}, x_{2t}, \ldots, x_{pt})'$ is a $(p \times 1)$ vector of endogenous variables, $u_t \sim N(0, \Sigma_u)$ is a p-dimensional n.i.d. error process with mean vector 0 and covariance matrix Σ_u, μ_t contains deterministic terms (which are ignored in the following) like a constant, a linear time trend and/or

- The ordinary least squares technique, and the optimal lag length [3]can be determined by comparing information criteria like Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ) or Schwarz Criterion (SC). Once the parameters of the model have been estimated, the structural information of the model can be summarized in different ways. One possibility is the inspection of the implied impulse response functions measuring the impact of single innovations on the endogenous variables.

Basic VAR as Tool for Monetary Policy Analysis

- Forecast error impulse responses Ä|are calculated from the moving average representation of the VAR:

$$A_0 x_t = \sum_{i=1}^{k} A_i^* x_{t-i} + A_0 u_t,$$

- The underlying assumption that innovations in the different equations are uncorrelated (that is diagonal) is in general not compatible with the observed data and with the theoretical background. The contemporaneous relationships between the variables can be included into the model by transforming the VAR model (1) into the structural vector autoregressive (SVAR) model:

Basic VAR as Tool for Monetary Policy Analysis

$$A_0 x_t = \sum_{i=1}^{k} A_i^* x_{t-i} + A_0 u_t,$$

where

$$A_i^* = A_0 A_i, i = 1, \ldots, k.$$

A usual way of identifying the instantaneous relationships is to assume a recursive causal structure. That is, the first variable xit is only influenced by innovations in the first equation and lagged variables; the second variable is affected by innovations in the first equation, by innovations in the second equation, and lagged variables, and so on.

BALANCE OF PAYMENTS APPROACHES

- The balance of payments is a statistical record of all the economic transactions between residents of the reporting country and residents of the rest of the world during a given time period. It reveals how many goods and services the country has been exporting and importing and whether the country has been borrowing from or lending to the rest of the world. In addition, whether or not the central monetary authority (usually the central bank) has added to or reduced its reserves of foreign currency is reported in the statistics.

BALANCE OF PAYMENTS APPROACHES

- The identity for an open economy is given by:

Y $= C + I + G + X - M$

- If taxation is deducted;

$$Y_d = C + I + G + X - M - T$$

- Given that private savings is S = Y_d - C
- Net savings/Dissavings of the private sector

- Current account balance

(X – M) = (S –I) + (T – G)

- Government deficit/surplus

- This implies that current account deficit depends on either private dissaving and/or a government deficit. By re-arrangement;

I + G + X = S + T + M

BALANCE OF PAYMENTS APPROACHES

- *Open economy multipliers*

➢ Keynesian analysis make assumptions about the determinants of the various components of national income.

➢ Government expenditure and exports are assumed to be exogenous- government expenditure is determined independently by political decision, and exports by foreign expenditure decisions and foreign income.

➢ Domestic consumption is partly autonomous and partly determined by the level of national income.

BALANCE OF PAYMENTS APPROACHES

- This is denoted algebraically by;

$C = C_a + cY$

- Import expenditure is assumed to be partly autonomous and partly a positive function of the level of domestic income,

$M = M_a + mY$

$Y = C_a + cY + I + G + X - M_a - mY$

$(1 – c + m)Y = C_a + I + G + X - M_a$

- Given that (1 - c) is equal to the marginal propensity to save, s,

$Y = \frac{1}{s+m}(C_a + I + G + X - M_a)$ this can be transformed into difference form to yield;

$Yd = \frac{1}{s+m}(dC_a + dI + dG + dX - dM_a)$, where d in front of a variable represents the change in the variable

BALANCE OF PAYMENTS APPROACHES

- *Government expenditure multiplier*

➢ This shows the increase in national income resulting from a given increase in government expenditure.

$$\frac{dy}{dG} = \frac{1}{s+m} > 0$$

- This implies that an increase in government expenditure will have an expansionary effect on national income, the size of which depends upon the marginal propensity to save and the marginal propensity to import

- Export multiplier

$$\frac{dy}{dX} = \frac{1}{s+m} > 0$$

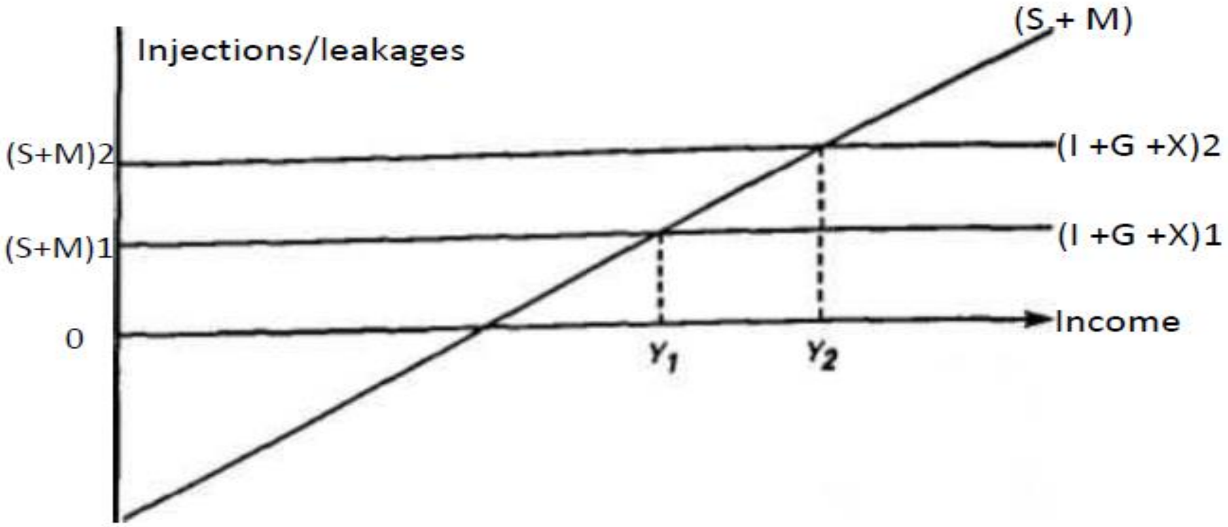
BALANCE OF PAYMENTS APPROACHES

- In practice, government expenditure tends to be somewhat more biased to domestic output than private consumption expenditure. This implies that the value of m is smaller in the case of the government expenditure multiplier than in the case of the export multiplier. Thus, an increase in government expenditure will have a more expansionary effect on domestic output than an equivalent increase in exports. The savings plus import expenditures (s + m) are assumed to increase as income rises, reflected by the upward slope of the injections schedule. Because the sum of the marginal propensity to import and save is less than unity this schedule has a slope less than unity.

BALANCE OF PAYMENTS APPROACHES

- An increase in exports or government expenditure or Investment results in an upward shift of the Injections schedule from (I+G+X)1 to (I+G+X)2 and this rise in income induces more saving and import expenditure but overall the increase in income from Y_1 to Y_2 is greater than the initial increase in injections. The lower the marginal propensities to save and import, the less steep the leakages schedule and the greater the increase in income.

Government expenditure/Export multipliers



BALANCE OF PAYMENTS APPROACHES

- *The current account multipliers*

➢ The effects of an increase in government expenditure and of exports on the current account (CA) balance; by re-arrangement;

Y – C – I – G – X + M = 0

Y – cY + mY - C_a + M_a - I – G – X = 0

- Since Y(1 - c + m) = Y(s + m), then

BALANCE OF PAYMENTS APPROACHES

Y(s + m) - C_a + M_a - I – G – X = 0

mY - $\frac{m}{s+m}(C_a$ - $M_a + I + G + X) = 0$

- Adding Ma and X to each side, recalling that M = Ma + mY and rearranging yields;

CA = X - M = X - Ma - $\frac{m}{s+m}(C_a$ - $M_a + I + G + X)$ $in\ difference\ form$;

dCA = dX - dMa - $\frac{m}{s+m}(dC_a$ - $dM_a + dI + dG + dX)$

- The effects of an increase in government expenditure on the current account balance is given by;

$\frac{dCA}{dG}$ = - $\frac{m}{s+m}$ < 0

BALANCE OF PAYMENTS APPROACHES

- Thus an increase in government spending leads to a deterioration of the current account balance which is some fraction of the initial increase in government expenditure.
- The effect of an increase in exports on the current balance; the multiplier is given by;

$$\frac{dCA}{dX} = 1 - \frac{m}{s+m} = \frac{s+m}{s+m} - \frac{m}{s+m} = \frac{s}{s+m} > 0$$

- Since s/(s + m) is less than unity, an increase in exports leads to an improvement in the current account balance that is less than the initial increase in exports.
- This is because part of the Increase in income resulting from the additional exports is offset to some extent by increase in expenditure on imports.

Elasticity Approach to Balance of Payments

- *Assumptions:*

➢ The supply elasticities for exports and imports are perfectly elastic, so that changes in demand volumes have no effect on prices.

➢ Domestic and foreign prices are fixed so that changes in relative prices are caused by changes in the nominal exchange rate.

➢ Income levels are fixed in the devaluing country.

➢ The price elasticities of demand for exports and imports are arc elasticities.

➢ Price elasticities refer to absolute values.

➢ The country's current account balance equals its trade balance

Elasticity Approach to Balance of Payments

- Given these assumptions, when a country devalues its currency, the domestic prices of its imports are raised and the foreign prices of its exports are reduced. Thus, devaluation helps to improve BOP deficit of a country by increasing its exports and reducing its imports. But the extent to which it will succeed depends on the country's price elasticities of domestic demand for imports and foreign demand for exports.
- This is what the Marshall-Lerner condition states: when the sum of price elasticities of demand for exports and imports in absolute terms is greater than unity, devaluation will improve the country's balance of payments

Elasticity Approach to Balance of Payments

- The current account balance when expressed in terms of the domestic currency is given by;

CA = PX_v - SP^*M_v

- where P is the domestic price level, Xv is the volume of domestic exports, S is the exchange rate, P* is the foreign price level and Mv is the volume of imports.
- By simplification, the domestic and foreign price levels are set at unity; the value of domestic exports (P Xv) is given by X; while the foreign currency value of imports (P* Mv) is given by M. Using these simplifications;

CA = X – SM

Elasticity Approach to Balance of Payments

- In difference form;

dCA = dX – S dM – M dS, by dividing through by dS;

$\frac{dCA}{dS} = \frac{dX}{dS} - S\frac{dM}{dS}$ - M $\frac{dS}{dS}$

- The price elasticity of demand for exports $\eta x -$ the percentage change in exports over the percentage change in price as represented by the percentage change in the exchange rate;

$\eta x = \frac{dX/X}{dS/S}$

dx = $\frac{\eta x \; dS \; X}{S}$

- The price elasticity of demand for imports ηm- the percentage change in imports over the percentage change in their price as represented by the percentage change in the exchange rate;

ηm = - $\frac{dM/M}{dS/S}$

dM = - $\frac{\eta m \; dS \; M}{S}$

Elasticity Approach to Balance of Payments

- By substitution;

$\frac{dCA}{dS} = \frac{\eta x\ X}{S} + \eta m$ M – M by dividing by M

$\frac{dCA}{dS}\ \frac{1}{M} = \frac{\eta x\ X}{S\ M} + \eta m$ -1

- Assuming a balanced trade, X/SM =1, then by re-arrangement.

$\frac{dCA}{dS}$ = M(ηx + ηm -1) – Marshal-Lerner condition

- This implies that when the current account is in equilibrium, a devaluation will improve the current account.
- Thus, dCA/dS > 0 only if the sum of the foreign elasticity of demand for exports and the home country elasticity of demand for imports is greater than unity. Thus, $(\eta x + \eta m) > 1$.
- If the sum of these two elasticities is less than unity, then a devaluation will lead to a deterioration of the current account.

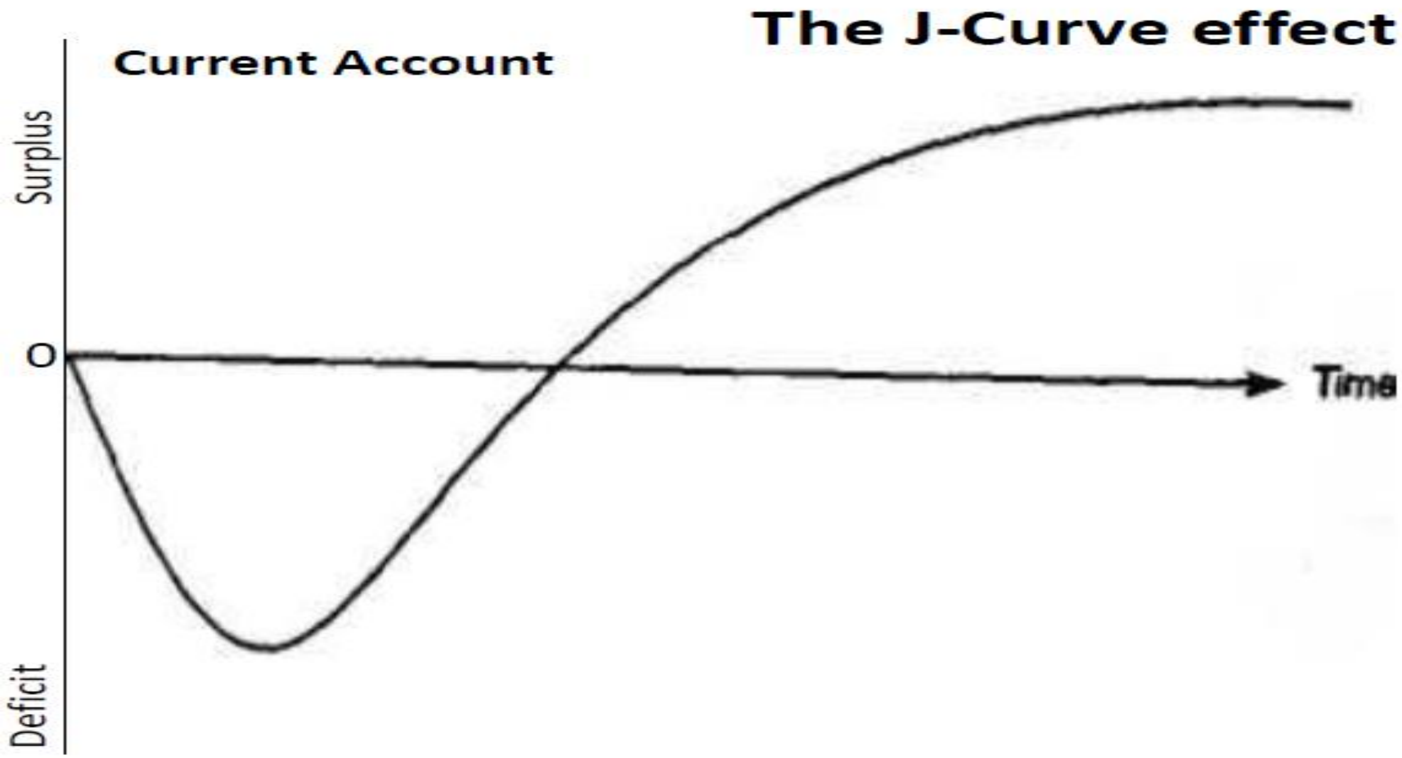
Elasticity Approach to Balance of Payments

- *The J-Curve Effect*

➢ Empirical studies have established that in the short-run, the Marshall-Lerner condition does not hold. This is based on the notion that elasticities are lower in the short run than in the long run, in which case the Marshall-Lerner conditions may not hold in the short run but may hold in the medium to long run. The effects of devaluation on domestic prices and demand for exports and imports will take time for consumers and producers to adjust themselves to the new situation.

Elasticity Approach to Balance of Payments

- The idea underlying the J-curve effect is that in the short run export volumes and import volumes do not change much so that the country receives less export revenue and spends more on imports leading to a deterioration in the current account balance. After the devaluation, it is often observed that the trade balance initially deteriorates for a while before getting improved. This traces a J-shaped curve through time. This is known as the J-curve effect of devaluation. If the Marshall-Lerner condition is not satisfied, in the long run the J-curve will flatten out to F.


The J-Curve effect
Current Account
Surplus
O
Time
Deficit

Elasticity Approach to Balance of Payments

- There are three reasons to explain the slow responsiveness of export and import volumes in the short run and why the response is far greater in the longer run;

➢ A time lag in consumer responses

➢ A time lag in producer responses

➢ Imperfect competition

➢ The pass-through effect of a depreciation or appreciation

Elasticity Approach to Balance of Payments

- ***Criticisms of Elasticity Approach to BOP***

➢ **Misleading**: The elasticity approach which applies the Marshallian concept of elasticity to solve BOP deficit is misleading. This is because it has relevance only to incremental change along a demand or supply curve and to problems dealing with shifts in these curves. Moreover, it assumes constant purchasing power of money which is not relevant to devaluation of the country's currency.

➢ **Partial Elasticities**: The elasticity approach has been criticised because it uses partial elasticities which exclude all factors except relative prices and quantities of exports and imports. This is applicable only to single-commodity trade rather than to a multi-commodity trade. It makes this approach unrealistic.

➢ **Supplies not Perfectly Elastic**: The Marshall-Lerner condition assumes perfectly elastic supplies of exports and imports. But this assumption is unrealistic because the country may not be in a position to increase the supply of its exports when they become cheap with devaluation of its currency.

Elasticity Approach to Balance of Payments

- **Partial Equilibrium Analysis**: The elasticity approach assumes domestic price and income levels to be stable within the devaluing country. It, further, assumes that there are no restrictions in using additional resources into production for exports. These assumptions show that this analysis is based on the partial equilibrium analysis. It, therefore, ignores the feedback effects of a price change in one product on incomes, and consequently on the demand for goods. This is a serious defect of the elasticity approach because the effects of devaluation always spread to the entire economy
- **Inflationary**: Devaluation can lead to inflation in the economy. Even if it succeeds in improving the balance of payments, it is likely to increase domestic incomes in export and import-competing industries. But these increased incomes will affect the BOP directly by increasing the demand for imports, and indirectly by increasing the overall demand and thus raising the prices within the country.

Elasticity Approach to Balance of Payments

- **Ignores Income Distribution**: The elasticity approach ignores the effects of devaluation on income distribution. Devaluation leads to the reallocation of resources. It takes away resources from the sector producing non-traded goods to export and import-competing industries sector. This will tend to increase the incomes of the factors of production employed in the latter sector and reduce that of the former sector.
- **Applicable in the Long Run**: As discussed above in the J-curve effect of devaluation, the Marshall-Lerner condition is applicable in the long-run and not in the short. This is because it takes time for consumers and producers to adjust themselves when there is devaluation of the domestic currency.
- **Ignores Capital Flows**: This approach is applicable to BOP on current account or balance of trade. But BOP deficit of a country is mainly the result of the outflow of capital. It thus ignores BOP on capital account. Devaluation as a remedy is meant to cut imports and the outflow of capital and increase exports and the inflow of capital.

Absorption Approach to Balance of Payments

- The absorption approach emphasizes changes in real domestic income as a determinant of a nation's balance of payments and exchange rate. This approach to balance of payments is also known as the Keynesian approach because it is based on the Keynesian national income relationships. It runs through the income effect of devaluation as against the price effect to the elasticity approach.
- The theory states that if a country has a deficit in its balance of payments, it means that people are 'absorbing' more than they produce. Domestic expenditure on consumption and investment is greater than national income. If they have a surplus in the balance of payments, they are absorbing less. Expenditure on consumption and investment is less than national income. A nation's expenditures fall into four categories, consumption (c), investment (i), government (g), and imports (m).

Absorption Approach to Balance of Payments

- The total of these four categories is referred to as domestic absorption (a)

$$A \equiv C + I + G + M,$$

- A nation's real income (y) is equivalent to total expenditures on its output

$$Y \equiv C + I + G + X,$$

- The current account (ca) is equivalent to $ca \equiv x - m.$
- The absorption approach hypothesizes that a nation's current account balance is determined by the difference between real income and absorption, which can be written as:

$Y - A = (C+I+G+X) - (C+I+G+M) = X - M,$

OR $Y - A = CA.$

- Here the BOP is defined as the difference between national income and domestic expenditure. This approach was developed by Sydney Alexander in 1952.

Absorption Approach to Balance of Payments

- Taking the equation for national income

$Y = C + I + G + X - M$ and defining domestic absorption as;

$A = C + I + G$, the equation can be rearranged as follows;

$CA = X\text{-}M = Y\text{-}A$

- This implies that the current balance represents the difference between domestic output and domestic absorption.
- By taking the difference;

$dCA = dY - dA$

- This equation implies that the effects of a devaluation on the current account balance will depend upon how it affects national income relative to how it affects domestic absorption.

Absorption Approach to Balance of Payments

- Absorption can be divided up into two parts:

➢ a rise in income will lead to an increase in absorption which is determined by the marginal propensity to absorb, a,

➢ a 'direct effect' on absorption which is all the other effects on absorption resulting from devaluation denoted by $A_{d.}$

- Thus, the change in total absorption dA, is given by;

dA = adY + d$A_{d.}$ by substitution.

dCA = (1-a)dY - d$A_{d.}$

Absorption Approach to Balance of Payments

- This reveals that a devaluation can affect the current account balance only by changing the marginal propensity to absorb a, changing the level of income, dY, and by affecting direct absorption, dAd.
- The condition for a devaluation to improve the current account is (1 - a)dY > d$A_{d.}$ that is, any change in income not spent on absorption must exceed any change in direct absorption

Absorption Approach to Balance of Payments

- **The effects of a devaluation on national income**

- ➢ If the marginal propensity to absorb is less than unity then a rise in income will raise the income to absorption ratio and so improve the current account. Whereas, if income were to fall this would raise the absorption to income ratio (as absorption would fall by less than income) which would worsen the current account

- ➢ **Employment effect:** If the economy is at less than full employment, then providing the Marshall-Lerner condition is fulfilled there will be an increase in net exports following a devaluation which will lead to an increase in national income via the foreign trade multiplier.

- ➢ **Terms of trade effect:** A devaluation tends to make imports more expensive in domestic currency terms which is not matched by a corresponding rise in export prices; this means that the terms of trade deteriorate. The terms of trade effect lowers national income

Absorption Approach to Balance of Payments

- **The effects of a devaluation on direct absorption**

➢ If the devaluing country has idle resources, devaluation will increase exports and decrease imports, income will rise and so will absorption. If the increase in absorption is less than the rise in income, BOP will improve. So an improvement in BOP can be brought about by reduction in direct absorption. Domestic absorption can fall automatically as a result of devaluation due to real cash balance effect, money illusion and income redistribution

➢ If a devaluation raises domestic income relative to domestic spending, current account improves. If, however, devaluation raises domestic absorption relative to domestic income, the current account deteriorates.

Absorption Approach to Balance of Payments

- **Real Cash Balance Effect:**

When a country devalues its currency, its domestic prices rise. If the money supply remains constant, the real value of cash balances held by the people falls and this reduce their expenditure or absorption. If people hold assets and devaluation reduces their real cash balances, they sell them. This reduces the prices of assets and increases interest rate. This, in turn, reduces investment and consumption, absorption will be reduced. This is the asset effect of real cash balance effect of devaluation.

- **Income Re-distribution Effect:**

The rise in the general price index resulting from a devaluation is likely to have a number of effects on the income distribution. If it redistributes income from those with a low marginal propensity to absorb to those with a high marginal propensity to absorb it will increase direct absorption.

Absorption Approach to Balance of Payments

- **Money Illusion Effect:**
- When prices rise because of devaluation, consumers may suffer money illusion and buy exactly the same bundle of goods as before, even though their real spending power has been reduced. If this is the case they are actually spending more on direct absorption than before. However, the money illusion effect may work in reverse and consumers, because of the price rises, may actually decide to cut back direct absorption in more than proportion to the price rise so that direct absorption falls. Whatever way the money illusion effect works it is unlikely to be very significant and is most probably only a temporary rather than a permanent factor

Monetary Approach to Balance of Payments

- **The monetary approach to BOP is based on the following assumptions**:
- ➢ The law of one price holds for identical goods sold in different countries, after allowing for transport costs.
- ➢ There is perfect substitution in consumption in both the product and capital markets which ensures one price for each commodity and a single interest rate across countries.
- ➢ The level of output of a country is assumed exogenously.
- ➢ All countries are assumed to be fully employed where wage, price flexibility fixes output at full employment.
- ➢ It is assumed that under fixed exchange rates the sterilisation of currency flows is not possible on account of the law of one price globally.
- ➢ The demand for money is a stock demand and is a stable function of income, prices, wealth and interest rate.
- ➢ The supply of money is a multiple of monetary base which includes domestic credit and the country's foreign exchange reserves.
- ➢ The demand for nominal money balances is a positive function of nominal income.

Monetary Approach to Balance of Payments

- ***Stable Money Demand Function***

➢ By assuming a stable demand for money the quantity theory of money is used as the basis of the money demand function, which is written as;

M_d = kPy where k > 0

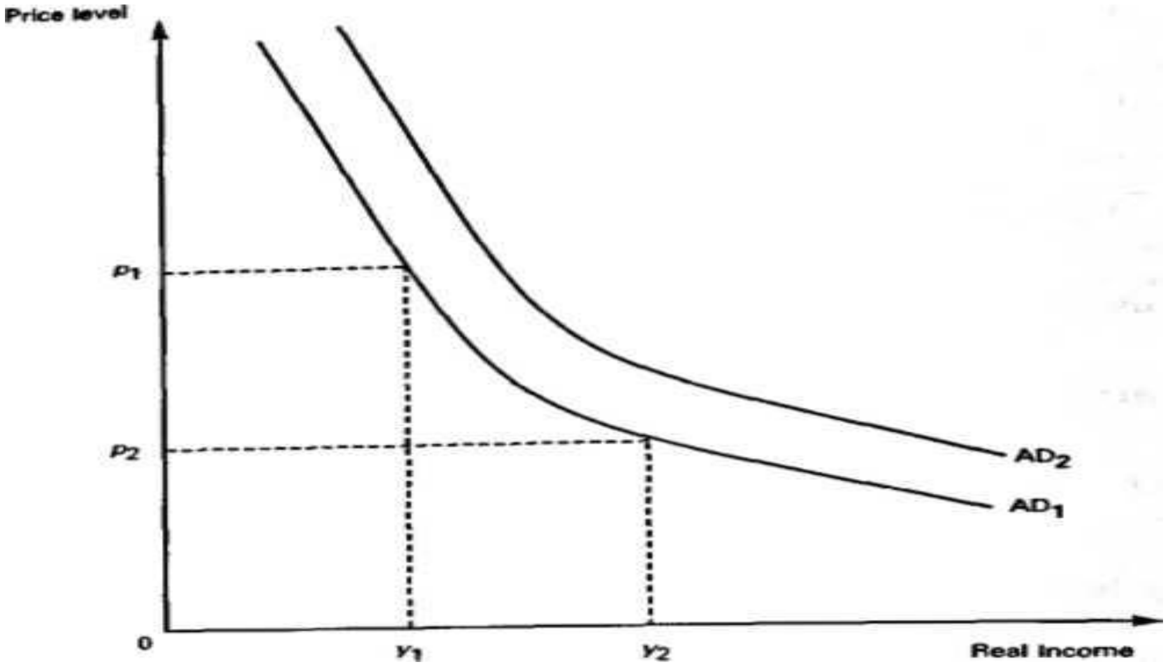
where Md is the demand for nominal money balances, P is the domestic price level, y is real domestic income, and k is a parameter that measures the sensitivity of money demand to changes in nominal income. The demand for money is a positive function of the domestic price level, because the demand for money is a demand for real money balances. A rise in the domestic price level will reduce real money balances (M/P) and accordingly lead to an equi-proportionate increase in the demand for money. The demand for money is positively related to real domestic income; a rise in real income will, ceteris paribus, lead to an increase in the transactions demand for money. The money demand function forms the basis of the aggregate demand schedule for a simple monetary model.

Monetary Approach to Balance of Payments

- ***The aggregate demand schedule*:**

If the money supply/money demand is held fixed and k is also a fixed parameter, this means that an increase in y from y_1 to y_2 requires an equi-proportionate fall in the price level from P_1, to P_2. Since $P_1 y_1 = P_2 y_2$, the aggregate demand schedule is a rectangular hyperbola given by AD_1. A fall in the price level from P_1 to P_2, given a fixed money supply, will create excess real money balances (M/P) and this leads to increased aggregate demand from y_1 to y_2. An increase in the money supply has the effect of shifting the aggregate demand schedule to the right from AD_1 to AD_2 because at any given price level there is a rise in real money balances which leads to increased aggregate demand.

Monetary Approach to Balance of Payments



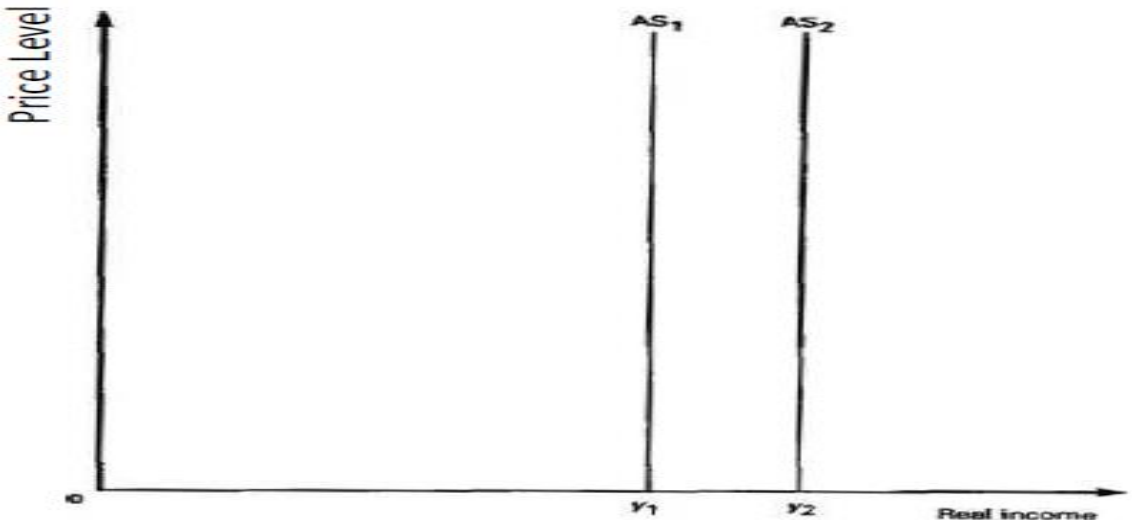
Monetary Approach to Balance of Payments

- ***Vertical aggregate supply schedule:***

The simple monetary model assumes that wages are sufficiently flexible that they are constantly at the level that equates the supply and demand for labour. This implies that the economy is always at a full employment level of output. A rise In the domestic price level does not lead to an increase in domestic output because wages adjust immediately to the higher price level so that there is no advantage for domestic producers to take on more labour. This means that the aggregate supply schedule is vertical at the full employment level of output.

Monetary Approach to Balance of Payments

- However, improvement in productivity due to technological progress may shift the AS curve to AS_2



Monetary Approach to Balance of Payments

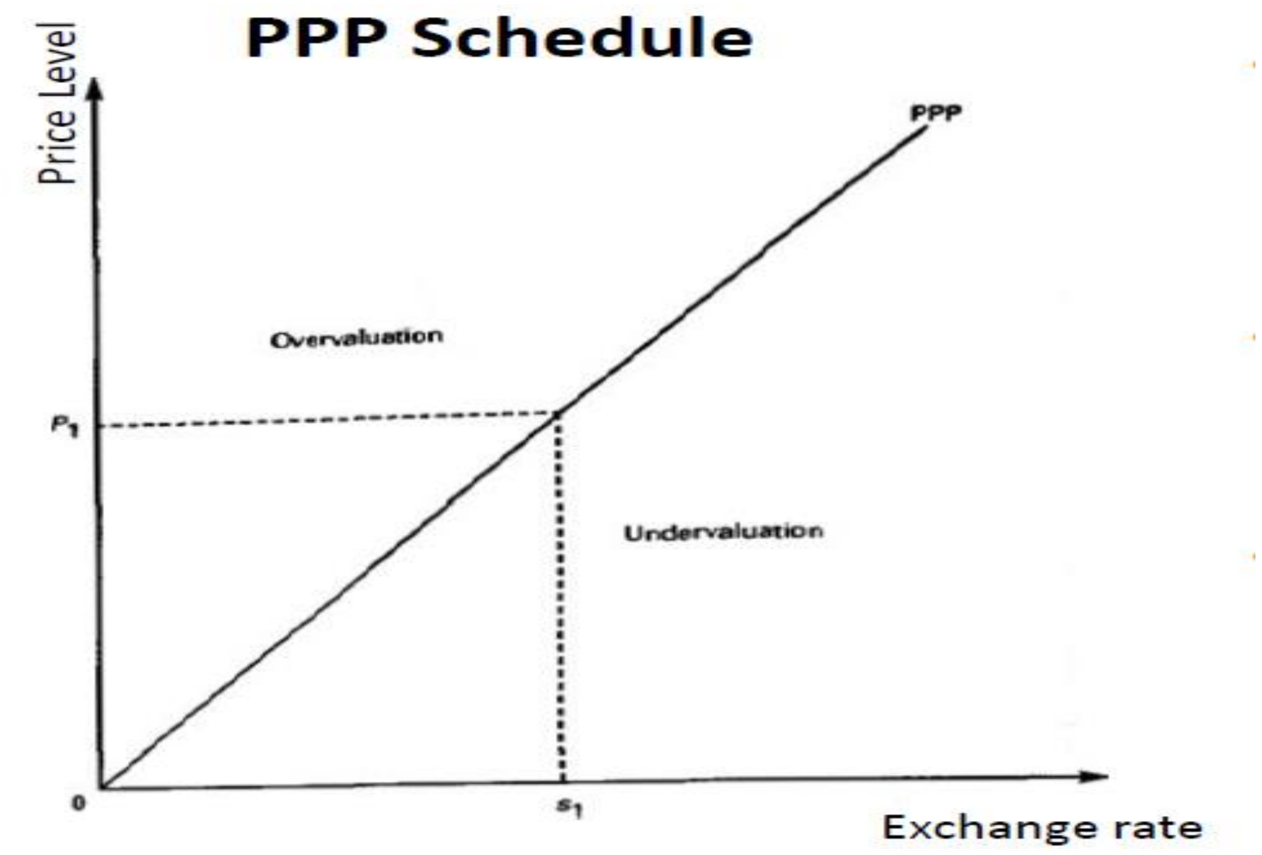
- ***Purchasing Power Parity (PPP)***

➢ The final assumption that underpins the monetary model is the assumption of purchasing power parity. The theory says that the exchange rate adjusts such to keep the following equation in equilibrium;

S = $\frac{P}{P^*}$ that is P = SP^*

➢ This figure depicts the PPP schedule which shows combinations of the domestic price level and exchange rate which are compatible with PPP, given the foreign price level P*. It has a slope given by P* and implies that a x% rise in the domestic price level requires a depreciation (rise) of the home currency to maintain PPP. Point to the left of the PPP schedule represent an overvaluation of the domestic currency in relation to PPP, whereas points to the right show undervaluation In relation to PPP.

Monetary Approach to Balance of Payments



Monetary Approach to Balance of Payments

- The simple monetary model uses some accounting identities and behavioural assumptions to develop a theory of the balance of payments.
- The domestic money supply is made up of two components:

M_s = D + R

where Ms is the domestic monetary base, D is domestic bond holdings of the monetary authorities and R is the reserves of foreign currencies.

- The monetary base can be changed in two ways;

➢ the authority may conduct an open-market operation, which involves the central bank purchasing treasury bonds held by private agents; this increases the central bank's monetary liabilities but increases its assets of domestic bond holdings which is the domestic component of the monetary base as represented by D

Monetary Approach to Balance of Payments

- The authorities may conduct a foreign exchange operation (FXO) which involves the central bank purchasing foreign currency assets (money or foreign treasury bonds) held by private agents by the central bank. This again increases the central bank's liabilities but increases its assets of foreign currency and foreign bonds which are represented by R.
- In difference form;

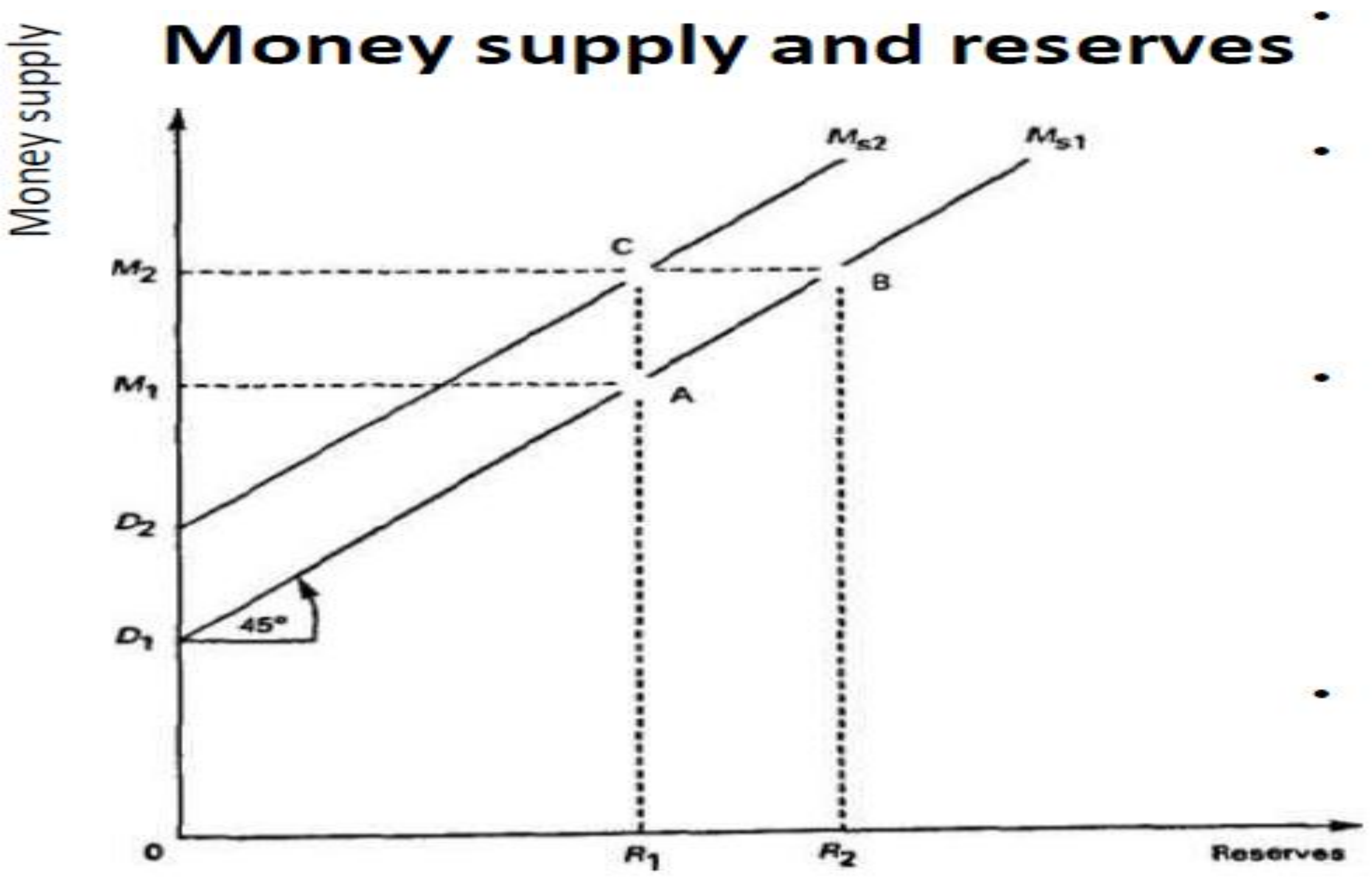
dM_s = dD + dR

- This equation says that any increase (decrease) in the domestic money supply can come about through either an OMO as represented by dD or a FXO as represented by dR. At point D_1 all the domestic money supply is made up entirely of the domestic component since reserves are zero. If the exchange rate is set such that the domestic to foreign currency is equal to unity; an increase of 1 unit of foreign currency leads to an increase in the domestic money supply by 1 unit, so that when reserves are R_1 the money supply is M_1, that is $D_1 + R_1$.

Monetary Approach to Balance of Payments

- An OMO will shift the Ms schedule by the amount of the increase in the central bank's domestic bond holdings. This increases the domestic component of the monetary base from D_1 to D_2 and shifts the money supply schedule from Ms1 to Ms2 and the total money supply rises from M_1 to M2 and is represented by a movement from point A to point C.
- By contrast, an expansion of the money supply due to a purchase of foreign currencies, that is an FXO, increases the country's foreign exchange reserves from R_1 to R_2. This raises the money stock from M_1 to M2 and this moves the money supply schedule from Ms1 to Ms2 represented by point A to B.

Monetary Approach to Balance of Payments



Monetary Approach to Balance of Payments

- **The Monetarist Concept of a Balance of Payments Disequilibrium**

➢ The monetarists view balance of payments surpluses and deficits as monetary flow due to stock disequilibrium in the money market. A deficit in the balance of payments is due to an excess money supply in relation to money demand, while a surplus in the balance of payments is a monetary flow resulting from an excess demand for money in relation to the stock money supply. In this sense the monetary flows are the 'autonomous' items in the balance of payments while the purchases and sales of goods/services and investments (long, medium and short-term) are viewed as the accommodating items.

Monetary Approach to Balance of Payments

- Monetarists observe that the overall balance of payments (BP) can be thought of as consisting of the current account balance, capital account balance and changes in the authorities' reserves.
- That is,

BP = CA + K + dR = 0   so that;

CA + K = - dR

where CA is the current account balance, K is the capital account balance and dR is the change in the authorities reserves.

CA + K = - dR

Monetary Approach to Balance of Payments

- According this equation, increases in reserves due to purchases of foreign currencies constitute a surplus in the balance of payments, while falls in reserves resulting from purchases of the domestic currency represent a deficit in the balance of payments. If the currency is left to float, then reserves do not change and as far as the monetary view of the balance of payments is concerned the balance of payments is in equilibrium. Under a floating exchange rate regime, a current account deficit must be financed by an equivalent capital inflow so that the balance of payments is in equilibrium.

Monetary Approach to Balance of Payments

- The model is in equilibrium when aggregate demand is equal to aggregate supply at P_1 and Y_1. Also, PPP holds in the foreign exchange market at price level P_1 and the exogenous foreign price level P* the exchange rate compatible with PPP is given by S_1. Finally, the money market is in equilibrium, so with the money supply M_1 made up of the domestic component Dl and reserve component R_1 is equal to money demand. The precise position of the money demand schedule is determined by the domestic price level and domestic income level. Equilibrium in the money market also implies equilibrium in the balance of payments.

Monetary Approach to Balance of Payments

- **Formal model of the Monetary Approach to the Balance of Payments.**

➢ The monetary approach to the balance of payments argues that the BOP is mainly a monetary phenomenon. This approach requires us to consider a country's supply of and demand for money. The money supply (Ms) can be seen either in terms of central bank liabilities:

Ms = a(BR + C), where

BR = reserves of commercial banks

C = currency held by nonbank public

a = the money multiplier

➢ Or central bank assets

Ms = a(DR + IR), where

DR = domestic reserves

IR = international reserves

Monetary Approach to Balance of Payments

- Suppose the central bank buys government securities or foreign exchange – in either case the money supply is expanded. Money demand (L) is a function of several variables:

L = f[Y, P, i, W, E(p), O], where

Y = level of real income in economy

P = price level

i = interest rate

W = level of real wealth

E(p) = expected % Δ in price level

O = other variables that may affect L the Demand for Money

Monetary Approach to Balance of Payments

- L is a positive function of Y, due to the transactions demand for money.
- L is a positive function of P, since more cash is needed to make purchases when P rises.
- L is a negative function of I; i is the opportunity cost of holding money.
- L is a positive function of W; as a person's wealth rises she will want to hold more money.
- L is a negative function of E(p); if a person expects inflation he will hold less money.

Monetary Approach to Balance of Payments

- Frequently a general expression for money demand is used:

$$L = kPY$$

where

P and Y are as discussed, and k is a constant embodying all other influences on money demand.

- Money market equilibrium occurs when

Ms = L or

a(DR+IR) = a(BR+C) = f[Y,P,I,W,E(p),O]

or

Ms = kPY.

Monetary Approach to Balance of Payments

- Increase in Ms causes individuals to shift to non-money assets, including foreign goods and assets. This creates a BOP deficit.
- When exchange rates are fixed, an increase in Ms leads to a BOP deficit. If the exchange rate is not fixed, BOP deficits and surpluses will be eliminated by exchange rate adjustments.
- Let's look at exchange rate changes in terms of money demand and supply

What happens if Ms is increased? If Ms is increased; Individuals wish to purchase non-money assets, including foreign goods and assets. This creates an "incipient" BOP deficit. The home country's currency will depreciate to eliminate the BOP deficit. If Ms is decreased then Individuals wish to sell non-money assets, including foreign goods and assets. This creates an "incipient" BOP surplus. The home country's currency will appreciate to eliminate the BOP surplus.

Monetary Approach to Balance of Payments

- If we assume that absolute purchasing power parity holds, then

  e = PA/PB

- Similarly, for Country B,

MsB = kBPBYB

Then

$$\frac{M_{sA}}{M_{sB}} = \frac{k_A P_A Y_A}{k_B P_B Y_B}$$

Monetary Approach to Balance of Payments

- For Country A, monetary equilibrium means that

MsA = kAPAYA

- This means

$$\frac{M_{sA}}{M_{sB}} = \frac{k_A Y_A}{k_B Y_B} e$$

- Rearranging yields

$$e = \frac{k_B Y_B M_{sA}}{k_A Y_A M_{sB}}$$

- This expression demonstrates that an increase in Ms by Country A will lead to a depreciation of the currency. Inflationary monetary policy only causes currency depreciation.
- Monetary Policy Coordination: MsA and MsB

Portfolio Balance Approach to the BOP and the Exchange Rate

- The approach extends the monetary approach to include other financial assets besides money.
- In a two country model there will continue to be demand for money by each country's citizens.
- Now there will also be demand for home-country bonds (Bd) and for foreign bonds (Bf). Bd yields interest return of id; Bf yields a return of if.

Portfolio Balance Approach to the BOP and the Exchange Rate

- The relationship between interest rates is as follows:

$$id = if + xa - RP,$$

where

RP = risk premium associated with the imperfect international mobility of capital

xa = expected percentage appreciation of the foreign currency, or [E(e)/e] – 1

- Demand by home country individual for home money

L = f(id, if, xa, Yd, Pd, Wd), where

id = return on home-country bonds

if = return on foreign-country bonds

xa = expected appreciation of foreign currency

Yd = home country real income

Pd = home country price level

Wd = home country real wealth

Portfolio Balance Approach to the BOP and the Exchange Rate

- Home money demand (L) will be:
  - inversely related to id
  - Inversely related to if
  - Inversely related to xa
  - Positively related to Yd
  - Positively related to Pd
  - Positively related to Wd

Portfolio Balance Approach to the BOP and the Exchange Rate

- Demand by home country individual for home bonds

Bd = h(id, if, xa, Yd, Pd, Wd),

where

- Home bond demand will be:

➢ Positively related to id

➢ Inversely related to if

➢ Inversely related to xa

➢ Inversely related to Yd

➢ Inversely related to Pd

➢ Positively related to Wd

Portfolio Balance Approach to the BOP and the Exchange Rate

- Demand by home country individual for foreign bonds (multiplied by e so that it's in terms of domestic currency

eBf = j(id, if, xa, Yd, Pd, Wd), where

- Foreign bond demand will be:

➢ Inversely related to id

➢ Positively related to if

➢ Positively related to xa

➢ Inversely related to Yd

➢ Inversely related to Pd

➢ Positively related to Wd

Portfolio Balance Approach to the BOP and the Exchange Rate

- Home country central bank sells government securities (i.e., decreases Ms and increase home bond supply). id should rise, resulting in:

➢ decrease in home-country money demand,

➢ decrease in foreign bond demand, and

➢ increase in home bond demand.

- Foreign investors switch towards holding home-country currency. Home country central bank sells government securities (i.e., decreases Ms and increase home bond supply).

➢ if should falls rise.

➢ The foreign currency depreciates (e falls), assuming flexible exchange rates.

➢ xa rises.

Portfolio Balance Approach to the BOP and the Exchange Rate

- There are second-round effects, continuing until a new portfolio balance is attained. Home country individual believe home inflation is likely in the future.
- Assume flexible exchange rates, xa should rise (that is, home citizens will expect a depreciation of the home currency), resulting in:

➢ decrease in home-country money demand

➢ decrease in home bond demand

➢ increase in foreign bond demand

Portfolio Balance Approach to the BOP and the Exchange Rate

- The home country currency depreciates. So, the expectation of a depreciation leads to a depreciation. An increase in home country real income, leading to:

➢ increase in home-country money demand

➢ decrease in home bond demand

➢ decrease in foreign bond demand

Portfolio Balance Approach to the BOP and the Exchange Rate

- The home country currency appreciates under a flexible exchange rate system; a BOP surplus occurs under a fixed exchange rate regime. An increase in home country bond supply causes increase in id, which causes a capital inflow and an appreciation of the home country currency. It also leads to increase in wealth, which (among other things) causes an increased demand for foreign bonds and a depreciation of the home currency. On net, it is likely that the home currency appreciates.

Portfolio Balance Approach to the BOP and the Exchange Rate

- An increase in home country wealth because of home-country current account surplus leads to an increase in money demand, leading to an increase in id. This also leads to an increase in demand for foreign bonds and for domestic bonds, both of which lead to a decrease in id. On net, it is not clear what will happen to the exchange rate.
- An increase in supply of foreign bonds because of foreign government budget deficit, causes an increase in the risk premium, and an appreciation of the home country currency.
- Exchange rate overshooting occurs when, in moving from one equilibrium to another, the exchange rate goes beyond the new equilibrium before eventually returning to it.

Portfolio Balance Approach to the BOP and the Exchange Rate

- Assume:

➢ Country is small

➢ Perfect capital mobility exists

➢ Essentially, uncovered interest parity applies

- The relationship between the price level (P) and the exchange rate (e) should be negative because a higher price increases demand for money, so id will rise. The result is an appreciation. If from point B prices were to rise to P2, demand for money would rise, and the home currency would appreciate (i.e., e falls). the Asset Market

Monetary Policy Under Alternative Exchange Rate Regimes

- **Monetary Policy with Fixed Exchange Rates**:

➢ Assume fixed exchange rates and perfect capital mobility

➢ Perfect capital mobility requires foreign and domestic bonds to be perfect substitute

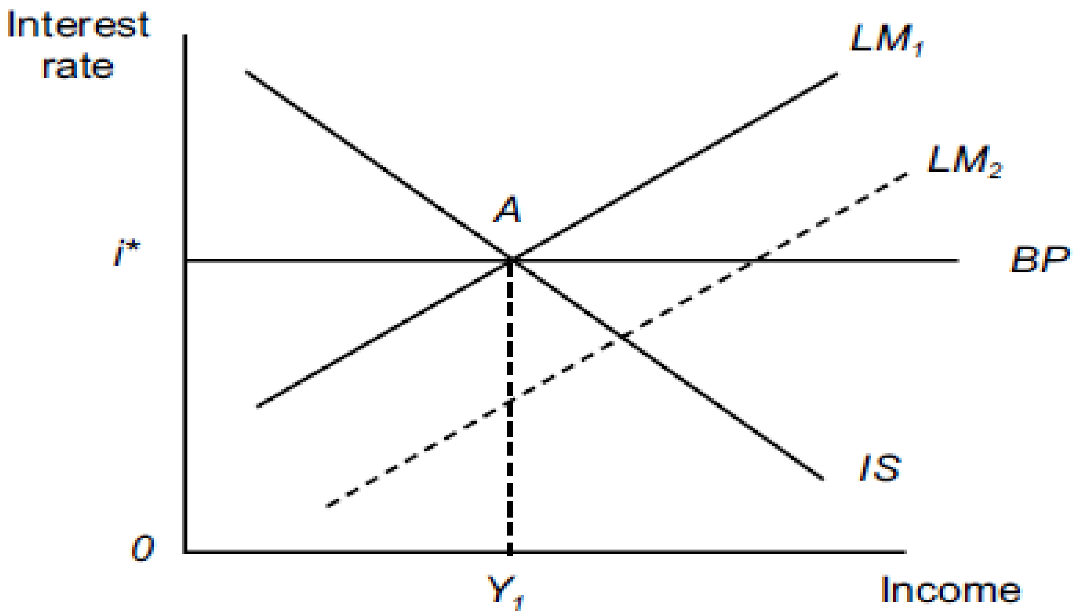
➢ Any small change in interest rates that causes the world interest rate to vary from the domestic rate causes a flow of capital, which reverses the interest rate change. Domestic interest rates, thus, cannot vary from world rates.

Monetary Policy Under Alternative Exchange Rate Regimes

- Domestic monetary policy is completely ineffective. An expansionary monetary policy does not cause even a temporary increase in income.
- The BP curve is drawn as a horizontal line at the world interest rate. An expansionary monetary policy in a closed economy shifts the LM curve from LM1 to LM2, but in an open economy with perfect capital mobility, this does not happen. Any tendency for the domestic interest rate to fall below the world rate (i*) causes a capital outflow and immediately pushes the interest rate back to the world level.
- Indeed, any expectation of a fall in the domestic rate of interest has this effect. The economy stays at point A with income at Y1.

Monetary Policy Under Alternative Exchange Rate Regimes

- Monetary policy with fixed exchange rates and capital mobility:



Monetary Policy Under Alternative Exchange Rate Regimes

- **This leaves the question of what determines i*?**

➢ It could be determined through the agreement of all member countries of the system or by the most powerful economy within the system.

➢The most powerful economy is known as asymmetric leadership since the leading country is in a different position from all other members. Only it is able to determine its own monetary policy

➢We assume that there is such a leader and make use of the Mundell-Fleming model to show how the leader's monetary policy is transmitted to the other member countries of the system.

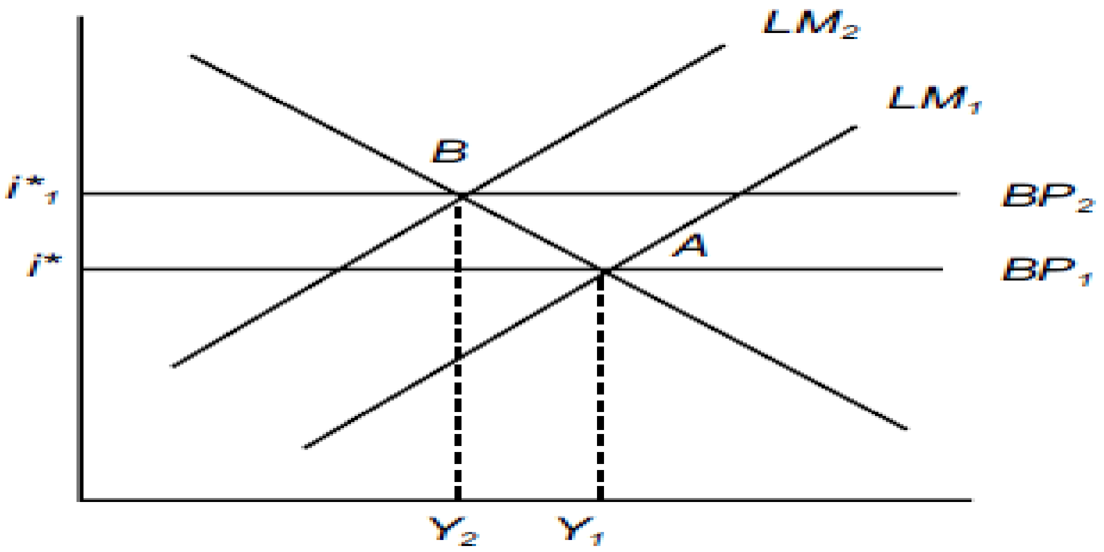
➢We keep the assumption of perfectly mobile capital.

Monetary Policy Under Alternative Exchange Rate Regimes

- We begin at A with the domestic economy in equilibrium at a full employment income level, Y1.
- The strong country tightens its monetary policy, forcing the world interest rate up to i1*.
- Capital immediately flows out of the domestic economy, putting downward pressure on the value of the domestic currency.
- The domestic monetary authorities act to protect the exchange rate, either directly by restrictive domestic open market operations (selling domestic bonds, forcing down bond prices and forcing domestic interest rates up to i1*) or by buying domestic currency on the currency markets, causing international reserves to fall. In both cases, the money stock falls and the domestic interest rate is driven up. The LM curve moves back to LM2.

Monetary Policy Under Alternative Exchange Rate Regimes

- The transmission of monetary policy with fixed exchange rates



Monetary Policy Under Alternative Exchange Rate Regimes

- We move to point B, at a lower level of income than previously. Domestic monetary policy is being determined by the strong country within the system. This simple example illustrates a major argument put forward within small countries for joining a fixed exchange rate system.
- This assumes that the domestic authorities wish to reduce inflation but find it difficult to do so because, in the light of the past performance of the economy, their announced anti-inflationary policy lacks credibility in the eyes of market agents. Inflationary expectations continue to be built into the economy’s inflation rate.
- The fixed exchange rate system provides the possibility of a link with a strong anti-inflationary country, which forces a tight monetary policy on the domestic economy. In effect, the government with the inflation problem borrows a reputation for financial prudence from the strong country in the system.

Monetary Policy Under Alternative Exchange Rate Regimes

- Opponents of fixed exchange rates argue that the monetary policy forced on the domestic economy through the exchange rate link may run counter to the interests of the domestic economy.
- This happens when the business cycles of the two countries are not synchronized or when the countries have different views of the desirable short-run relationship between inflation and unemployment.

Monetary Policy Under Alternative Exchange Rate Regimes

- Meanwhile, the strong economy is experiencing boom conditions and high rates of inflation. It applies a tight monetary policy, forcing up interest rates just at the time when the domestic economy requires an easing of monetary policy.
- A fixed exchange rate system (or a single currency covering a number of countries) is likely to face fewer problems if the business cycles of the member countries are synchronized and if external shocks to the economies are symmetric — that is, they effect all member economies in broadly the same way. Another issue of importance is the extent to which monetary policy has real effects. If monetary policy does not have real effects in the long run, applying the incorrect monetary policy for a country’s position on its business cycle causes short-run pain but does not damage the real economy in the long run.

Monetary Policy Under Alternative Exchange Rate Regimes

- The strong country might take some account of the needs of the other members in choosing its policy.
- However, if it feels that it would, for political reasons, have to compromise its own policy preferences too much, the strong country would have little incentive to join the system in the first place.
- In any case, if the strong country does take account of the needs of the weaker countries in determining its policy, it may, by lowering the anti-inflationary credibility of its own monetary policy, damage the anti-inflation credentials of the system as a whole. This, in turn, would reduce the potential gains for the small countries from being a member of the system.

Monetary Policy Under Alternative Exchange Rate Regimes

- **Brakes on the transmission of monetary influences**

➢ Theoretically, countries wishing to follow a less deflationary or less inflationary policy than the system as a whole, while retaining membership of a fixed exchange rate system may do so by:

❖ devaluing or revaluing the domestic currency, although this needs to conform to the rules of the system and/or be approved by partner governments; or by

❖ sterilizing the monetary influences spilling over from the policy followed by the strong country.

Monetary Policy Under Alternative Exchange Rate Regimes

- Let us consider these two possibilities:

➢ Countries devaluing their currencies within a fixed exchange rate system obtain a competitive advantage that produces a current account surplus, although there may be long time lags in this process.

➢ Countries are able to maintain a balance of payments balance for any given level of income at a lower interest rate. The BP curve moves down to BP2.

➢ This enables the authorities to run a more expansionary monetary policy. Interest rates fall (the LM curve shifts down to LM2), capital flows out of the economy and the current account surplus is offset by a capital account deficit.

Monetary Policy Under Alternative Exchange Rate Regimes

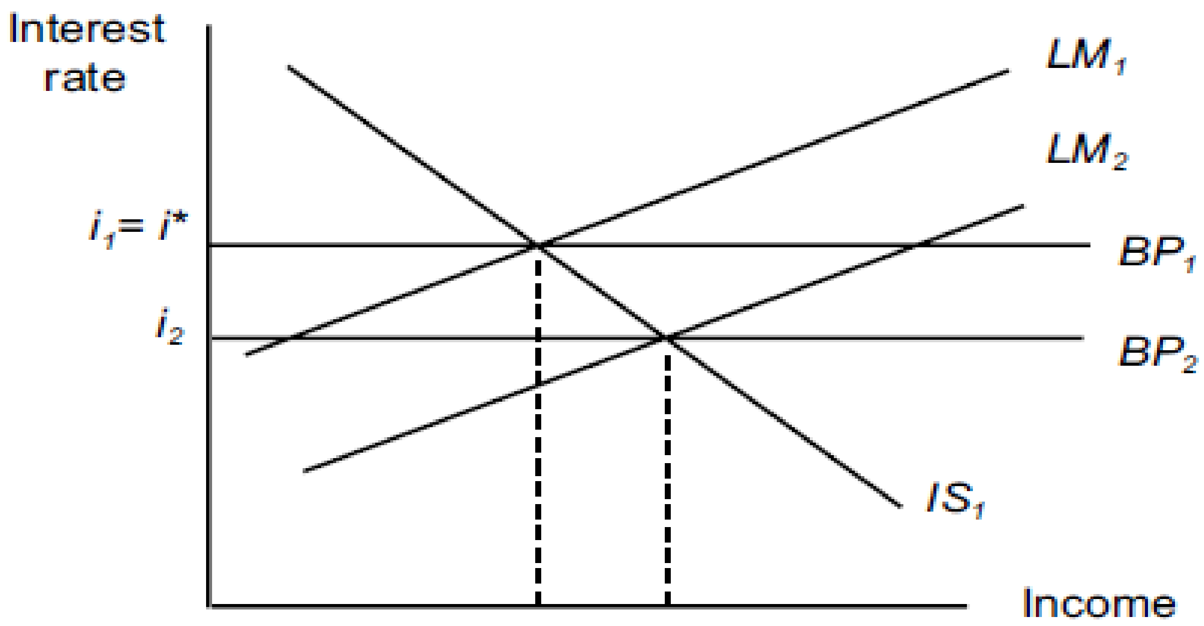
- However, the current account gain is likely to be only temporary. Domestic prices are likely to rise, undermining the competitive advantage obtained from the devaluation. As the current account surplus disappears, the balance of payments moves into deficit and interest rates need to rise again to reverse the capital outflow. If the government wishes its monetary policy to continue to be different from that of the system as a whole, further devaluations become necessary.
- The possibility that one devaluation will be followed by others reduces the credibility of the existing fixed exchange rate and damages any reputation for an anti-inflation stance the government might have been trying to build up. Workers and firms build higher inflationary expectations into wage demands and price-setting formulae and speculators are likely to put pressure on the currency.

Monetary Policy Under Alternative Exchange Rate Regimes

- Nonetheless, the competitive edge granted by the devaluation may last over a sufficiently long period to be judged useful. A country wishing to follow less expansionary policies than the strong country in the system may be forced to revalue at regular intervals. The initial revaluation removes (again after a lengthy time lag) the current account

Monetary Policy Under Alternative Exchange Rate Regimes

Short-run freedom for monetary policy after devaluation



Monetary Policy Under Alternative Exchange Rate Regimes

- However, the current account gain is likely to be only temporary. Domestic prices are likely to rise, undermining the competitive advantage obtained from the devaluation.
- As the current account surplus disappears, the balance of payments moves into deficit and interest rates need to rise again to reverse the capital outflow. If the government wishes its monetary policy to continue to be different from that of the system as a whole, further devaluations become necessary.
- The possibility that one devaluation will be followed by others reduces the credibility of the existing fixed exchange rate and damages any reputation for an anti-inflation stance the government might have been trying to build up. Workers and firms build higher inflationary expectations into wage demands and price-setting formulae and speculators are likely to put pressure on the currency.

Monetary Policy Under Alternative Exchange Rate Regimes

- Nonetheless, the competitive edge granted by the devaluation may last over a sufficiently long period to be judged useful. A country wishing to follow less expansionary policies than the strong country in the system may be forced to revalue at regular intervals. The initial revaluation removes (again after a lengthy time lag) the current account surplus that had been driving up the country's reserves and inflating its money supply. Yet this, too, is likely to be only temporary; meanwhile expectations of further revaluations are likely to reinforce the tendency for capital to flow in from the inflating economy.
- The result may be an overall balance of payments balance, this time with a current account deficit being offset by a capital account surplus. The inflationary tendencies emanating from the strong economy are countered temporarily but at the expense of lower output and employment.

Monetary Policy Under Alternative Exchange Rate Regimes

- Regular changes in exchange rate parities in a fixed exchange rate system undermine the system's basis:

- ➢ Firstly, exchange rate uncertainty remains and risk premiums will be demanded on currencies thought at all likely to devalue.
- ➢ Secondly, it opens up the possibility of countries seeking to gain advantage through devaluations.
- ➢ Thus, fixed exchange rate systems must be constructed on the principle that large changes in exchange rate parities should occur infrequently and should be allowed only if a country can show that its balance of payments is in ‘fundamental disequilibrium’. The ability to alter exchange rate parities within a fixed exchange rate system can provide only an escape route for economies in serious difficulties rather than granting monetary policy independence.

Monetary Policy Under Alternative Exchange Rate Regimes

- A country can also try to avoid inflationary influences from abroad by using domestic monetary policy to sterilize the impact on domestic money stocks of the inflating economy’s balance of payments deficit. This operates through the open market sale of government securities, soaking up excess money balances. Domestic bond prices fall and interest rates rise. The increase in reserves is offset by the decline in the domestic component of the money stock. The high domestic interest rate damages investment and, in time, affects both employment and the rate of economic growth.
- Nonetheless, faced with the threat of imported inflation, governments have often chosen sterilization. It cannot, however, operate effectively in a world with high capital mobility since the high interest rates attract further capital inflows from abroad, merely compounding the initial problem.

Monetary Policy Under Alternative Exchange Rate Regimes

- The chances of some degree of monetary policy independence within a fixed exchange rate system are not quite as slim.
- In the real world, even without capital controls, capital is not perfectly mobile. In addition, fixed exchange rate systems usually allow some freedom for the exchange rate to move around the established exchange rate parities. There are some limitations on the free international flow of goods and services.
- Finally, changes in central parities do not always generate expectations of further changes in the same direction. Let us consider each of these points briefly.

Monetary Policy Under Alternative Exchange Rate Regimes

- **Capital mobility**

- ➢ Capital is not perfectly mobile internationally unless securities issued in different countries are considered perfect substitutes for each other across international borders.
- ➢ This may not occur because of the existence of political or exchange rate risk, different credit ratings of firms and governments or lack of information on the part of market participants.
- ➢ Any immobility of capital gives the authorities some opportunity to maintain temporarily an interest rate different from world rates.

Monetary Policy Under Alternative Exchange Rate Regimes

- **Bands Around Exchange Rate Parities**

➢ All fixed (but adjustable) exchange rate systems maintain bands around the established central parities within which market-determined exchange rates may move. These bands may be narrow, as with the ± 1 per cent of the Bretton Woods system between 1945 and 1971, or broad, such as the ± 6 per cent for currencies within the broad band of the exchange rate mechanism of the EMS in operation until July 1993.

Monetary Policy Under Alternative Exchange Rate Regimes

- If the value of the domestic currency stays below its central rate for any length of time, expectations of a movement back to the central rate begin to be undermined and capital again begins to flow out, leading to expectations of a future devaluation. Thus, the degree of independence of domestic monetary policy granted by the existence of bands around central rates of exchange is strictly limited and conditional, but some short-run freedom is provided and this freedom is greater the wider is the band.

Monetary Policy Under Alternative Exchange Rate Regimes

- **Limitations on free trade**

➢ Some freedom may be retained also through the ability of a government to protect the current account of its balance of payments using commercial policy (tariffs, quotas and other non-tariff barriers). Although the capital account is a much more potent source of instability, expectations of devaluation are often triggered by current account weakness. Extra tension was caused in the EMS in the early 1990s because of the move (under the Single European Act of 1986) towards a unified market within the EU, severely limiting the ability of member governments to protect their current accounts through trade restrictions as well as leading to the removal of restrictions on capital movements within the EU.

Monetary Policy Under Alternative Exchange Rate Regimes

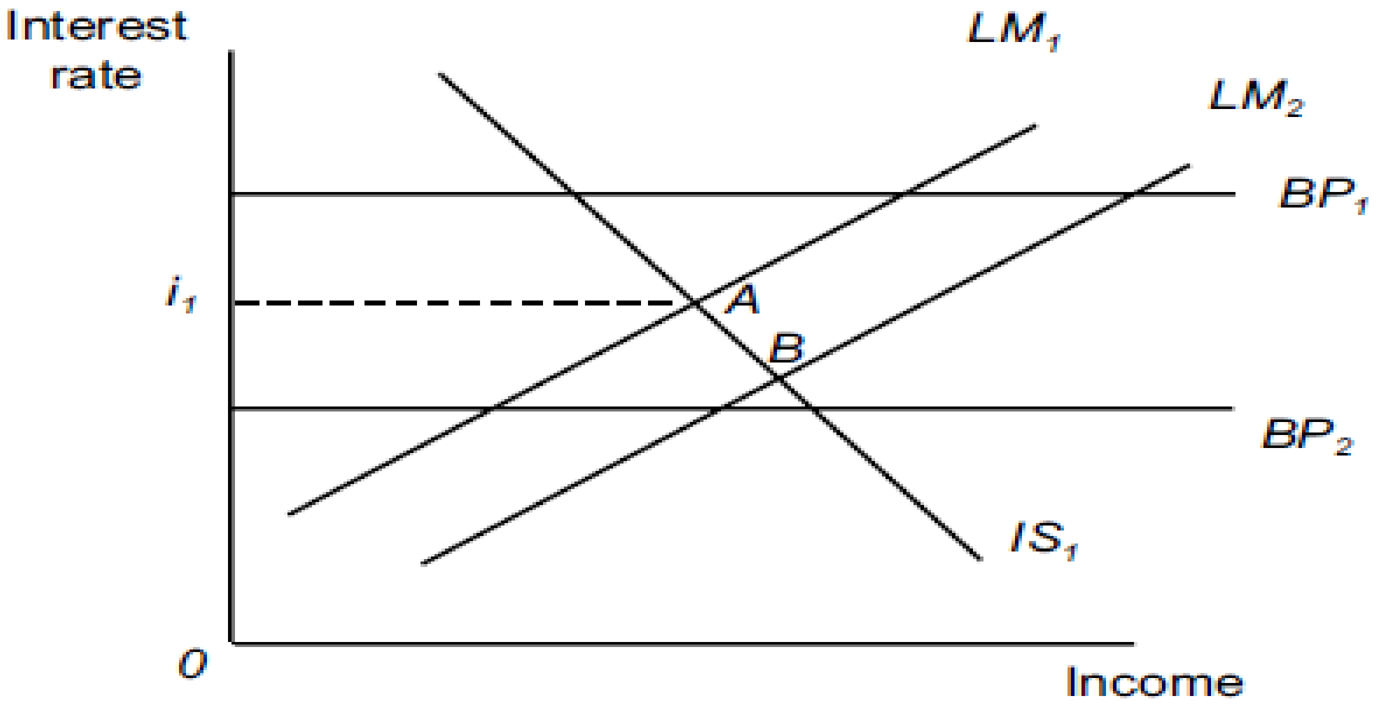
- **Expectations of future devaluations following a devaluation**

➢ One devaluation does not always convince the financial markets that others will follow.

➢ Consider a case in which a country maintains a fixed parity for an extended period but steadily loses competitiveness over that period. Its rate of inflation may be converging on that of the strong country within the system, but only slowly. Under these circumstances, many come to appreciate that the existing parity cannot be maintained and that devaluation is necessary to restore competitiveness. The secret is either to make small adjustments to the exchange rate when needed, such that each change does not engender significant inflationary expectations and/or to accompany the devaluation with other policies aimed at preserving the credibility of the government's anti-inflationary stance.

Monetary Policy Under Alternative Exchange Rate Regimes

Monetary Policy in a Fixed Exchange Rate System



Monetary Policy Under Alternative Exchange Rate Regimes

- **Monetary Policy with Floating Exchange Rates**

➢ Monetary policy was more effective in an open economy with floating exchange rates than in a closed economy for two reasons:

❖ the exchange rate freedom grants the economy monetary independence and allows the authorities to choose the domestic inflation rate;

❖ the exchange rate movements have an impact on the real economy by changing the international competitiveness of the country’s output.

Monetary Policy Under Alternative Exchange Rate Regimes

- Thus, an increase in the money supply causes income to rise and the interest rate to fall.
- The increase in income causes a deterioration in the current account in the balance of payments while the fall in interest rate causes a deterioration in the capital account. There is a net outflow of currency (the supply of domestic currency increases) and the exchange rate depreciates.
- The depreciation improves the international competitiveness of domestically produced goods and this causes a further increase in income.

Monetary Policy Under Alternative Exchange Rate Regimes

- The simplest model of exchange rate determination is the flexible price monetary model.
- This assumes that capital is perfectly mobile (domestic and foreign bonds are perfect substitutes), markets are competitive, trans actions costs are negligible, and investors hold exchange rate expectations with certainty. Uncovered interest rate parity (UIRP) holds — that is, the expected rate of depreciation of a currency equals the interest rate differential between domestic and foreign bonds.
- The key determinants of exchange rates are the supply of and demand for money.

Monetary Policy Under Alternative Exchange Rate Regimes

- We assume, also, that all prices are perfectly flexible. Purchasing power parity (PPP) holds and money markets clear continuously. The demand for money is stably related to real income and stably and negatively related to the rate of interest.

$$m - p = \eta y - si$$

where m is the log of the domestic money stock, p is the log of the domestic price level, y is the log of domestic real income, and r is the rate of interest. The same relationship holds abroad and thus:

$$m^* - p^* = \eta y^* - si^*$$

Monetary Policy Under Alternative Exchange Rate Regimes

- Since PPP is assumed, we can write:

$s = p - p^*$

where s is the exchange rate. Further, since UIRP holds, we have:

$Es = i - i^*$

(the expected rate of depreciation of the home currency equals the difference between the domestic and foreign interest rates).

- Re-arranging and substituting in 10.3 gives:

$s = (m - m^*) - \eta(y - y^*) + \sigma\,(i - i^*)$

Monetary Policy Under Alternative Exchange Rate Regimes

- That is, the rate of exchange is determined by the supply of money and the demand for money function at home and abroad.
- We can use this model to consider the impact of expansionary and contractionary monetary policy changes.
- Ceteris paribus, an increase in the rate of growth of the domestic money supply causing the domestic money supply to grow more rapidly than the foreign money supply causes domestic prices to rise more rapidly than foreign prices and, to maintain PPP, the domestic currency must depreciate. A ten-percentage point increase in the rate of growth of the domestic money supply causes the domestic currency to depreciate by ten per cent. Money is neutral in this case.

Monetary Policy Under Alternative Exchange Rate Regimes

- In Dornbusch's (1976) model, the goods and labour markets are slow to adjust whereas the asset market adjusts immediately. Exchange rates are determined in the asset market and, thus, exchange rate changes are not matched, in the short run, by price changes. That is, we depart from PPP in the short run but return to it in the long run.

Monetary Policy Under Alternative Exchange Rate Regimes

- The model is described by four equations:

(a) uncovered interest rate parity

$Es = i - i^*$

(b) the demand for real money balances

$m - p = \eta y - \sigma i$

(c) purchasing power parity

$$\bar{s} = p - p^*$$

(d) regressive exchange rate expectations in the short-run: where is the equilibrium or long-run exchange rate and $\theta > 0$.

That is, in each period the expected change in the exchange rate is given by a fraction (θ) of the difference between its current value and the longrun equilibrium value

Monetary Policy Under Alternative Exchange Rate Regimes

➢ Thus, the model has four endogenous variables: $E_s = \theta(\bar{s} - s)$

❖ domestic interest rate

❖ the expected change in the exchange rate and

❖ the current value of the exchange rate

❖ the price level.

➢ There are four exogenous variables:

❖ the foreign interest rate

❖ the long-run equilibrium exchange rate

❖ real income and

❖ the stock of money.

Monetary Policy Under Alternative Exchange Rate Regimes

- The diagrammatic solution of the model gives a relationship between the exchange rate and the price level with the asset market always in equilibrium, in which equilibrium is at N, with pe and se. Note that the exchange rate is here expressed in direct terms. That is, as we move along the horizontal axis s increases but this means that the value of the home currency falls (one has to pay more home currency for one unit of foreign currency).

Monetary Policy Under Alternative Exchange Rate Regimes

- AA represents asset market equilibrium. The negative slope of AA reflects the assumptions of an exogenous money supply and UIRP. This latter assumption tells us that if interest rates on domestic bonds fall, currency will flow out to buy foreign bonds. This flow will continue until people come to expect a sufficient appreciation of the currency to balance the interest rate differential between domestic and foreign bonds. XX represents equilibrium in the goods market. This slopes up since an increase in the price level leads to a fall in domestic demand because:

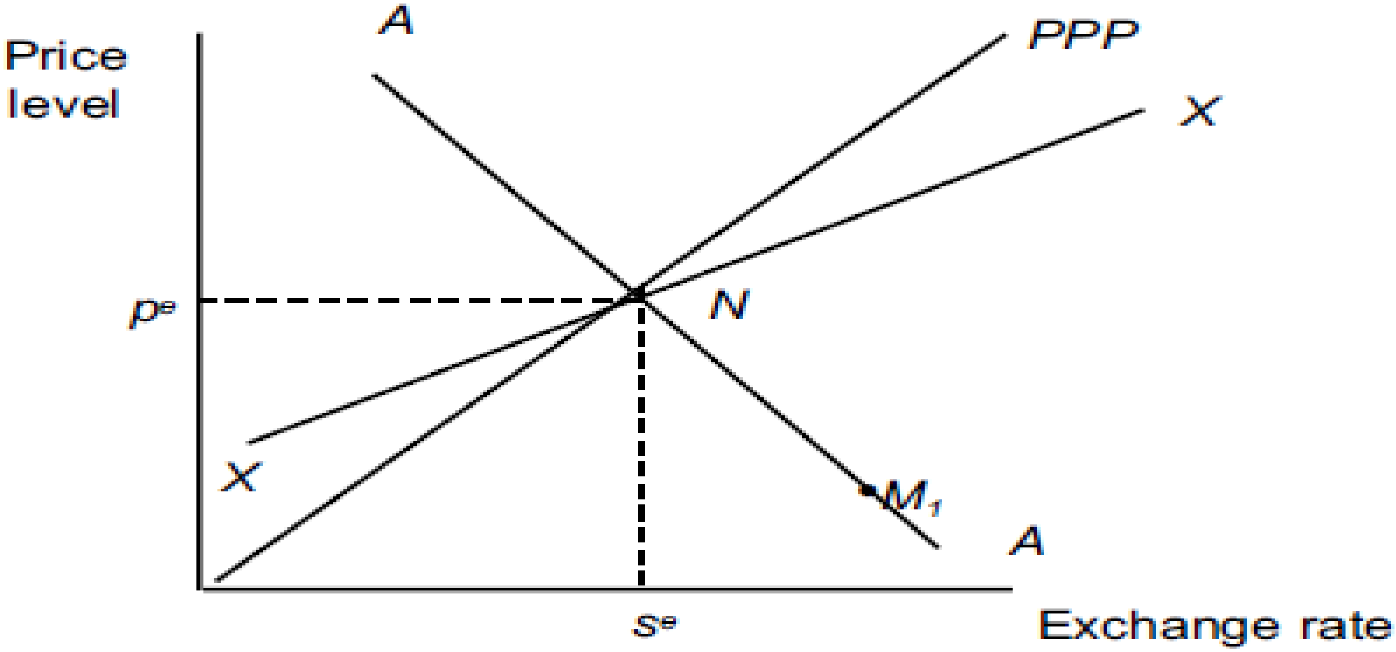
- the real exchange rate falls (competitiveness declines) and
- the real value of the exogenous money supply falls, pushing domestic interest rates up.

Monetary Policy Under Alternative Exchange Rate Regimes

- To return the goods market to equilibrium, the value of the currency must fall (s must rise). Thus, the price level and the exchange rate are positively related. Below XX, there is excess demand for goods and prices will be rising. Above XX, there is excess supply of goods and prices will be falling. We assume that the asset market is always in equilibrium (that is, we are always on AA).
- If we are at M1, there is an excess demand for goods and prices rise slowly. We move along AA towards N. As prices increase, aggregate demand falls and s falls (the domestic currency appreciates), compensating investors for low domestic interest rates caused by the high real money balances.

Monetary Policy Under Alternative Exchange Rate Regimes

Exchange Rate Overshooting

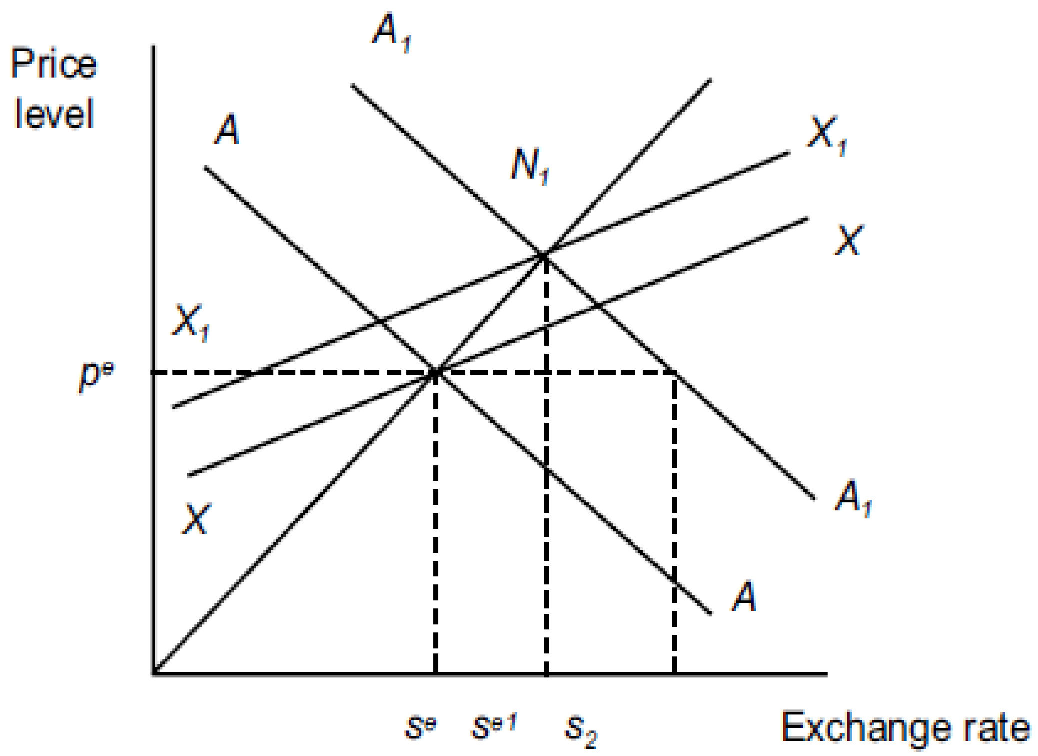


Monetary Policy Under Alternative Exchange Rate Regimes

- Assume now a once and for all unanticipated increase in the supply of money. The AA curve shifts out to A1A1. There is no permanent effect on the current account of the balance of payments and PPP holds at the new equilibrium at N1 (X1X1 shifts up). Investors realize this.
- The movement to long-run equilibrium takes place in two stages. We start at N. The unexpected increase in the money supply pushes up XX and the market knows that the new equilibrium will be at N1 with an exchange rate of se1. That is, the market knows the domestic currency will depreciate. However, because domestic prices are slow to rise, the initial effect is to increase real money balances and lower domestic interest rates, causing people to sell domestic currency, pushing the exchange rate instantaneously to s2. At s2, investors can see the prospect of a sufficient exchange rate appreciation to compensate for the lower interest rate on domestic bonds and the currency depreciation ceases.

Monetary Policy Under Alternative Exchange Rate Regimes

- There follows a gradual adjustment to the new equilibrium exchange rate, se1, as prices increase in the goods market. Therefore, we have overshooting of the exchange rate even with rational expectations. If we dropped this assumption and assumed that the market did not know the long-run equilibrium position, they would try to infer the truth from what others were doing and there would be much wilder movements


Price level
A₁
A
N₁
X₁
X
X₁
pᵉ
X
A₁
A
sᵉ
sᵉ¹
s₂
Exchange rate

Monetary Policy Under Alternative Exchange Rate Regimes

- **Frankel Model (Frankel, 1979:**

➢ combines inflationary expectations with the sticky price element of the Dornbusch model.

➢The expected rate of depreciation of the domestic currency is positively related to the difference between the current exchange rate and the equilibrium exchange rate, but here it is also a function of the expected long-run inflation differential between the domestic and foreign economies.

Monetary Policy Under Alternative Exchange Rate Regimes

- The long-run equilibrium exchange rate in this model is determined by the relative supplies of and demands for money in the two countries just as in the flexible monetary model.
- The gap between the current exchange rate and its long-run equilibrium value is now proportional to the real interest rate differential between the two countries. If the expected real rate of interest on foreign bonds is greater than the expected real rate of interest on domestic bonds, there will be a real depreciation of the domestic currency until the long-run equilibrium exchange rate is reached.
- When this occurs, real interest rates will be the same in the two countries and any difference in nominal interest rates must be the result of differences in inflation rates.

Monetary Policy Under Alternative Exchange Rate Regimes

- An unanticipated monetary expansion in the domestic economy causes the exchange rate to overshoot its long-run equilibrium level
- Expansionary monetary policy could obtain worthwhile reductions in unemployment for significant periods. If a sticky-price model were combined with a labour market model with hysteresis, these short-run employment gains could become long-run gains.
- Sticky-price models also provide a justification for a gradual approach to monetary policy.

Monetary Policy Under Alternative Exchange Rate Regimes

- Two problems with sticky price models from the point of view of monetary policy:

- Firstly, although PPP does better in long run than in short run tests, the evidence that it holds in the long run is not convincing. This increases the strength of the argument that monetary policy in an open economy has a long run impact on real variables.

- Secondly, all monetary models do not allow a distinction to be made between open market and foreign exchange operations. Suppose the monetary authorities seek to improve the country’s competitiveness by lowering the value of the currency. They buy foreign bonds with domestic currency, increasing the supply of the domestic currency on the market. The exchange rate of the domestic currency rises (its value falls) and the current account of the balance of payments improves.